

Teachers' beliefs in context: A factor and cluster analytic study of open lessons in Kazakhstan

Nailya Rakhmetova¹ , Samat Maxutov^{1*} , Aigerim Sagynbayeva¹ , Akniyet Issain¹ ,
Nursultan Japashov^{1,2,3} 

¹ School of Education and Humanities, SDU University, Kaskelen, KAZAKHSTAN

² Department of Educational Theory and Practice, University at Albany, State University of New York, Albany, NY, USA

³ Faculty of Physics and Technology, Farabi University, Almaty, KAZAKHSTAN

Received 05 May 2026 ▪ Accepted 15 October 2026

Abstract

Teacher beliefs play a central role in how professional development (PD) shapes classroom practice. The open lesson (OL), a long-standing mandatory PD practice in Kazakhstan and other post-Soviet contexts, involves teachers conducting observed classes before colleagues and administrators. Using a three-stage sequential design, this study investigated the structure, characteristics, and demographic correlates of OL beliefs among 218 secondary school teachers in Kazakhstan. Exploratory factor analysis identified three correlated belief dimensions – professional growth, professional collaboration, and perceived student benefit – accounting for 65% of total variance. Cluster analysis revealed three teacher profiles: skeptical (9.6%), moderately positive (38.6%), and highly enthusiastic (51.8%) teachers. Gender, age, and teaching experience did not significantly differentiate beliefs. A significant difference in perceived student benefit was found between teachers of natural sciences (physics, chemistry, and biology combined) and teachers of other subjects ($p = .015$). The near-absence of demographic moderation suggests that OL's cultural embeddedness produces convergent belief patterns regardless of professional background.

Keywords: open lesson, teacher beliefs, professional development, exploratory factor analysis, cluster analysis, Kazakhstan

INTRODUCTION

Professional development (PD) is most effective when teachers sincerely believe in its value. Research shows that teachers who find the PD experience meaningful and relevant to their work are more likely to engage with it fully and learn from it. However, teachers can participate externally without meaningful participation if they view PD sessions as a formal requirement set by the educational institution rather than as a genuine chance for advancement (Ball, 2003; Desimone, 2009; Opfer & Pedder, 2011). In these situations, administrators and academics attempting to determine when and why PD is effective have a significant challenge due to the discrepancy between the

official goal of PD practice and how teachers actually perceive it.

The open lesson (OL), a popular PD method in Kazakhstan and other post-Soviet nations, is the subject of this study. In order to get feedback on their instruction, teachers perform a lesson while colleagues and school authorities watch. However, in practice, the feedback process frequently veers away from collegial support and toward evaluation, which causes the watched teacher a great deal of stress. Because of this pressure, many teachers treat OL as a performance, carefully staging their best lesson rather than teaching authentically. OL is situated at the nexus of professional autonomy and institutional control due to the conflict between OL as a learning opportunity and OL as an

Contribution to the literature

- This study provides the first factor-analytic and person-centered examination of teachers' beliefs about the OL in Kazakhstan, identifying three correlated belief dimensions – professional growth, professional collaboration, and perceived student benefit – using exploratory factor analysis (EFA).
- By applying cluster analysis, the study uncovers three empirically distinct teacher belief profiles (skeptical, moderately positive, and highly enthusiastic), revealing meaningful variation within a mandatory PD context that prior research had not captured. The near-complete absence of demographic moderation supports an institutional socialization hypothesis, suggesting that the deep cultural embeddedness of OL in Kazakhstan shapes teachers' beliefs more powerfully than individual professional biographies.
- These findings advance theoretical understanding of how institutionalized PD practices shape professional belief systems and carry practical implications for PD designers seeking to differentiate support across diverse teacher profiles.

assessment exercise (Abdulkakioglu et al., 2022; Ball, 2003; Balta et al., 2025; Lewis et al., 2006; Sachs, 2003).

Kazakhstan offers a particularly informative setting for examining how teachers form beliefs about an institutionally embedded PD practice. The OL is compulsory for teachers at all levels (Abdulkakioglu et al., 2022), and both the practice and the wider expectation that teachers observe one another predate recent educational reform (Wilson & Sharimova, 2019). It is also explicitly evaluative in orientation: teachers prepare a lesson on which they are subsequently judged (Wilson & Sharimova, 2019). Moreover, it is enacted within a formal professional structure in which teachers are required to confirm or raise their qualification category at least once every five years (Republic of Kazakhstan, 2019). Beliefs formed under these conditions reflect sustained exposure to an established practice rather than reaction to a recently introduced one. This makes the setting analytically valuable for a question of broad international relevance: how professional belief systems take shape when a developmental practice also functions as an instrument of institutional evaluation.

Teachers' beliefs about PD are multifaceted and cannot be reduced to a single global attitude. A teacher's views on instructional practice, student outcomes, and collegial collaboration can diverge substantially (Calderhead, 1996; Fives & Buehl, 2012; Pajares, 1992; Richardson, 1996). One teacher, for instance, may appreciate OL for the professional dialogue it creates while remaining unconvinced that it genuinely benefits students.

These issues are still unanswered despite increased scholarly interest in the OL in Kazakhstan. No previous research has used factor-analytic methods to examine the latent dimensional structure of Kazakhstani teachers' OL beliefs, used cluster-analytic techniques to identify empirically distinct teacher belief profiles, or investigated whether these profiles vary systematically according to teachers' professional backgrounds.

The present study addresses these gaps. This study examines how teachers' beliefs are organized across

various dimensions, whether different groups of teachers hold meaningfully different belief profiles, and whether teachers' professional backgrounds—such as years of experience, age, gender, and subject area— influence how they perceive the practice, rather than asking whether teachers have positive or negative attitudes toward the OL overall. The following research questions (RQs) serve as a guide for this study:

Main RQ: What dimensions characterize Kazakhstani teachers' perceptions of OL?

Sub-questions:

RQ1: What beliefs do teachers hold about the teaching aspect of OL?

RQ2: What beliefs do teachers hold about students' learning in OL?

RQ3: How do teachers perceive the professional and collaboration aspects of OL?

RQ4: Do teachers' perceptions of OL differ according to gender, age group, subject area, and teaching experience?

By addressing these questions, the study aims to provide a deeper and more detailed understanding of teachers' participation in institutional PD and contribute to broader theoretical discussions about what makes PD meaningful or ineffective from the teacher's perspective.

LITERATURE REVIEW

Open Lesson as a Form of Professional Learning and Pedagogical Development

The main argument in the PD literature is that teacher training is effective when it is directly related to classroom practice, subject pedagogy, and teachers' personal learning tasks (Darling-Hammond et al., 2017; Desimone, 2009). Forms of PD that are incorporated into the day-to-day work of teachers, and not within the framework of external seminars or one-time training events, lead to a longer improvement in the quality of teaching and a significant increase in teacher education (Balta et al., 2023; Borko, 2004; Little, 1993). An OL, as a practice-based school event, has the structural potential

to fulfill this function. By developing and conducting classes under the observation of colleagues, teachers have the opportunity to carefully consider the choice of teaching methods, apply new pedagogical methods, and think about the effectiveness of teaching in a structured and supported way (Abdulkakioglu et al., 2022; Shen et al., 2007).

Research on OL in Kazakhstan and other post-Soviet Union countries has revealed a number of reasons why teachers perceive OL as a factor contributing to their PD. According to teachers, preparation for an OL encourages them to learn new ways of teaching, think carefully about the content of the subject, and develop more thoughtfully structured activities than a regular lesson (Abdulkakioglu et al., 2022; Balta et al., 2025; Liang, 2011). This preparatory process can be a form of structured, self-learning that encourages teachers to update their knowledge of pedagogical content and expand the repertoire of teaching strategies. Shulman (1987) argued that pedagogical content of knowledge – the ability to represent subject matter in ways that are accessible and meaningful to students – is the defining domain of teacher expertise, and that its development requires sustained, reflective engagement with the challenges of teaching specific content to specific learners. The OL, when approached as a genuine professional exercise rather than a performance obligation, provides exactly such an occasion.

Professional growth through OL is theoretically grounded in the concept of learning as a craft. This craft develops through purposeful, reflective engagement with practice (Hiebert et al., 2002). This insight drives the current study's emphasis on Kazakhstani teachers' interactions with this aspect of OL.

Open Lesson and Professional Collaboration

The ability of OL beliefs to promote professional collaboration is the second significant aspect. Teaching is frequently a solitary occupation. Teachers in various educational institutions work alone in their classrooms for most of the working day. Opportunities to observe colleagues, exchange instructional ideas, or engage in structured professional dialogue are limited (Little, 1993; Lortie, 1975). To overcome this isolation, professional learning communities and collaborative PD models were created. They create structured opportunities for teachers to work together, observe each other's practice, and collectively reflect on what they see (Cajkler et al., 2015; Stoll et al., 2006). The OL, as a formally observed lesson followed by group feedback and discussion, can serve as a vehicle for developing this kind of collaborative professional culture.

The Japanese lesson study model offers the strongest international evidence for the value of collaborative lesson observation. In this model, teachers jointly design a lesson around a specific instructional problem. They

observe it together, paying close attention to student responses. Afterwards, they conduct a systematic collective analysis of what they observed (Fernandez & Yoshida, 2004; Lewis et al., 2006). Research shows that this process strengthens professional relationships among teachers. It also deepens shared understanding of subject-specific pedagogy and generates collective knowledge that no teacher could gain by working alone (Cheung & Wong, 2014; Kanellopoulou & Darra, 2019; Richit et al., 2021). The OL differs from lesson study in several important ways. It is typically planned by one teacher rather than collaboratively, and the feedback process is less formal. Nevertheless, it shares the core principle that teachers can learn meaningfully from observing and discussing each other's practices.

A further point of international comparison is the peer observation of teaching (POT), a widely used form of PD in Western higher and further education. Gosling (2002) distinguishes three models according to who observes whom and for what purpose: an evaluation model, in which senior staff observe colleagues for appraisal, promotion or quality assurance; a development model, in which educational developers or expert teachers observe practitioners; and a peer review model, in which colleagues observe one another on terms of mutuality. A recurring concern in this literature is that observation intended for professional learning shifts toward compliance once it is tied to institutional accountability. Gosling (2002) argues that where observation is used to determine performance-related pay, appraisal or promotion, the opportunity to learn from it is correspondingly reduced. Shortland (2004) examines a peer observation scheme introduced in a UK university ahead of an external quality review and questions whether such schemes serve staff development or compliance, while O'Leary and Wood (2017), drawing on a national study of England's further education sector, describe how lesson observation has been normalized as a mechanism of performance measurement rather than of professional learning. This work is concentrated in post-compulsory rather than school settings, and this difference in sector should be borne in mind. Its recurring theme, however, is consistent: the evaluative orientation is treated as problematic for professional learning rather than as a settled feature of the practice.

The Kazakhstani OL differs from these models less in whether observation takes place than in how it is institutionally situated and understood. Wilson and Sharimova (2019) record that Kazakhstani teachers were already required to take part in a regular teacher evaluation process, and that a long tradition of teachers observing one another teach predated recent reform, so that lesson study was received as an extension of the established OL requirement. They further note that in OLs teachers plan a performance and are judged on how well they carry out the lesson. This is consistent with

Abdulgaliyev et al.'s (2022) account of OL as mandatory for teachers from the primary to the university level. The observational tradition is also situated within a formal professional structure: under the law on the status of a teacher, teachers are obliged to raise or confirm their qualification category at least once every five years (Republic of Kazakhstan, 2019, art. 15), and category upgrades are associated with increases in salary (OECD, 2018). Evaluation of teaching is therefore not an accretion onto an otherwise developmental practice, but a longstanding feature of the professional environment within which OL is conducted.

The contrast with Western POT accordingly concerns institutional embedding, evaluative orientation and historical normalization rather than compulsion alone. In the Western literature the evaluative model is one option among several and is treated as problematic for professional learning; in Kazakhstan the observed and assessed lesson is long established, administratively expected, and enacted within a career structure carrying material consequences. This makes Kazakhstan an informative setting for examining how teachers' beliefs form around a PD practice whose evaluative character is neither novel nor widely disputed.

Teachers' beliefs about the collaborative dimension of OL reflect their experience of whether post-lesson discussion and feedback genuinely contribute to their professional learning. When feedback is specific, constructive, and collegially grounded, teachers are more likely to perceive the collaborative aspect of OL as professionally valuable. Prior research in Kazakhstan has found that the professional collaboration dimension of OL beliefs tends to receive higher ratings than the teaching or student learning dimensions—suggesting that teachers may value the collegial exchange aspect of OL more than its direct instructional impact (Abdulgaliyev et al., 2022; Balta et al., 2025).

Teachers' Beliefs About Student Learning During Open Lessons

A third dimension of OL perceptions concerns teachers' beliefs about how the practice affects their students. This dimension is conceptually distinct from students' own perceptions of OL—it captures what teachers believe about student engagement, motivation, understanding, and performance during observed lessons, based on their own professional observation and judgment. Teacher beliefs about the impact of their instructional practices on student outcomes are recognized as an important construct in the PD literature, because teachers who believe that a practice benefits students are more likely to invest in it meaningfully and sustain their engagement with it over time (Guskey, 2002; Pajares, 1992; Saralar-Aras, 2022).

What teachers believe about the effects of OL on pupils is greatly influenced by what they see in observed

sessions. They take note of whether pupils appear more motivated or involved than normal. They also take note of whether the presence of observers appears to create anxiety or disrupt the learning environment. Observational classes can develop very differently from traditional classroom training, according to research. Students participate more enthusiastically during OL, according to some teachers. They credit this to the lesson's more meticulously planned and organized format (Abdulgaliyev et al., 2022; Balta et al., 2025). Other teachers observe the opposite. According to Balta et al. (2025) and Rakhmetova et al. (2025), students may experience pressure when being observed, which might impede their natural engagement and have an impact on their performance. Students' opinions of physics OLs in Kazakhstan were investigated by Rakhmetova et al. (2025). They discovered that whereas OL was generally seen favorably by pupils, older students were more skeptical about its authenticity. During monitored sessions, students with lower performance levels reported feeling more nervous.

Institutional Context and Workload as Contextual Considerations

The teachers' beliefs about professional growth, collaboration, and student learning are the main subjects of this study. However, it is also important to consider the institutional setting in which OLs occur. OLs are required for all teachers in Kazakhstan. They are closely linked to salary progression and administrative evaluation. Teachers' experiences and interpretations of the practice may be influenced by the institutional pressures this creates (Abdulgaliyev et al., 2022; Balta et al., 2025). OLs are bureaucratic routines, according to some educators, especially those with more experience. They contend that institutional goals outweigh actual needs for PD (Balta et al., 2025; Fullan & Miles, 1992). This observation aligns with broader theoretical arguments. According to Ball (2003), Kelchtermans (2005), and Sachs (2003), educators typically concentrate on showcasing their abilities to outside audiences when PD is integrated into accountability frameworks. Genuine professional investigation is neglected.

Another important factor is workload. OLs require significantly more preparation time than conventional sessions, according to teachers in Kazakhstan (Balta et al., 2025; Liang, 2011). This relates to a more general trend of increased workload in the teaching profession. According to Apple (1986), Hargreaves (1994), Kyriacou (2001), and Skaalvik and Skaalvik (2011), the accumulation of administrative and performative responsibilities increasingly reduces the amount of time available for genuine professional reflection. Whether these institutional pressures function as independent belief dimensions or contextual moderators is an empirical question this study addresses.

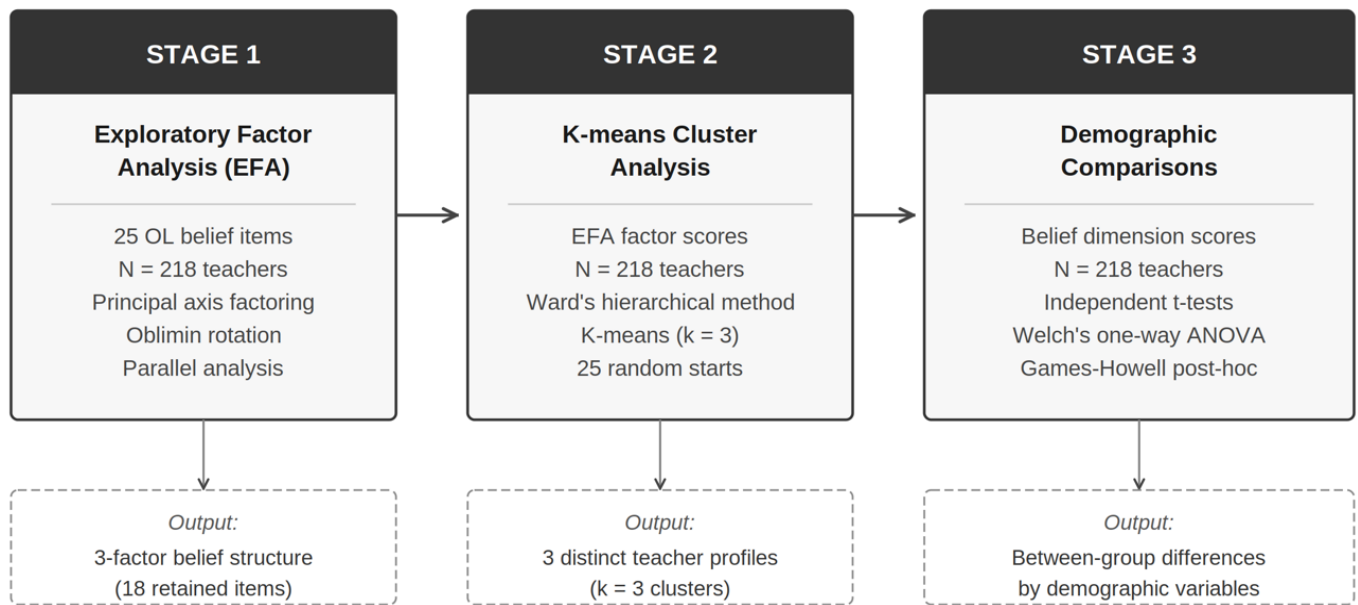


Figure 1. Three-stage sequential analytical design (the authors' own elaboration)

Demographic Moderation of Open Lesson Beliefs

This section looks at how teachers' OL beliefs may be moderated by professional experience, subject area, age, and gender—factors that are significant from a theoretical and practical standpoint (Fives & Buehl, 2012; Pajares, 1992).

One of the most frequently reported moderating factors in the research on PD beliefs is teaching experience (Levin, 2015). Early-career teachers are more receptive to structured evaluation and outside advice because they are still developing their professional identities and instructional repertoire (Borko, 2004; Feiman-Nemser, 2001). More experienced teachers, who have already established their professional approach, may evaluate OL more critically—particularly if their accumulated experience of it has been primarily evaluative rather than developmental. This pattern has been observed in prior Kazakhstani OL research, where experienced teachers were more likely to question the practice's value (Balta et al., 2025). Subject areas may also shape beliefs, given that pedagogical cultures differ meaningfully across disciplines (Grossman & Stodolsky, 1995; Siskin, 1994). Prior research found that students in social science subjects held more positive views of OL than those in natural science subjects—a difference attributed to the greater interpretive flexibility of social science pedagogy (Abdulgakioglu et al., 2022). Whether analogous subject-level differences exist at the teacher belief level is an open question addressed in this study.

Age group and gender represent additional dimensions of professional background that may shape teachers' beliefs about OLs. Gender has also been associated with different orientations toward collaborative learning in some studies (Cajkler et al., 2015; Desimone et al., 2002), although prior Kazakhstani

research on OLs has not identified significant gender differences (Abdulgakioglu et al., 2022; Balta et al., 2025).

METHODOLOGY

Research Design

This study adopted a quantitative, cross-sectional survey design. A quantitative approach was selected because the central objectives of the study—identifying the latent structure of a multidimensional belief construct, classifying teachers into distinct belief profiles, and examining group differences across demographic variables—are most appropriately addressed through statistical methods including factor analysis, cluster analysis, and between-group comparisons (Creswell & Creswell, 2018; Field, 2018). A cross-sectional design was appropriate given that the study aims to describe and analyze the structure of teacher beliefs at a single point in time rather than to trace development or change over time (Cohen et al., 2018).

As shown in **Figure 1**, the analytical approach used a three-stage sequential design: one-way analysis of variance (ANOVA) for demographic comparisons, K-means cluster analysis for belief profile categorization, and EFA for dimension identification.

Participants

There were 219 secondary school teachers in the study sample. A final analytical sample of N = 218 was obtained after one participant was eliminated for missing answers on one or more survey items. Convenience sampling was used to find participants. Google Forms was used to send the survey to colleagues and teachers in various parts of Kazakhstan, as well as through personal and professional networks.

Convenience sampling is a commonly used technique in educational survey research when the objective is to obtain a large, contextually diverse dataset within practical constraints. This strategy was chosen because a full national sampling frame of secondary school teachers was not available (Cohen et al., 2018). For the analytical techniques employed in this investigation, the total sample size of $N = 218$ is deemed sufficient, especially for EFA, which needs at least 200 instances to provide stable and trustworthy factor solutions (Hair et al., 2019; Tabachnick & Fidell, 2019).

Of the 218 participants, 147 were female (67.4%) and 71 were male (32.6%), a gender distribution consistent with the general demographic profile of the Kazakhstani secondary school teaching workforce. Participants taught across five subject areas: physics ($n = 111$, 50.9%), mathematics ($n = 50$, 22.9%), other subjects ($n = 33$, 15.1%), chemistry ($n = 13$, 6%), and biology ($n = 11$, 5.1%). For the subject-area analyses these categories were subsequently regrouped. Age ranged from 21 to 60 years and was grouped into four categories: 21-30 ($n = 98$, 44.9%), 31-40 ($n = 58$, 26.6%), 41-50 ($n = 32$, 14.7%), and 51-60 ($n = 30$, 13.8%) years. Teaching experience ranged from 1 to 36 years and was organized into four bands: 1-5 ($n = 87$, 39.9%), 6-10 ($n = 40$, 18.3%), 11-20 ($n = 42$, 19.3%), and 21-36 ($n = 49$, 22.5%) years.

The sample was not designed to be nationally representative and should not be interpreted as such. Two features in particular limit their representativeness. First, physics teachers account for just over half of the sample (50.9%), a proportion substantially exceeding their share of the national secondary teaching workforce; this likely reflects the network-based recruitment strategy described above. Second, although the gender distribution is broadly comparable to that of the Kazakhstani secondary teaching workforce, correspondence on a single demographic dimension does not establish representativeness more generally. The findings reported below therefore describe belief structures and profiles within this sample of 218 secondary school teachers working in the Kazakhstani OL system and are not offered as population estimates for Kazakhstani teachers as a whole. References to Kazakhstan in this article accordingly denote the national institutional and policy setting within which the OL is practiced, rather than a claim that the sample is representative of the Kazakhstani teaching workforce as a whole.

Instrument

Two sections of a structured questionnaire were used to gather data. Four demographic factors were collected in the first section: years of teaching experience, gender, age group, and subject area. Teachers' beliefs regarding OL were measured in the second portion using 25 Likert-scale items. Higher scores indicated more positive beliefs

about the practice, and responses were recorded on a five-point scale from 1 (strongly disagree) to 5 (strongly agree).

Abdulkakioglu et al. (2022) initially created and validated the questionnaire in Kazakhstan with a sample of university-level instructors. Three theoretically suggested characteristics of OL beliefs were covered by the original instrument: beliefs about OL and teaching (14 items), beliefs about OL and student learning (6 items), and beliefs about OL and professional collaboration with colleagues (5 items). Strong overall internal consistency (Cronbach's $\alpha = .86$) was reported in the initial validation study. The instrument was implemented without modification, given its established psychometric validation, which was later verified by Balta et al. (2025).

The original instrument was created and validated in three languages: English, Russian, and Kazakh. As part of the original instrument development process, bilingual subject-matter experts checked translated versions for linguistic accuracy and semantic equivalence (Abdulkakioglu et al., 2022). To guarantee complete accessibility for every participant, the same multilingual versions were used in the current study. Online distribution was used for the survey. All participants were told of the study's academic goal and given the assurance that their answers would remain anonymous and confidential. Participation was completely voluntary. Throughout the whole investigation, no personally identifiable information was gathered.

Prior to the main analysis, the internal consistency of the full 25-item instrument was assessed in the present sample to confirm its suitability for use with Kazakhstani teachers. The overall Cronbach's α for the 25-item scale was $\alpha = .933$ in the present sample, compared with the $\alpha = .86$ reported for the same instrument in the original validation study (Abdulkakioglu et al., 2022), indicating excellent internal consistency and confirming the suitability of the instrument for the current dataset. Following item reduction through the EFA procedure, reliability coefficients for each of the three retained subscales are reported in the results section alongside the EFA solution.

Although the original instrument comprised of 25 items, the final EFA solution, in the current study, retained 18 items. Seven items were removed due to factor loadings below .40, substantial cross-loadings, or low communality values—following standard psychometric criteria (Hair et al., 2019; Tabachnick & Fidell, 2019). The 18 retained items were judged to adequately represent the three theoretically proposed dimensions of OL beliefs, and the content coverage of each dimension was verified against the original instrument framework (Abdulkakioglu et al., 2022).

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics. The analysis proceeded in three sequential stages corresponding to the three core research objectives of the study.

Stage 1

EFA was conducted to examine the empirical structure underlying the 25 OL belief items (Fabrigar et al., 1999; Hair et al., 2019). Exploratory rather than confirmatory factor analysis (CFA) was selected because the original validation of the instrument was conducted with university instructors (Abdulgakioglu et al., 2022), whereas the present sample comprises secondary school teachers. Because a factor structure established in one population cannot be assumed to hold in another, the analysis sought to establish whether the proposed dimensional structure was recoverable in this population rather than imposing it a priori. It should be noted that the three-dimensional structure discussed in the literature review derives from the original validation of the instrument (Abdulgakioglu et al., 2022) and was therefore specified prior to, and independently of, the present analysis. The EFA reported here was conducted to test whether that previously established structure would be recovered in a secondary school teacher population, rather than to generate a new dimensional framework from these data. Before proceeding with the EFA, two standard diagnostic tests—the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity—were used to confirm the suitability of the correlation matrix for factor analysis; results are reported later. Principal axis factoring was used as the extraction method, with direct oblimin rotation applied to allow for correlations between factors—a reasonable expectation given that beliefs about different aspects of OL are likely to be interrelated. The number of factors to retain was determined by three complementary criteria: eigenvalues greater than 1.0, visual inspection of the scree plot, and the substantive interpretability of the factor solution. Items with primary factor loadings below .40, or with cross-loadings that prevented clear assignment to a single factor, were considered for removal (Hair et al., 2019). Internal consistency (Cronbach's alpha) was calculated for each retained factor.

Stage 2. Cluster analysis

K-means cluster analysis was applied to EFA factor scores to identify distinct OL belief profiles (Hair et al., 2019). The optimal number of clusters was guided by preliminary hierarchical cluster analysis using Ward's linkage method with squared Euclidean distances. Solution stability was evaluated by examining cluster centroid distinctiveness, cluster sizes, and conceptual coherence of the resulting profiles.

Table 1. Descriptive statistics for OL belief dimensions (N = 218)

Belief dimension	M	SD	Min	Max
Professional growth	3.70	0.80	1.00	5.00
Professional collaboration	3.81	0.83	1.00	5.00
Perceived student benefit	3.36	0.84	1.00	5.00

Note. Min: Minimum observed score; Max: Maximum observed score; Scores reflect subscale means computed across retained items; One case excluded due to missing data

Stage 3. Demographic comparisons

One-way ANOVA was used to test whether teachers' scores on each of the three belief dimensions—professional growth, professional collaboration, and perceived student benefit—differed significantly as a function of gender, subject area, age group, and teaching experience. Because the chemistry ($n = 13$) and biology ($n = 11$) subgroups were too small to support stable between-group comparison even under Welch's correction (Field, 2018), they were combined with physics into a single natural sciences category. All subject-area analyses therefore compared natural sciences ($n = 135$), mathematics ($n = 50$), and other subjects ($n = 33$). Prior to conducting the one-way ANOVA, the assumptions of normality and homogeneity of variances were assessed using the Shapiro-Wilk test and Levene's test, respectively. Where the homogeneity of variances assumption was violated, Welch's ANOVA was reported as a robust alternative (Field, 2018). Statistically significant main effects were followed by post-hoc pairwise comparisons using Tukey's HSD test when variances were equal, or the Games-Howell procedure when variances were unequal. Effect sizes were reported as partial eta-squared (η^2_p) and interpreted using Cohen's (1988) conventional benchmarks of small ($\eta^2_p = .01$), medium ($\eta^2_p = .06$), and large ($\eta^2_p = .14$) effects (Field, 2018).

FINDINGS

Descriptive Statistics

For each of the three belief dimensions across the entire sample, descriptive statistics were computed before the factor analysis. The professional growth, professional collaboration, and perceived student benefit subscales' means (Ms), standard deviations (SDs), and observed ranges are shown in **Table 1**. Teachers had the highest positive beliefs about professional collaboration ($M = 3.81$, $SD = 0.83$), followed by professional growth ($M = 3.70$, $SD = 0.80$), and perceived student benefit ($M = 3.36$, $SD = 0.84$) overall. The scale midpoint of 3.0 was exceeded by all three averages, suggesting generally positive OL orientations. Teachers appear to be less convinced of OL's direct benefit to students, as evidenced by the lowest mean for perceived student benefit.

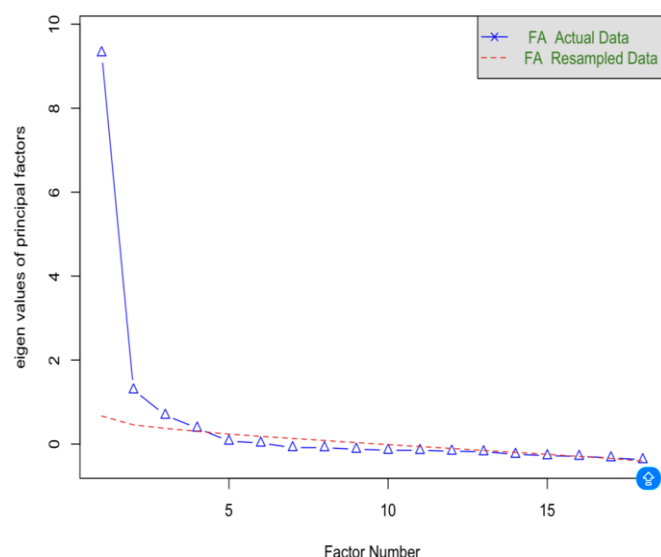


Figure 2. Parallel analysis scree plot comparing eigenvalues of actual data (solid blue line) and resampled data (dashed red line) (factors where observed eigenvalues exceed simulated eigenvalues are retained) (the authors' own elaboration)

Exploratory Factor Analysis

Prior to conducting the EFA, the suitability of the data was assessed using two standard diagnostic indices. The KMO measure of sampling adequacy was $KMO = .936$, indicating excellent sampling adequacy (Kaiser, 1974). Bartlett's test of sphericity was statistically significant, $\chi^2(153) = 3121.3$, $p < .001$, confirming that the correlation matrix was suitable for factor analysis (Tabachnick & Fidell, 2019). Together, these results confirmed that the 18 retained items shared sufficient common variance to support reliable factor extraction.

To determine the number of factors to retain, parallel analysis was conducted alongside inspection of the scree plot. The parallel analysis plot (Figure 2) displayed the eigenvalues of the actual data against those generated from resampled random data. The actual data eigenvalues exceeded the simulated eigenvalues for the first four factors, with the most pronounced separation occurring at factor 1 and factor 2 (eigenvalues ≈ 9.3 and 1.4 , respectively), while factor 3 and factor 4 showed markedly smaller and more gradual eigenvalue differences. Notwithstanding the parallel analysis suggestion of four factors, three factors were retained based on convergent evidence: a clear scree plot elbow after factor 3, and an uninterpretable fourth factor with only two acceptable loadings (Fabrigar et al., 1999). The three-factor solution was adopted as the most parsimonious and empirically interpretable solution (Zwick & Velicer, 1986). The resulting structure was also consistent with the dimensions proposed by Abdulkakioglu et al. (2022), although the composition of the factors differed from that instrument: seven of the original 25 items were removed, and the first factor comprised eight items rather than the fourteen of the original teaching dimension.

EFA was conducted using principal axis factoring with direct oblimin rotation, consistent with the expectation of correlated belief dimensions. The three-factor solution accounted for 65% of the total variance ($MR1 = 26\%$, $MR2 = 20\%$, $MR3 = 19\%$). Model fit indices indicated acceptable model fit: Tucker-Lewis index (TLI) = .907, RMSEA = .090 (90% CI [.078, .103]; approaching but within acceptable range for EFA, Fabrigar et al., 1999), and BIC = -265.51. The standardized pattern matrix with factor loadings and communalities (h^2) is presented in Table 2.

Table 2. Pattern matrix of EFA with factor loadings and communalities (N = 218)

Item	Factor/item description	MR1	MR2	MR3	h^2
Factor 1. Professional growth					
Q3	OL helps me to better prepare for the lesson.	.92	-	-	.71
Q11	OL improves the quality of my teaching.	.77	-	-	.71
Q12	OL helps me to increase my knowledge of the content.	.75	-	-	.71
Q10	OL increases my pedagogical skills.	.73	-	-	.74
Q13	OL helps me to increase my pedagogical content knowledge.	.68	-	-	.61
Q1	I am teaching better in OL.	.66	-	-	.41
Q2	OL allows me to try new teaching methods.	.64	-	-	.51
Q4	I use technologies more in OL.	.57	-	-	.54
Factor 2. Professional collaboration					
Q23	Listening to and observing the lessons of other teachers is helpful.	-	.94	-	.88
Q25	I implement the best practices I see in OL.	-	.89	-	.81
Q24	In preparing an OL I consult experienced teachers.	-	.72	-	.54
Q21	The participating teachers give positive and/or constructive feedback after OL to help me improve my course.	-	.69	-	.67
Q22	OL increases the collaboration among teachers.	-	.62	-	.58
Factor 3. Perceived student benefit					
Q16	With OL students understand the topics better compared to traditional courses.	-	-	.85	.68
Q17	Students' performance increases in OL compared to traditional courses.	-	-	.84	.70
Q19	Students are more motivated in OL compared to traditional courses.	-	-	.77	.68

Table 2 (Continued).

Item	Factor/item description	MR1	MR2	MR3	h ²
Q15	Students are more actively engaged in their learning in OL compared to traditional courses.	-	-	.71	.61
Q18	Lessons through OL are more engaging to students compared to traditional courses.	-	-	.69	.70
SS loadings		4.75	3.57	3.47	
Proportion of variance explained		.26	.20	.19	
Cumulative variance explained		.26	.46	.65	
Cronbach's alpha		.921	.913	.907	

Note. Extraction method: Principal axis factoring; Rotation method: Direct oblimin; Factor loadings below .40 are suppressed (shown as -); h²: Communality; Item descriptions are taken from Abdulkakioglu et al. (2022)

Table 3. Inter-factor correlation matrix

Factor	MR1	MR2	MR3
MR1. Professional growth	1.00	-	-
MR2. Professional collaboration	.67	1.00	-
MR3. Perceived student benefit	.69	.49	1.00

Note. Factor correlations derived from the oblimin rotation solution

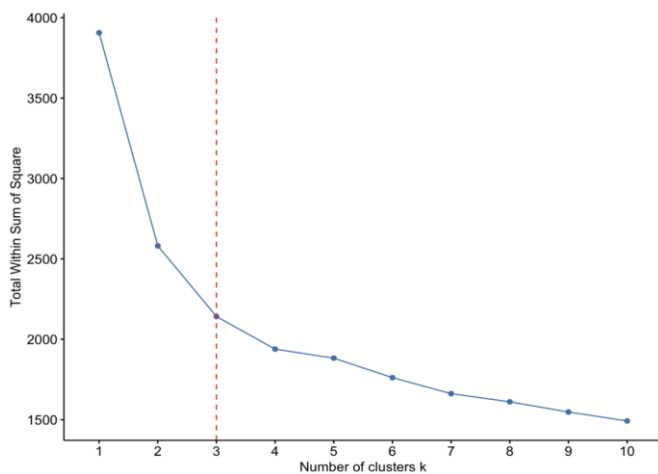


Figure 3. Elbow method plot showing total within-cluster sum of squares as a function of the number of clusters ($k = 1$ to 10) (the dashed red line marks the optimal solution at $k = 3$) (the authors' own elaboration)

The first factor, professional growth (MR1), comprised eight items (loadings: .57-.92) reflecting beliefs about instructional improvement and pedagogical development. The second factor, professional collaboration (MR2), comprised five items (loadings: .62-.94) reflecting the collegial value of OLs. The third factor, perceived student benefit (MR3), comprised five items (loadings: .69-.85) reflecting beliefs about OL's impact on student engagement, motivation, and performance.

All items demonstrated adequate communalities (range: .41-.88), indicating that a sufficient proportion of each item's variance was accounted for by the three-factor solution. No items were retained with primary loadings below .40, and cross-loadings across factors were negligible for all retained items. Internal consistency was excellent for the full 18-item scale ($\alpha = .949$) and at the subscale level: professional growth ($\alpha = .921$), professional collaboration ($\alpha = .913$), and perceived student benefit ($\alpha = .907$), all substantially exceeding the .70 threshold (Nunnally, 1978).

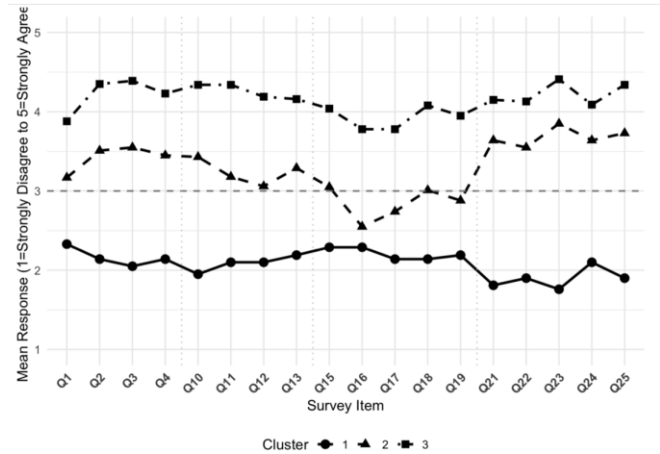


Figure 4. Cluster profile plot showing mean item scores (1-5 scale) for the three teacher belief clusters across all 18 OL survey items (the horizontal dashed line at 3.0 represents the scale midpoint; cluster 1 (circles) = skeptical teachers; cluster 2 (triangles) = moderately positive teachers; cluster 3 (squares) = highly enthusiastic teachers) (the authors' own elaboration)

Inter-factor correlations are presented in **Table 3**, confirming that oblique rotation was appropriate and that the three dimensions, while correlated, are empirically distinguishable.

Cluster Analysis: Teacher Belief Profiles

K-means cluster analysis was conducted on EFA factor scores ($N = 218$). The elbow method (**Figure 3**) plotted within-cluster sum of squares against $k = 1$ to 10, revealing a clear inflection point at $k = 3$ —after which variance reduction became substantially smaller—supporting a three-cluster solution. The K-means algorithm was executed with $k = 3$ and 25 random starts to ensure solution stability. The final cluster solution classified 218 teachers into three groups. Cluster 1 comprised 21 teachers (9.6%), cluster 2 comprised 84 teachers (38.6%), and cluster 3 comprised 113 teachers (51.8%). Cluster profile plot (**Figure 4**) presents the mean response scores for all 18 items across the three clusters, organized by thematic section: Q1-Q4 (teaching), Q10-Q13 (teaching), Q15-Q19 (student learning items), and Q21-Q25 (collaboration items). The three clusters displayed clearly distinct and non-overlapping mean profiles across the full range of items, providing visual confirmation of well-separated groupings.

Table 4. Cluster profiles: Descriptive statistics by belief dimension (N = 218)

Cluster	n (%)	M (SD)			M
		Professional growth	Professional collaboration	Perceived student benefit	Overall
Cluster 1. Skeptical teachers	21 (9.6)	2.12 (0.54)	1.9 (0.68)	2.21 (0.68)	≈ 2.08
Cluster 2. Moderately positive teachers	84 (38.6)	3.33 (0.49)	3.68 (0.56)	2.85 (0.56)	≈ 3.29
Cluster 3. Highly enthusiastic teachers	113 (51.8)	4.23 (0.41)	4.22 (0.4)	3.93 (0.53)	≈ 4.13

Note. Percentages are based on the cluster analysis sample of N = 218 (one case excluded due to listwise deletion)

Table 5. Independent samples t-test results for gender differences in OL belief dimensions (N = 218)

Belief dimension	Male: M (SD)	Female M: (SD)	t	df	p	Cohen's d
Professional growth	3.63 (0.87)	3.73 (0.76)	-0.91	216	.362	-0.13
Professional collaboration	3.67 (0.99)	3.87 (0.73)	-1.54 ^a	107	.128	-0.23
Perceived student benefit	3.31 (0.84)	3.38 (0.84)	-0.57	216	.567	-0.08

Note. Male n = 71; Female n = 147; Welch's t-test was used for professional collaboration due to a significant Levene's test ($p = .009$); Student's t-test was used for the remaining dimensions; All p-values are two-tailed; ^a Welch's correction applied

Table 4 reports the cluster sizes and overall mean scores per cluster.

Cluster 1. Skeptical teachers (n = 21, 9.6%)

Teachers in this cluster produced consistently low mean scores across all 18 items, with individual item means ranging from approximately 1.76 to 2.33. All scores fell below the scale midpoint of 3.0 across every item and thematic section, indicating an overall skeptical orientation toward the OL across all three belief dimensions. The lowest scores within this cluster were observed for collaboration items (Q23: $M = 1.76$; Q21: $M = 1.81$; Q25: $M = 1.90$), while the comparatively highest score was observed for Q1 ($M = 2.33$).

Cluster 2. Moderately positive teachers (n = 84, 38.6%)

Teachers in this cluster demonstrated moderate mean scores overall, with item means ranging from approximately 2.55 to 3.85. The cluster profile revealed notable within-profile variation: scores on collaboration items—particularly Q23 ($M = 3.85$), Q25 ($M = 3.73$), and Q24 ($M = 3.64$)—were the highest in this cluster and above the scale midpoint, while scores on student benefit items Q16 ($M = 2.55$) and Q17 ($M = 2.74$) were among the lowest and fell below the scale midpoint. This pattern suggests that teachers in this cluster held more positive beliefs about the collegial aspects of OLs than about their direct impact on student outcomes.

Cluster 3. Highly enthusiastic teachers (n = 113, 51.8%)

Teachers in this cluster produced the highest mean scores across all 18 items (range: 3.78–4.41), all well above the scale midpoint. The highest scores were observed for Q23 ($M = 4.41$) and Q25 ($M = 4.34$) on professional collaboration, and Q3 ($M = 4.39$) on professional growth. The profile was notably stable across thematic sections, with little within-profile variation compared to cluster 2.

Demographic Comparisons

Gender

Independent samples t-tests compared male ($n = 71$) and female ($n = 147$) teachers' scores on each belief dimension. Welch's t-test was used for professional collaboration due to a significant Levene's test ($F[1, 216] = 7.025$, $p = .009$); Student's t-test was used for the remaining dimensions.

No statistically significant gender differences were found on any of the three belief dimensions. For professional growth, $t(216) = -0.91$, $p = .362$, $d = -0.13$; for professional collaboration, $t(107) = -1.54$, $p = .128$, $d = -0.23$; and for perceived student benefit, $t(216) = -0.57$, $p = .567$, $d = -0.08$. All effect sizes were negligible to small, indicating that gender had no meaningful influence on OL beliefs in this sample. Results are presented in **Table 5**.

Subject area

Welch's one-way ANOVA was conducted to examine differences across three subject area groups: natural sciences (physics, chemistry, and biology combined; $n = 135$), mathematics ($n = 50$), and other subjects ($n = 33$). Levene's test was statistically significant for professional growth, $F(2, 215) = 5.62$, $p = .004$, and professional collaboration, $F(2, 215) = 4.03$, $p = .019$, but not for perceived student benefit, $F(2, 215) = 1.48$, $p = .230$. Welch's ANOVA was therefore used for all three dimensions, both where indicated by Levene's test and for consistency across dimensions.

No statistically significant differences were found for professional growth, $F(2, 71.2) = 1.28$, $p = .284$, $\eta^2_p = .035$, or professional collaboration, $F(2, 70.7) = 1.41$, $p = .250$, $\eta^2_p = .038$. Effect sizes (η^2_p) are reported for all comparisons to support transparency and future meta-analytic use. However, η^2_p values for non-significant results should be interpreted with caution, as they are not reliable estimators of population effects when the null hypothesis is not rejected (Cohen, 1988).

Table 6. Group descriptive statistics for teaching experience (N = 218)

Teaching experience group	n	M (SD)		
		Professional growth	Professional collaboration	Perceived student benefit
Group 1: 1-5 years	87	3.70 (0.82)	3.83 (0.93)	3.36 (0.81)
Group 2: 6-10 years	40	3.46 (0.80)	3.75 (0.80)	3.25 (0.92)
Group 3: 11-20 years	42	3.73 (0.87)	3.77 (0.84)	3.41 (0.96)
Group 4: 21-36 years	49	3.86 (0.65)	3.86 (0.64)	3.40 (0.73)

A statistically significant difference was observed for perceived student benefit, $F(2, 70.6) = 4.18$, $p = .019$, $\eta^2_p = .106$, representing a medium effect size. Games-Howell post-hoc comparisons revealed that natural sciences teachers reported significantly higher perceived student benefit scores than teachers of other subjects (mean difference = 0.47, $p = .015$). The difference between natural sciences and mathematics teachers (mean difference = 0.09, $p = .831$) and between mathematics and other-subject teachers (mean difference = 0.38, $p = .145$) did not reach statistical significance.

Age group

Welch's one-way ANOVA was conducted to examine differences across four age groups (21-30, 31-40, 41-50, and 51-60 years). Levene's test was non-significant for all three dimensions (all $p > .19$), indicating no violation of the homogeneity of variances assumption. No statistically significant age group differences were found for professional growth, $F(3, 86.4) = 1.86$, $p = .142$; professional collaboration, $F(3, 86.6) = 0.41$, $p = .746$; or perceived student benefit, $F(3, 82.7) = 0.67$, $p = .572$. All Games-Howell post-hoc comparisons were non-significant (all $p > .05$), indicating that age group was not associated with meaningful differences in OL beliefs.

Teaching experience

Welch's one-way ANOVA examined differences across four teaching experience groups (1-5, 6-10, 11-20, and 21-36 years; **Table 6**). Levene's test was non-significant for all dimensions (all $p > .07$), indicating no violation of homogeneity of variances. No statistically significant differences were found across teaching experience groups on any of the three belief dimensions: professional collaboration, $F(3, 103.3) = 0.22$, $p = .882$; perceived student benefit, $F(3, 98.1) = 0.27$, $p = .844$; or professional growth, $F(3, 100.9) = 2.23$, $p = .090$. Although a descriptive trend was observed in the group means for professional growth—with teachers in the 21-36 years experience group reporting slightly higher scores ($M = 3.86$, $SD = 0.65$) compared to the 6-10 years group ($M = 3.46$, $SD = 0.80$)—this pattern did not reach statistical significance in Games-Howell post-hoc comparisons (all $p > .05$). Overall, teaching experience was not a statistically significant differentiator of OL beliefs in this sample. **Table 7** shows the summary of Welch's one-way ANOVA results for demographic variables (N = 218). Post-hoc results are presented in **Table 8**.

Table 7. Summary of Welch's one-way ANOVA results for demographic variables (N = 218)

Belief dimension	F	df ₁	df ₂	p	η^2_p
Subject area					
Professional growth	1.28	2	71.2	.284	.035
Professional collaboration	1.41	2	70.7	.250	.038
Perceived student benefit	4.18	2	70.6	.019*	.106
Age group					
Professional growth	1.86	3	86.4	.142	.061
Professional collaboration	0.41	3	86.6	.746	.014
Perceived student benefit	0.67	3	82.7	.572	.024
Teaching experience					
Professional growth	2.23	3	100.9	.090	.062
Professional collaboration	0.22	3	103.3	.882	.006
Perceived student benefit	0.27	3	98.1	.844	.008

Note. Welch's F-statistic reported throughout; df₁: Between-groups df; df₂: Welch-corrected within-groups df; η^2_p : Partial eta-squared, calculated as $(F \times df_1) / (F \times df_1 + df_2)$; Effect sizes are reported for all comparisons; those associated with non-significant results should be interpreted with caution (Cohen, 1988); * $p < .05$

Table 8. Games-Howell post-hoc comparisons for subject area differences in perceived student benefit

Comparison	Mean difference	t	df	p
Natural sciences vs. mathematics	0.09	0.58	74.0	.831
Natural sciences vs. other	0.47	2.91	46.3	.015*
Mathematics vs. other	0.38	1.90	74.7	.145

Note. Groups: natural sciences (physics, chemistry, and biology combined; $n = 135$), mathematics ($n = 50$), other subjects ($n = 33$); Mean differences calculated as group i minus group j; * $p < .05$

DISCUSSION

Overview

This study used a three-stage sequential design to investigate the structure, profiles, and demographic correlates of OL beliefs among secondary school teachers in Kazakhstan. The findings contribute to a growing but still limited literature on how teachers in post-Soviet contexts perceive institutionalized PD practices.

Teacher Belief Profiles: A Person-Centered Perspective

Using cluster analysis, three different teacher belief profiles were identified. They were categorized as skeptical teachers ($n = 21$, 9.6%), moderately positive teachers ($n = 84$, 38.6%), and highly enthusiastic teachers ($n = 113$, 51.8%). Important information on Kazakhstani

teachers' attitudes toward OL may be found in each profile.

The size of the highly enthusiastic cluster is the most significant finding. In all three dimensions, over half of the sample consistently held favorable beliefs. The item means were between 3.78 and 4.41. This level of enthusiasm is somewhat unexpected. Surface compliance, disengagement, and strategic performance have all been reported in studies on mandatory PD, especially when teachers believe PD serves administrative rather than developmental aims (Ball, 2003; Sachs, 2003). The prevalence of genuine enthusiasm suggests that OL has achieved real professional legitimacy in Kazakhstan. This likely reflects its long history in the post-Soviet educational tradition—OL has been part of professional culture for decades (Abdulkadioglu et al., 2022; Liang, 2011), and many teachers appear to have internalized it as a natural part of professional life.

There is an intriguing internal pattern in the moderately positive cluster. The collaborative components of OL were highly appreciated by these teachers. They scored above the midpoint of the scale for both receiving feedback (Q25: $M = 3.73$) and observing colleagues (Q23: $M = 3.85$). Simultaneously, they scored below the midpoint on student learning measures (Q16: $M = 2.55$; Q17: $M = 2.74$). This implies that for these teachers, OL is essentially a social and collaborative activity. They remain skeptical about whether this directly benefits students. There is no prior documentation of this distinction in Kazakhstani OL literature. It is consistent with the findings of Little (1993) and Lortie (1975) that teachers value collegial engagement because their professional lives are otherwise marked by isolation. Regardless of its instructional impact, OL may be important for these teachers as a unique chance for professional connection. A comparatively poor inter-factor correlation between professional collaboration and perceived student benefit ($r = .49$) lends credence to this hypothesis.

Despite being modest at 9.6%, the skeptical cluster was nevertheless instructive. Even within this group, student learning items (Q16: $M = 2.29$; Q18: $M = 2.14$) were rated lower than Q1 ($M = 2.33$). This suggests some residual openness to OL in principle. Nevertheless, these teachers remain unconvinced of OL's benefits overall. In cluster 2 and cluster 3, perceived student benefit was the lowest-rated dimension, a pattern consistent with earlier studies (Abdulkadioglu et al., 2022; Balta et al., 2025; Rakhmetova et al., 2025).

Demographic Moderation: The Institutional Socialization Hypothesis

One of the most theoretically interesting findings of this study is the near-complete absence of statistically significant demographic differences across the three

beliefs dimensions. Gender, age group, and teaching experience were not associated with meaningful variation in professional growth, professional collaboration, or perceived student benefit. The single exception was a statistically significant difference between natural sciences and other-subject teachers on perceived student benefit ($p = .015$, $\eta^2_p = .106$, a medium effect). Because this was the only significant contrast to emerge across the demographic comparisons conducted, and because these comparisons were not adjusted for multiple testing across the three belief dimensions, it is treated here as a provisional finding requiring independent replication rather than as an established disciplinary difference.

In essence, the lack of demographic moderation is a significant discovery. Early-career teachers are more receptive to external feedback, according to the PD literature. In contrast, teachers with more experience are more likely to critically assess mandatory practices (Borko, 2004; Feiman-Nemser, 2001; Levin, 2015). It is notable that there are no such differences in this sample. It implies that the socializing power of a deeply embedded institutional practice shapes OL beliefs in Kazakhstan more than individual professional biographies. In Kazakhstan, OL is not merely recommended. It is mandatory, institutionally evaluated, and linked to salary progression (Abdulkadioglu et al., 2022). In these circumstances, the practice might lead to some normative convergence in the beliefs of teachers. The individual-level diversity usually observed in more voluntary PD circumstances seems to be superseded by this convergence. In other words, OL might serve as an effective institutional socializer. Regardless of their demographic background, it results in generally comparable belief tendencies among teachers. Opfer and Pedder's (2011) conceptualization of professional learning as a system-level rather than a strictly individual-level process is consistent with this.

The absence of gender differences is consistent with prior Kazakhstani OL research (Abdulkadioglu et al., 2022; Balta et al., 2025), while the absence of experience effects contrasts with Balta et al. (2025), possibly reflecting differences in sample composition or measurement approach.

The subject area finding merits consideration, but several constraints limit how far it can be interpreted. Teachers of natural sciences (physics, chemistry, and biology) reported higher perceived student benefit than teachers in the other subjects category. Interpretation of this contrast is restricted by the composition of the comparison group: the specific disciplines comprising the other subjects category were not recorded in the present dataset. Any disciplinary explanation of the difference therefore remains conjectural. One possibility is that natural science lessons frequently incorporate experiments, demonstrations, and other observable

activities, during which changes in student engagement may be more readily apparent to a teacher within a single observed lesson. This account cannot be tested with the present data and evaluating it would require studies in which subject affiliation is recorded at the discipline level and combined with qualitative follow-up. What the finding indicates more securely is that subject-area context warrants attention as a potential source of variation in student-centered OL beliefs, an area that has not received enough attention in OL research (Grossman & Stodolsky, 1995; Siskin, 1994).

Theoretical Implications

This study has a number of theoretical implications for research on institutional PD and teacher beliefs. First, the results demonstrate the true multidimensionality of teachers' beliefs regarding a particular PD practice. They cannot be reduced to a single global attitude. Although they are different, the three dimensions discussed here are connected. Each one encapsulates a distinct aspect of the relationship between teachers and OL. This supports Fives and Buehl's (2012) argument that rather than being generic dispositions, teacher beliefs are arranged into domain-specific systems. It also suggests that future research on OL and similar practices should measure beliefs at the dimension level. Relying on a single composite score risks masking important variation. Second, cluster analysis reveals that teachers vary in the distribution of their OL beliefs across dimensions as well as in the degree to which they hold these beliefs. An excellent illustration is the moderately positive cluster. Although they were skeptical about student-centered beliefs, these teachers had favorable collaborative beliefs. This discrepancy implies that for many teachers, the social and instructional roles of OL may be psychologically distinct. Different professional learning pathways seem to be represented by collegial interaction and instructional progress. To develop, they could need various circumstances. Third, an institutional socialization explanation of the establishment of OL beliefs is supported by the almost complete lack of demographic moderation. Because of how deeply ingrained the practice is in Kazakhstani education, normative convergence seems to result. The individual-level diversity usually seen in more voluntary PD circumstances is superseded by this convergence. This finding has significant implications for understanding how mandatory PD practices shape professional belief systems over time.

Practical Implications

The findings carry several practical implications for administrators, PD designers, and school leaders in Kazakhstan and similar post-Soviet contexts. One thing is evident from the three different belief profiles. It is unlikely that a one-size-fits-all strategy for OL will work. 9.6% of teachers belong to the skeptical cluster. In all

three categories, their beliefs are consistently negative. They are unlikely to be reached by standard OL forms. Alternative PD pathways that specifically address these teachers' concerns might be necessary (Duran et al., 2020). A valuable first step toward designing targeted interventions would be qualitative research that examines the causes of their skepticism.

The task is different for the moderately positive cluster. The collaborative elements of OL are already valued by these teachers. They are still skeptical of its effects on students, though. A potential developmental pathway is indicated by this gap. Their beliefs might change in favor of stronger pedagogical conviction if their good collaborative experiences could be more explicitly linked to student learning outcomes. According to Guskey (2002), when teachers witness favorable student responses firsthand, their beliefs about student outcomes tend to shift. They do not precede it. For this group, creating feedback mechanisms that prioritize student learning over instructional methods may be especially beneficial.

There is a useful lesson to be learned from the nearly universal lack of demographic differences. It is not necessary to focus on particular subgroups in order to improve OL quality. All teachers throughout the professional spectrum are likely to gain from improving the constructiveness of post-lesson feedback, lowering evaluation pressure, and establishing genuine chances for collaborative reflection.

Limitations and Directions for Future Research

This study has a number of limitations that should be noted. First, the results' statistical representativeness is limited by the convenience sampling approach, therefore caution should be exercised in generalizing the results to the larger Kazakhstani teaching community. To evaluate the stability of the three-factor structure and three-cluster typology found here, future studies should use probability sampling techniques and larger, more regionally representative samples.

Second, the cross-sectional design of the study precludes causal inference and limits understanding of how OL beliefs develop and change over time. Longitudinal research tracking belief trajectories across teachers' careers—and examining how beliefs respond to changes in OL format, feedback quality, or institutional context—would significantly advance theoretical understanding of how embedded PD practices shape professional belief systems.

Third, because OL is institutionally required and associated with evaluation, exclusive reliance on self-report data increases the danger of social desirability bias. Insight into the origins of various belief configurations would be enhanced by mixed methods of research that includes qualitative interviews, especially with skeptical and moderately positive cluster teachers.

Fourth, the small chemistry and biology subgroups required combination with physics into a single natural sciences category for the subject-area analysis. While this produces a more balanced comparison, the specific disciplines comprising the other subjects category ($n = 33$) were not recorded in the present dataset, which limits the specificity of any disciplinary interpretation of the perceived student benefit finding (mean difference = 0.47, $p = .015$, $\eta^2_p = .106$). Future research with larger, discipline-specific samples is needed to clarify which particular subjects drive this effect.

Finally, even though the three-factor structure found here is theoretically sound and psychometrically sound, it has not yet been independently confirmed due to the lack of a CFA in an independent sample. Future studies should test the factor structure's reproducibility and generalizability across other teacher populations and educational contexts using a split-sample or independent-sample CFA strategy.

Beyond the limitations noted above, because the OL and comparable forms of observed teaching are practiced across a range of post-Soviet and East Asian education systems, comparative research examining teachers' beliefs about such practices in other national contexts would help establish which features of the present findings are specific to Kazakhstan and which reflect more general properties of institutionally mandated lesson observation.

CONCLUSION

This study offers the first factor-analytic and person-centered examination of Kazakhstani secondary school teachers' beliefs about the OL. The results demonstrate that the teaching community has significantly varied belief profiles and that OL beliefs are organized around three distinct but correlated dimensions: professional growth, professional collaboration, and perceived student benefit. The nearly universal lack of demographic moderation suggests that, among the teachers studied here, OL beliefs were shaped more by institutional embeddedness than by personal biography. In addition to providing useful advice for administrators and PD designers looking to maximize the developmental value of the OL for all teachers, these findings deepen theoretical understanding of institutionalized PD practices.

Author contributions: NR: conceptualization, investigation, methodology, project administration, writing – original draft, writing – review & editing; SM: data curation, methodology, resources, writing – original draft, writing – review & editing; AS: data curation, visualization, writing – original draft; AI: data curation, writing – review & editing; NJ: formal analysis, supervision, validation, writing – review & editing. All authors agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: This study was approved by Suleyman Demirel University on 18 August 2022 with approval number 09-12/58. Participants were adult secondary school teachers who took part

voluntarily and anonymously by completing an online survey (Google Forms). They were informed about the purpose of the study and their right to withdraw at any time, and informed consent was obtained prior to data collection. No personally identifiable information was collected, and the data were used solely for research purposes.

AI statement: During the preparation of this manuscript, the authors used Claude for language editing and writing assistance. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the published article.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

- Abdulkakioglu, M., Kolushpayeva, A., Balta, N., Japashov, N., & Bae, C. L. (2022). Open lesson as a means of teachers' learning. *Education Sciences*, 12(10), Article 692. <https://doi.org/10.3390/educsci12100692>
- Apple, M. W. (1986). *Teachers and texts: A political economy of class and gender relations in education*. Routledge.
- Ball, S. J. (2003). The teacher's soul and the terrors of performativity. *Journal of Education Policy*, 18(2), 215-228. <https://doi.org/10.1080/0268093022000043065>
- Balta, N., Fukkink, R., & Amendum, S. J. (2023). The effect of job-embedded professional development on teacher and student outcomes: A multi-level meta-analysis. *International Educational Review*, 1(1), 1-23. <https://doi.org/10.58693/ier.111>
- Balta, N., Japashov, N., Toker, A., Maxutov, S., & Mansurova, A. (2025). Open lesson as a professional development program: teachers' attitudes and beliefs. *Teacher Development*, 30(2), 478-498. <https://doi.org/10.1080/13664530.2025.2528709>
- Borko, H. (2004). Professional development and teacher learning: mapping the terrain. *Educational Researcher*, 33(8), 3-15. <https://doi.org/10.3102/0013189x033008003>
- Cajkler, W., Wood, P., Norton, J., Pedder, D., & Xu, H. (2015). Teacher perspectives about lesson study in secondary school departments: a collaborative vehicle for professional learning and practice development. *Research Papers in Education*, 30(2), 192-213. <https://doi.org/10.1080/02671522.2014.887139>
- Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. C. Berliner, & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 709-725). Macmillan.

- Cheung, W. M., & Wong, W. Y. (2014). Does lesson study work? A systematic review on the effects of lesson study and learning study on teachers and students. *International Journal for Lesson and Learning Studies*, 3(2), 137-149. <https://doi.org/10.1108/ijlls-05-2013-0024>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge. <https://doi.org/10.4324/9781315456539>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute. <https://doi.org/10.54300/122.311>
- Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199. <https://doi.org/10.3102/0013189x08331140>
- Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birman, B. F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis*, 24(2), 81-112. <https://doi.org/10.3102/01623737024002081>
- Duran, V., Can, T., & Özer, B. (2020). Development of an individual professional development plan proposal that is based on continuing professional development needs of teachers. *The European Educational Researcher*, 3(3), 139-172. <https://doi.org/10.31757/euer.334>
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3), 272-299. <https://doi.org/10.1037/1082-989X.4.3.272>
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record: The Voice of Scholarship in Education*, 103(6), 1013-1055. <https://doi.org/10.1111/0161-4681.00141>
- Fernandez, C., & Yoshida, M. (2004). *Lesson study: A Japanese approach to improving mathematics teaching and learning*. Lawrence Erlbaum Associates.
- Field, A. (2018). *Discovering statistics using IBM SPSS Statistics* (5th ed.). SAGE.
- Fives, H., & Buehl, M. M. (2012). Spring cleaning for the "messy" construct of teachers' beliefs: What are they? Which have been examined? What can they tell us? In K. R. Harris, S. Graham, & T. Urdan (Eds.), *APA educational psychology handbook* (vol. 2, pp. 471-499). American Psychological Association. <https://doi.org/10.1037/13274-019>
- Fullan, M. G., & Miles, M. B. (1992). Getting reform right: What works and what doesn't. *Phi Delta Kappan*, 73(10), 745-752.
- Gosling, D. (2002). *Models of peer observation of teaching*. LTSN Generic Center.
- Grossman, P. L., & Stodolsky, S. S. (1995). Content as context: The role of school subjects in secondary school teaching. *Educational Researcher*, 24(8), 5-23. <https://doi.org/10.3102/0013189x024008005>
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8(3/4), 381-391. <https://doi.org/10.1080/135406002100000512>
- Hair, J. F., Babin, B. J., Anderson, R. E., & Black, W. C. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.
- Hargreaves, A. (1994). *Changing teachers, changing times: Teachers' work and culture in the postmodern age*. Teachers College Press.
- Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: what would it look like and how can we get one? *Educational Researcher*, 31(5), 3-15. <https://doi.org/10.3102/0013189x031005003>
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36. <https://doi.org/10.1007/BF02291575>
- Kanellopoulou, E. D., & Darra, M. (2019). Benefits, difficulties and conditions of lesson study implementation in basic teacher education: A review. *International Journal of Higher Education*, 8(4), 18-35. <https://doi.org/10.5430/ijhe.v8n4p18>
- Kelchtermans, G. (2005). Teachers' emotions in educational reforms: Self-understanding, vulnerable commitment and micropolitical literacy. *Teaching and Teacher Education*, 21(8), 995-1006. <https://doi.org/10.1016/j.tate.2005.06.009>
- Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational Review*, 53(1), 27-35. <https://doi.org/10.1080/00131910120033628>
- Levin, B. (2015). The development of teachers' beliefs. In H. Fives, & M. G. Gill (Eds.), *International handbook of research on teachers' beliefs* (pp. 48-65). Routledge.

- Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? the case of lesson study. *Educational Researcher*, 35(3), 3-14. <https://doi.org/10.3102/0013189X035003003>
- Liang, S. (2011). Open class: An important component of teachers' in-service training in China. *Education*, 1(1), 1-5. <https://doi.org/10.5923/j.edu.20110101.01>
- Little, J. W. (1993). Teachers' professional development in a climate of educational reform. *Educational Evaluation and Policy Analysis*, 15(2), 129-151. <https://doi.org/10.3102/01623737015002129>
- Lortie, D. C. (1975). *Schoolteacher: A sociological study*. University of Chicago Press.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill.
- O'Leary, M., & Wood, P. (2017). Performance over professional learning and the complexity puzzle: Lesson observation in England's further education sector. *Professional Development in Education*, 43(4), 573-591. <https://doi.org/10.1080/19415257.2016.1210665>
- OECD. (2018). Education policy outlook: Kazakhstan. OECD. <https://www.oecd.org/content/dam/oecd/en/about/projects/edu/education-policy-outlook/Education-Policy-Outlook-Country-Profile-Kazakhstan-2018.pdf>
- Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376-407. <https://doi.org/10.3102/0034654311413609>
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307-332. <https://doi.org/10.3102/00346543062003307>
- Rakhmetova, N., Aitjanov, N., Toktassyn, M., Tursumbekova, A., Rakhymberdiyev, B., Abdulkakioglu, M., & Yilmaz, H. S. (2025). Exploring students' attitudes towards open lessons conducted by physics teachers. *Journal of Research in Didactical Sciences*, 4(1), 67-89. <https://doi.org/10.51853/jorids/16839>
- Republic of Kazakhstan. (2019). Law of the Republic of Kazakhstan no. 293-VI of 27 December 2019 "on the status of a teacher." *Government of Kazakhstan*. <https://adilet.zan.kz/eng/docs/Z1900000293>
- Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. 102-119). Macmillan.
- Richit, A., Da Ponte, J. P., & Tomasi, A. P. (2021). Aspects of professional collaboration in a lesson study. *International Electronic Journal of Mathematics Education*, 16(2), Article em0637. <https://doi.org/10.29333/iejme/10904>
- Sachs, J. (2003). *The activist teaching profession*. Open University Press.
- Saralar-Aras, I. (2022). An exploration of middle school mathematics teachers' beliefs and goals regarding a dynamic tool in mathematics lessons: Case of GeoGebra. *Journal of Research in Science, Mathematics and Technology Education*, 5(SI), 41-63. <https://doi.org/10.31756/jrsmte.113SI>
- Shen, J., Zhen, J., & Poppink, S. (2007). Open lessons: A practice to develop a learning community for teachers. *Educational Horizons*, 85(3), 181-191.
- Shortland, S. (2004). Peer observation: A tool for staff development or compliance? *Journal of Further and Higher Education*, 28(2), 219-228. <https://doi.org/10.1080/0309877042000206778>
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-23. <https://doi.org/10.17763/haer.57.1.j463w79r56455411>
- Siskin, L. S. (1994). *Realms of knowledge: Academic departments in secondary schools*. Falmer Press.
- Skaalvik, E. M., & Skaalvik, S. (2011). Teacher job satisfaction and motivation to leave the teaching profession: Relations with school context, feeling of belonging, and emotional exhaustion. *Teaching and Teacher Education*, 27(6), 1029-1038. <https://doi.org/10.1016/j.tate.2011.04.001>
- Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional learning communities: A review of the literature. *Journal of Educational Change*, 7(4), 221-258. <https://doi.org/10.1007/s10833-006-0001-8>
- Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.
- Wilson, E., & Sharimova, A. (2019). Conceptualizing the implementation of lesson study in Kazakhstan within a social theory framework. *International Journal for Lesson and Learning Studies*, 8(4), 320-333. <https://doi.org/10.1108/IJLLS-08-2019-0060>
- Zwick, W. R., & Velicer, W. F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin*, 99(3), 432-442. <https://doi.org/10.1037/0033-2909.99.3.432>