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Pedagogical opportunities, school manager literacy, and managerial potential among pre- service teachers in Kazakhstan: a latent class analysis

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Cultivating leadership capabilities and managerial competencies among pre-service teachers has become an important objective of contemporary teacher education programs. This study examines pedagogical opportunities for the development of leadership-related competencies and managerial readiness among pre-service teachers. Data were collected from 220 pre-service teachers, enrolled in two universities in Kazakhstan, through a structured survey consisting of three scales measuring pedagogical opportunities, school manager literacy, and managerial potential. Latent class analysis was conducted separately for each scale to identify distinct response profiles among participants. The results revealed three latent profiles of pedagogical opportunities (strong, moderate, and limited), two profiles of school manager literacy (high and relatively lower), and three profiles of managerial potential (very high, high, and moderate). Most respondents belonged to profiles reflecting strong pedagogical opportunities and high managerial competence, indicating generally positive perceptions of leadership readiness among pre-service teachers. The findings suggest that most pre-service teachers perceive themselves as possessing relatively strong managerial competencies and leadership potential, although variations exist in the availability and perception of pedagogical opportunities during teacher education. The findings suggest that teacher education programs can better prepare pre-service teachers for leadership roles by more systematically integrating leadership training and school-based experiences.

KEYWORDS

latent class analysis, managerial potential, pedagogical opportunities, school manager literacy, teacher education, teacher leadership

Introduction

Contemporary educational systems are increasingly characterized by organizational complexity, rapid reform pressures, and heightened accountability demands, positioning schools as dynamic learning organizations rather than merely instructional settings. Within this evolving context, the professional role of teachers has expanded beyond classroom instruction to include active participation in school leadership, collaborative decision-making, and continuous improvement processes. Research on

distributed leadership shows that effective schools benefit when teachers actively participate in planning, collaboration, and data-informed decision-making (Gumus et al., 2018; Harris et al., 2019; Ntuli and Mahlangu, 2023). At the same time, international policy reports emphasize that preparing teachers for these broader responsibilities requires the development of managerial and organizational competencies during initial teacher education, not only after entering the profession (Schleicher, 2012; Schott et al., 2020).

Despite the growing expectation that teachers contribute to school leadership and organizational improvement, teacher education programs in many contexts continue to prioritize subject-matter knowledge and classroom pedagogy over systematic preparation for managerial and leadership responsibilities. Empirical reviews indicate that leadership-related learning opportunities in pre-service programs are often fragmented, implicit, or confined to isolated courses rather than embedded across the curriculum (Gumus et al., 2018; Schott et al., 2020). Many pre-service teachers complete their preparation with limited exposure to strategic planning, school-level decision-making, and organizational coordination processes that are increasingly required in contemporary schools. This misalignment creates a critical readiness gap: graduates may enter the pedagogically competent profession yet insufficiently prepared to participate effectively in collaborative leadership and school improvement initiatives.

To address this readiness gap, the present study focuses on three interrelated constructs. Pedagogical opportunities refer to the structured learning experiences within teacher education, such as leadership-infused coursework, practice-oriented activities, mentoring, and digital/data-supported tasks, that provide conditions for developing organizational competence (Darling-Hammond et al., 2020; Nansubuga et al., 2019; Tondeur et al., 2021). School manager literacy is conceptualized as a multidimensional professional competence encompassing strategic and organizational understanding, communication and human-relations skills, educational law awareness, data-informed digital management, and ethical instructional leadership required for effective participation in school-level processes (Gumus et al., 2018; Schott et al., 2020). Managerial potential reflects the psychological readiness of pre-service teachers to assume leadership responsibilities, including leadership self-efficacy, proactive initiative, responsible decision-making, openness to change, and interpersonal influence capacity (Bandura and Wessels, 1997; Molla and Nolan, 2020). These constructs together provide a coherent framework for examining how teacher education may cultivate leadership-oriented readiness among pre-service educators.

Despite increasing scholarly attention to teacher leadership and professional competence, important gaps remain in the evidence base. First, relatively few empirical studies have explicitly examined school manager literacy among pre-service teachers, as most research continues to focus on in-service principals or experienced teachers (Gumus et al., 2018; Schott et al., 2020). Second, the field lacks integrated multidimensional models that simultaneously capture the developmental links among preparation experiences, leadership-related competencies, and psychological readiness, with many studies relying on isolated or single-domain analyses (Scherer et al., 2020). Third,

robust quantitative evidence from Kazakhstan and the broader post-Soviet context remains limited, particularly research using advanced modeling approaches to investigate leadership preparation in initial teacher education (Qanay et al., 2024). The relationships among pedagogical opportunities, school manager literacy, and managerial potential remain insufficiently theorized and empirically tested, showing the need for a comprehensive structural examination in this underrepresented context.

The purpose of this study is to identify latent response profiles of pedagogical opportunities for the formation of school manager literacy, school manager literacy, and managerial potential among pre-service teachers using latent class analysis. Building on contemporary perspectives that view teacher leadership capacity as a multidimensional and developmental outcome of structured preparation experiences, the study investigates both the direct and indirect pathways linking these constructs. By modeling pedagogical opportunities, school manager literacy, and managerial potential represent interconnected dimensions of leadership readiness among pre-service teachers. The study seeks to offer empirically grounded insights into how leadership-oriented readiness can be systematically cultivated during initial teacher education, particularly within the underexamined context of Kazakhstan.

Research questions

RQ1. What latent profiles exist among pre-service teachers regarding pedagogical opportunities for the formation of school manager literacy in teacher education programs?

RQ2. What distinct latent profiles characterize school manager literacy among pre-service teachers?

RQ3. What distinct latent profiles characterize managerial potential among pre-service teachers?

Literature review

Concept of school leadership in teacher education

Contemporary educational reforms have expanded the role of teachers from classroom instructors to active contributors in school leadership and organizational improvement. The literature increasingly portrays schools as complex, knowledge-intensive organizations that require collaborative leadership capacity at multiple levels rather than relying solely on formal administrators (Pretorius and Plaatjies, 2023). Within this shift, the concept of teacher leadership, often framed within distributed leadership theory, shows that leadership functions are shared among principals, teachers, and professional teams to enhance school effectiveness and innovation. Empirical research shows that distributed leadership positively influences teacher autonomy, collaboration, and innovativeness, showing the importance of preparing teachers to participate meaningfully in school decision-making processes (Lin, 2022). Systematic reviews further note that teacher leadership has become central to professional development, school reform, and teacher retention

debates, yet conceptual clarity and stronger preparation pathways remain needed (Schott et al., 2020).

Despite this growing emphasis, teacher education programs have traditionally prioritized instructional competence while giving comparatively limited attention to managerial and organizational readiness. Studies focusing on pre-service teachers indicate that many enter the profession with leadership aspirations but insufficient awareness of available leadership pathways, showing a need for earlier leadership socialization during initial preparation (Reeves, and Lowenhaupt, 2016). Recent work in preservice contexts similarly argues that distributed pedagogical leadership practices within teacher education can empower pre-service teachers to become effective classroom and school leaders (Okiri et al., 2025). The literature reveals a persistent gap between teaching skills and leadership preparedness, showing the importance of systematically embedding leadership development opportunities in teacher education programs (Ghamrawi et al., 2024).

School manager literacy

Building on broader discussions of teacher leadership, the concept of school manager literacy helps explain the specific competencies required for participation in school-level organizational processes. School manager literacy is increasingly conceptualized as a multidimensional professional competence that integrates strategic, interpersonal, legal, digital, and ethical capacities required for effective school functioning. Contemporary educational leadership literature emphasizes that leadership for learning operates through interconnected domains, such as instructional leadership, transformational leadership, and distributed leadership, that jointly influence teaching quality and organizational effectiveness (García-Carreño, 2021; Papadakis et al., 2024). Within this perspective, strategic and organizational literacy enables educators to plan, coordinate, and align school processes with improvement goals, while communication and human-relations competencies support collaboration within professional learning communities. Research consistently shows that distributed leadership reframes leadership as a collective, socially constructed practice involving multiple stakeholders, thereby showing the importance of interpersonal coordination and shared decision-making skills for teachers and future leaders (Nadeem, 2024). Furthermore, instructional leadership frameworks indicate the centrality of goal setting, monitoring teaching quality, and increasing supportive work environments in strengthening teacher effectiveness and professional confidence (Zhang et al., 2025).

In parallel, recent models of educational management competence stress the growing importance of legal literacy, data-informed decision-making, and digital management skills in modern school systems (Brazauskienė, 2025). Reviews of educational leadership research indicate that effective school leadership integrates collaboration, continuous professional development, and evidence-based decision processes to improve school performance and teacher growth (Pitriani, 2024). Ethical and instructional leadership dimensions further emphasize fairness, accountability, and the promotion of positive school culture as core components of leadership competence. These

theoretical and empirical strands support the view that school manager literacy is not a single skill, but a combination of competencies related to strategic planning, communication, policy awareness, data use, and ethical leadership.

Pedagogical opportunities in teacher education

To develop these competencies, teacher education programs must provide meaningful pedagogical and leadership-related learning experiences. Pedagogical opportunities within teacher education programs are widely recognized as critical conditions for developing leadership-oriented competencies in pre-service teachers (Seemiller, 2021). Contemporary research emphasizes that leadership preparation should not be limited to formal administrative training but embedded across coursework, practice-based learning, and reflective experiences during initial teacher education (Darling-Hammond et al., 2020). Studies grounded in experiential learning theory indicate that curriculum-integrated leadership content, problem-based tasks, and authentic school-based experiences help pre-service teachers connect theoretical knowledge with the organizational realities of schools. Moreover, clinically rich teacher preparation models demonstrate that candidates who engage in structured practicum and guided reflection (supervised school-based practice combined with reflective activities) develop stronger professional judgment, collaboration skills, and leadership awareness compared to those in primarily lecture-based programs (Körkkö et al., 2016; Zeichner, 2010).

In addition, mentoring and feedback processes have been consistently identified as key mechanisms supporting leadership identity formation and professional growth in teacher candidates (Toh et al., 2022). High-quality mentoring relationships provide social modeling (learning through observing experienced educators and mentors), guided practice, and evaluative feedback that strengthen both competence development and self-efficacy beliefs (Walters et al., 2020). The growing digitalization of schooling further shows the importance of technology- and data-supported learning environments within teacher preparation, as teachers are increasingly expected to participate in data-informed decision-making and digitally mediated coordination processes (Demir, 2023; Tondeur et al., 2021). However, despite these advances, the literature repeatedly notes that many teacher education programs still emphasize classroom pedagogy while providing fragmented or implicit exposure to leadership and managerial learning opportunities (Ghamrawi et al., 2024). This imbalance shows the need to systematically examine pedagogical opportunities as a foundational antecedent of school manager literacy in pre-service teachers.

Managerial potential of pre-service teachers

In addition to competence development, teacher education also influences pre-service teachers' psychological readiness for leadership roles. Managerial potential in pre-service teachers is

best understood as a multidimensional form of psychological readiness that enables individuals to assume leadership and organizational responsibilities in complex school environments. Grounded in Bandura's (1997) social cognitive theory (Bandura's social cognitive theory, which explains learning through observation, experience, and self-beliefs), leadership self-efficacy constitutes a central component, reflecting teachers' beliefs in their capacity to influence school processes, guide others, and manage challenging professional situations. Research in teacher agency additionally shows that educators who perceive themselves as active contributors to school improvement are more likely to demonstrate initiative, responsibility, and proactive engagement beyond classroom instruction (Molla and Nolan, 2020). These perspectives align with contemporary teacher leadership frameworks, which position pre-service teachers as future instructors and as emerging organizational actors capable of contributing to school development when appropriately prepared (Gumus et al., 2018).

From an organizational behavior standpoint, managerial potential also encompasses change readiness, decision-making responsibility, and interpersonal influence, competencies increasingly emphasized in modern educational leadership research. Studies show that teachers with stronger proactive dispositions and openness to change are more willing to support innovation, participate in collaborative problem-solving, and navigate uncertainty in reform-oriented school contexts (Huang and Lai, 2020; Kondakci et al., 2017). Likewise, interpersonal influence and team leadership readiness are closely linked to effective participation in professional learning communities and distributed leadership structures. The literature supports conceptualizing managerial potential as an integrated psychological construct combining efficacy beliefs, proactive motivation, responsible decision-making, adaptability, and social influence capacity.

Relationships among the three constructs

These three areas suggest a potentially interconnected framework of leadership readiness among pre-service teachers. Although research on teacher preparation, leadership competence, and psychological readiness has expanded in recent years, these domains are often examined separately rather than as parts of a developmental system. Emerging evidence shows that structured pedagogical opportunities in teacher education, such as leadership-infused coursework, practicum experiences, mentoring, and reflective activities, play a formative role in developing teachers' organizational understanding and leadership-related competencies. Clinically rich preparation models and experiential learning studies show that pre-service teachers who engage in authentic school-based experiences and receive guided feedback show stronger professional competence and leadership awareness (Darling-Hammond et al., 2020; Walters et al., 2020). Consistent with social cognitive theory, such mastery and feedback experiences also contribute to the growth of leadership self-efficacy and proactive professional identity, suggesting a developmental pathway from preparation experiences to competence formation (Bandura and Wessels, 1997).

The increasing emphasis on data-informed and digitally supported school management further strengthens the theoretical linkage between pedagogical preparation and managerial readiness (Brazauskienė, 2025). Research on technology integration and teacher competence indicates that exposure to digital and data-use practices during teacher education enhances teachers' capacity to participate in school-level planning and improvement processes (Bekdemir, 2024; Scherer et al., 2020; Tondeur et al., 2021). However, prior studies typically investigate these elements in isolation, focusing, for example, only on mentoring effects or technology readiness, without modeling how pedagogical opportunities collectively increase school manager literacy and, in turn, managerial potential. Building on distributed leadership and teacher agency perspectives, the present study proposes an integrated framework in which pedagogical opportunities serve as developmental inputs that build school manager literacy, which subsequently supports the emergence of managerial potential in pre-service teachers.

Methods

Participants

The study involved 220 pre-service teachers enrolled in teacher education programs at two universities in Kazakhstan. Participants were recruited from Korkyt Ata University and Yessenov University. Of the respondents, 212 (96.4%) were female and 8 (3.6%) were male, reflecting the gender distribution commonly observed in teacher education programs in Kazakhstan. The mean age of the participants was 20.41 years.

Participants represented different stages of their teacher education programs. Specifically, 68 pre-service teachers (30.9%) were in their first year, 52 (23.6%) were in their second year, 70 (31.8%) were in their third year, 12 (5.5%) were in their fourth year, and 18 pre-service teachers (8.2%) were graduate-level pre-service teachers. Regarding institutional affiliation, 166 participants (75.5%) were enrolled at Korkyt Ata University, while 52 participants (23.6%) studied at Yessenov University.

Korkyt Ata Kyzylorda University is a major public university located in the city of Kyzylorda in southern Kazakhstan. The institution traces its origins to 1937, when it was established as a pedagogical institute primarily focused on teacher education. Over time, it expanded its academic scope and gained university status in 1996, later adopting its current name in 2020. Today, the university offers a wide range of undergraduate, master's, and doctoral programs organized across several institutes and departments. Teacher education remains a central component of its academic structure, particularly through pedagogical institutes and departments responsible for training pre-service educators in areas such as primary education, languages, and science education. The university is recognized as an important educational and cultural center in the Kyzylorda region and plays a significant role in preparing teachers and other professionals for the broader Pre-Aral Sea region, the region surrounding the Aral Sea in Kazakhstan.

The second participating institution was Yessenov University (Caspian University of Technology and Engineering named after Sh. Yessenov), located in Aktau, a major port city on the eastern

shore of the Caspian Sea in western Kazakhstan. Established in 1976 as a technical faculty of the Kazakh Polytechnic Institute, the university gradually developed into a multidisciplinary higher education institution offering bachelor's, master's, and doctoral programs across engineering, economics, law, pedagogy, and social sciences. The university is considered a key educational, scientific, and cultural center of the Mangystau region and contributes to workforce development in sectors such as engineering, energy, and education. In addition to technical fields, the institution also provides teacher education programs and participates in international academic collaborations and student mobility initiatives aimed at strengthening higher education and research capacity in the Caspian region.

Instrument

Data were collected using a structured self-report questionnaire (See the Appendix). The instrument was developed based on contemporary frameworks in teacher leadership, instructional leadership, and professional competence development. It was designed to measure three underlying dimensions measured in the study relevant to leadership readiness in pre-service teachers. The questionnaire consisted of two parts: (a) demographic information and (b) three multi-item scales (A–C). All substantive items were rated on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree, with higher scores indicating stronger perceived competence or exposure.

The demographic section collected information on gender, age, year of study, field of specialization, and type of institution. Scale A (Pedagogical Opportunities for the Formation of School Manager Literacy) comprised five subdimensions: curriculum-based leadership learning, practice-oriented managerial training, school-based experiential opportunities, mentoring and reflective support, and digital and data-supported learning environment. Scale B (School Manager Literacy) measured five domains: strategic and organizational literacy, communication and human relations literacy, educational law and policy literacy, data-informed and digital management literacy, and ethical and instructional leadership literacy. Scale C (Managerial Potential of a Pre-service Teacher) assessed five psychological readiness dimensions: leadership self-efficacy, initiative and proactive behavior, decision-making responsibility orientation, change readiness and innovation orientation, and interpersonal influence and team leadership readiness. Prior to main data collection, the instrument went to an expert review for content validity and pilot testing with three pre-service teachers to ensure clarity and relevance. Reliability was evaluated in the main study using Cronbach's alpha. The Cronbach Alpha Reliability coefficients are presented in Table 1.

TABLE 1 The Cronbach alpha reliability coefficients of the each dimension.

Scale	Dimension	α
Pedagogical opportunities for the formation of school manager literacy	A1. Curriculum-based leadership learning	.88
	A2. Practice-oriented managerial training	.92
	A3. School-based experiential opportunities	.92
	A4. Mentoring, feedback, and reflective support	.94
	A5. Digital and data-supported learning environment	.95
School manager Literacy	B1. Strategic and organizational literacy	.91
	B2. Communication and human relations literacy	.95
	B3. Educational law and policy literacy	.95
	B4. Data-informed and digital management literacy	.97
	B5. Ethical and instructional leadership literacy	.97
Managerial potential of a future teacher	C1. Leadership self-efficacy	.96
	C2. Initiative and proactive behavior	.92
	C3. Decision-making and responsibility orientation	.92
	C4. Change readiness and innovation orientation	.96
	C5. Interpersonal influence and team leadership readiness	.97

scheduled class sessions. Participants were invited to complete the questionnaire voluntarily, and the survey required approximately 15 min to complete.

To ensure consistency in the administration procedure across both institutions, instructors were provided with standardized instructions explaining the purpose of the study and the procedures for completing the questionnaire. Instructors briefly introduced the survey to pre-service teachers and clarified that participation was voluntary and responses would remain anonymous. Pre-service teachers completed the questionnaire individually during class time using their personal devices. The data collection process lasted approximately two weeks, during which responses were gathered from participants at both universities.

Data collection

Data were collected in February 2026 using an online questionnaire administered through Google Forms. The survey link was distributed to pre-service teachers enrolled at Korkyt Ata Kyzylorda University and Yessenov University during

Data analysis

The data were analyzed using latent class analysis (LCA) to identify unobserved subgroups of respondents based on their response patterns. LCA is a person-centered statistical technique that classifies individuals into mutually exclusive latent groups

according to similarities in their responses to observed variables (Linzer and Lewis, 2011).

Separate LCAs were conducted for each of the three scales in the survey: (a) Pedagogical Opportunities for the Formation of School Manager Literacy (Scale A), (b) School Manager Literacy of Pre-service Teachers (Scale B), and (c) Managerial Potential of Pre-service Teachers (Scale C). All items within each scale were treated as categorical indicators.

For each scale, several competing models with different numbers of latent classes were estimated. Model selection was based on commonly used information criteria and goodness-of-fit statistics, including Akaike Information Criterion (AIC), AIC3, Bayesian Information Criterion (BIC), Sample-size Adjusted BIC (SABIC), Consistent AIC (CAIC), log-likelihood, Pearson χ^2 , and likelihood-ratio statistic (G^2). Lower values of information criteria were interpreted as indicating better model fit.

In addition to numerical fit indices, the interpretability and theoretical meaningfulness of the classes were considered when determining the optimal number of latent classes. Conditional response probabilities were examined to interpret the response patterns characterizing each latent class. Class proportions were also calculated to determine the relative size of each subgroup in the sample. Classification quality was also examined using entropy values and posterior class membership probabilities. The entropy values indicated adequate classification accuracy, suggesting that respondents were assigned to latent classes with acceptable reliability. All analyses were conducted using Jamovi statistical software with the Latent Class Analyses in the SnowRMM module (the SnowRMM module in Jamovi, which supports latent class analysis).

Results

This section presents the results of the latent class analyses conducted to identify distinct response patterns among pre-service teachers regarding pedagogical opportunities, school manager literacy, and managerial potential. Separate LCAs were performed for the data collected from three scales of the instrument. For each scale, competing models were compared using multiple fit indices, and the optimal class solution was selected. The identified latent classes were then interpreted based on their conditional response probability profiles.

Scale A: pedagogical opportunities for the formation of school manager literacy

To identify latent subgroups of respondents based on their perceptions of pedagogical opportunities within teacher

education programs, an LCA was conducted using the items from Scale A. The survey items measured curriculum-based leadership learning, practice-oriented managerial training, school-based experiential opportunities, mentoring and feedback, and digital/data-supported learning environments.

Several models with different numbers of classes were estimated and compared using standard model fit indices including AIC, AIC3, BIC, SABIC, CAIC, log-likelihood, χ^2 , and G^2 . Lower values of information criteria indicate better model fit. Table 2 presents the model comparison results for the one-, two-, and three-class solutions.

The results show a consistent improvement in model fit as the number of classes increases. The three-class model produced the lowest values for AIC, AIC3, BIC, SABIC, CAIC, and G^2 , indicating that it provided the best fit to the data among the tested models. Additionally, the log-likelihood increased substantially from the one-class to the three-class solution, showing that the three-class model better captured heterogeneity in participants' responses. To complement the numerical model comparison presented in Table 2, a graphical representation (Figure 1) of the information criteria across different class solutions was examined.

Figure 1 shows the changes in model fit indices (AIC, AIC3, BIC, SABIC, and CAIC) across the one-, two-, and three-class models. All indices decrease as the number of classes increases, indicating improved model fit. The lowest values are observed for the three-class model, supporting its selection as the optimal solution for Scale A.

To better understand the characteristics of the identified latent groups, the response probability profiles for each class were examined (Figure 2).

Figure 2 shows the conditional response probabilities for each item across the three latent classes. Class 1 represents the largest group (53.1%) and generally shows moderate-to-high probabilities for higher response categories. Class 2 (10.0%) displays relatively lower and more moderate response probabilities across items. Class 3 (36.9%) demonstrates consistently high probabilities for the upper response categories, suggesting the strongest perceived pedagogical opportunities among the groups.

To further examine the response patterns across classes, the conditional probabilities for each Likert response category were analyzed. In Figure 3, Pr(1)–Pr(5) represent the conditional response probabilities for each Likert response category within each latent class. For example, Pr(1) is the probability that respondents in each latent class choose response category 1 (e.g., *strongly disagree*). In latent class analysis, these probabilities indicate how likely members of each latent group are to select each response category for every item. Therefore, the patterns in Figure 3 help interpret the response tendencies of the three

TABLE 2 Model comparison indices for latent class models for scale A.

Class	AIC	AIC3	BIC	SABIC	CAIC	Log-likelihood	χ^2	G^2
1	14,674.46	14,774.46	15,013.82	14,696.92	15,113.82	−7,237.23	1.07E + 49	12,048.26
2	12,836.74	13,037.74	13,518.85	12,881.89	13,719.85	−6,217.37	2.47E + 39	10,065.66
3	12,139.18	12,441.18	13,164.05	12,207.01	13,466.05	−5,767.59	4.95749E + 18	9,216.17

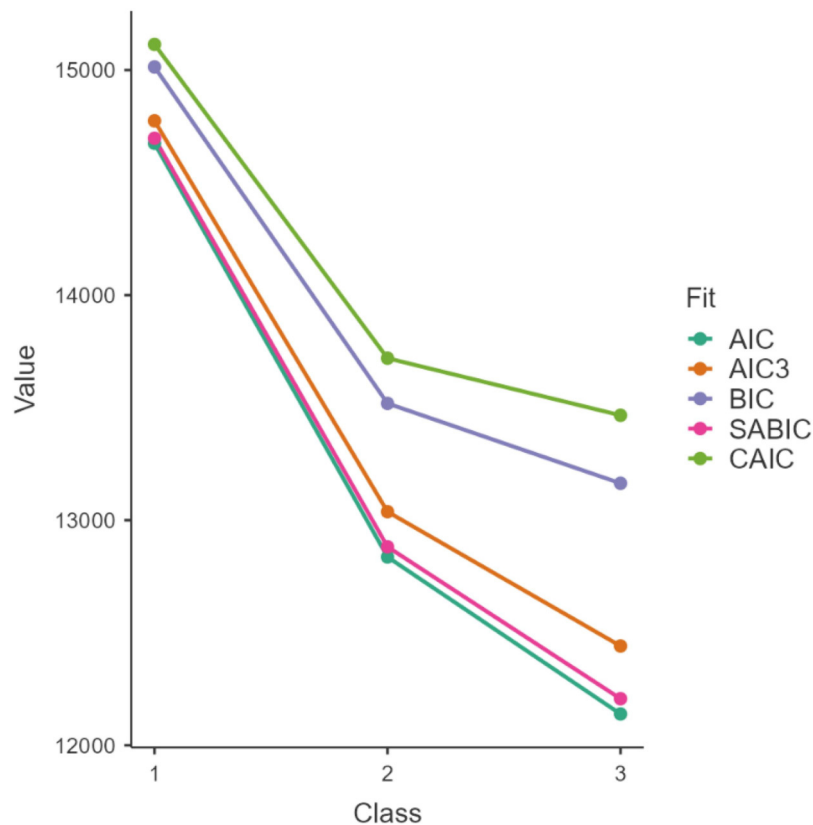


FIGURE 1
Changes in model fit indices across latent class solutions for scale A. Elbow Plot.

classes, showing whether a class tends to select lower, moderate, or higher agreement categories across the Scale A items.

Figure 3 shows the probability of selecting each response category (1–5) across all items for the three latent classes. Class 3 shows the highest probabilities for the upper response categories (4 and 5), indicating stronger agreement with statements describing pedagogical opportunities. Class 1 demonstrates moderate probabilities across middle and higher categories, while Class 2 shows relatively higher probabilities for lower response categories, suggesting weaker perceived pedagogical opportunities. Based on the three-class solution, respondents can be grouped into three distinct profiles showing different levels of perceived pedagogical opportunities for developing school manager literacy.

Class 1 (Moderate Pedagogical Opportunity Profile (53.1%): This largest group demonstrates moderate-to-high probabilities of selecting upper response categories across many items. Participants in this class perceive that their teacher education programs provide some opportunities for leadership learning, managerial training, and mentoring, although these opportunities are not consistently strong across all areas.

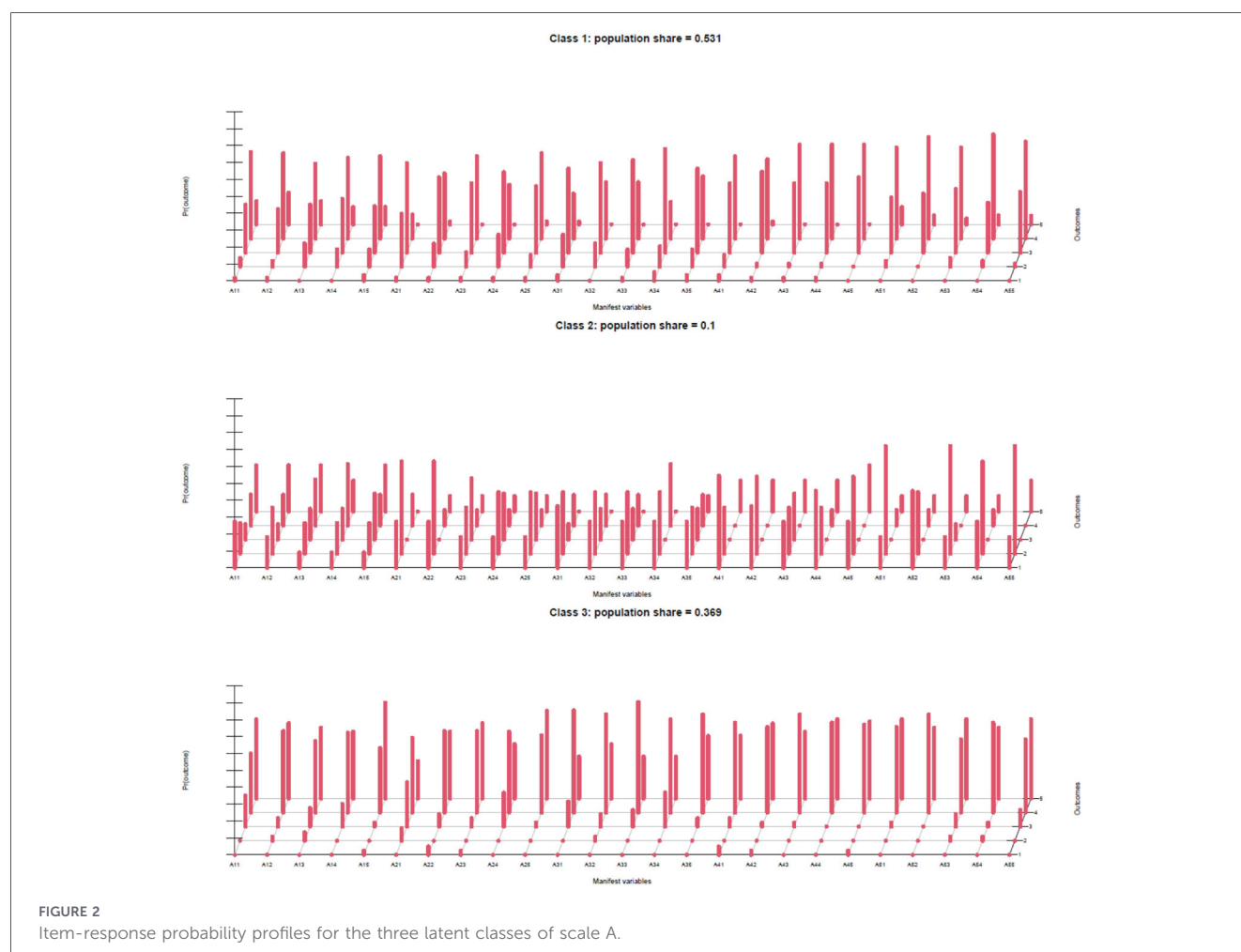
Class 2 (Limited Pedagogical Opportunity Profile (10.0%): This smaller group shows relatively higher probabilities for lower and mid-level response categories. Respondents in this class perceive limited exposure to leadership-related pedagogical opportunities, including fewer practical experiences, mentoring interactions, and digital or data-supported management activities.

Class 3 (Strong Pedagogical Opportunity Profile (36.9%): This group demonstrates consistently high probabilities for the upper response categories across most items. Participants in this class report strong pedagogical opportunities for developing school management literacy, including curriculum-based leadership learning, practical managerial training, experiential school-based learning, and supportive mentoring environments.

Scale B: school manager literacy

An LCA was conducted to identify subgroups of respondents based on their perceptions of school manager literacy among pre-service teachers. The analysis was performed using the items from Scale B, which measure strategic and organizational literacy, communication and human relations literacy, educational law and policy literacy, data-informed and digital management literacy, and ethical and instructional leadership literacy. Table 3 presents the model comparison results for the one-class and two-class solutions.

The results indicate a substantial improvement in model fit when moving from the one-class to the two-class model. All information criteria (AIC, AIC3, BIC, SABIC, and CAIC) show noticeably lower values for the two-class solution. In addition, the log-likelihood increases and the G^2 statistic decreases, indicating a better representation of heterogeneity in respondents' perceptions. To visually support the model



comparison results presented in Table 3, the changes in information criteria across class solutions were examined.

Figure 4 shows the variation of AIC, AIC3, BIC, SABIC, and CAIC across the one- and two-class models. All indices decrease substantially when moving from the one-class to the two-class solution, indicating an improvement in model fit. These results further support the selection of the two-class model as the optimal solution for Scale B.

To interpret the characteristics of the identified groups, the conditional response probability profiles for each latent class were examined (Figure 5).

Figure 5 presents the conditional response probabilities for each item across the two latent classes. Class 1 represents a smaller group (17.6%) and shows more moderate response probabilities across the scale items. In contrast, Class 2 represents most respondents (82.4%) and demonstrates consistently higher probabilities for the upper response categories, indicating stronger perceived school manager literacy among this group.

To further examine the response patterns of the two latent groups, the conditional probabilities for each response category were analyzed (Figure 6).

Figure 6 shows the probability of selecting each Likert response category [Pr(1)–Pr(5)] across the items for the two

latent classes. Class 1 demonstrates higher probabilities for lower and mid response categories, indicating relatively weaker levels of perceived school manager literacy. In contrast, Class 2 shows higher probabilities for the upper response categories (4 and 5), showing stronger perceived school manager literacy among most respondents. The two-class solution identified two distinct profiles of school manager literacy among pre-service teachers.

Class 1 (Relatively Lower School Manager Literacy Profile (17.6%): This smaller group shows higher probabilities for lower and mid-level response categories across several items. Respondents in this class demonstrate relatively lower levels of perceived school manager literacy compared with the high-literacy group. They show less confidence in competencies such as strategic planning, communication and human relations, understanding of educational regulations, data-informed decision-making, and ethical leadership.

Class 2 (High School Manager Literacy Profile (82.4%): This majority group demonstrates consistently higher probabilities for the upper response categories across most items. Participants in this class report strong perceived school manager literacy, showing that they feel capable of organizing school processes, communicating effectively with stakeholders, understanding educational policies, using data for decision-making, and demonstrating ethical and instructional leadership.

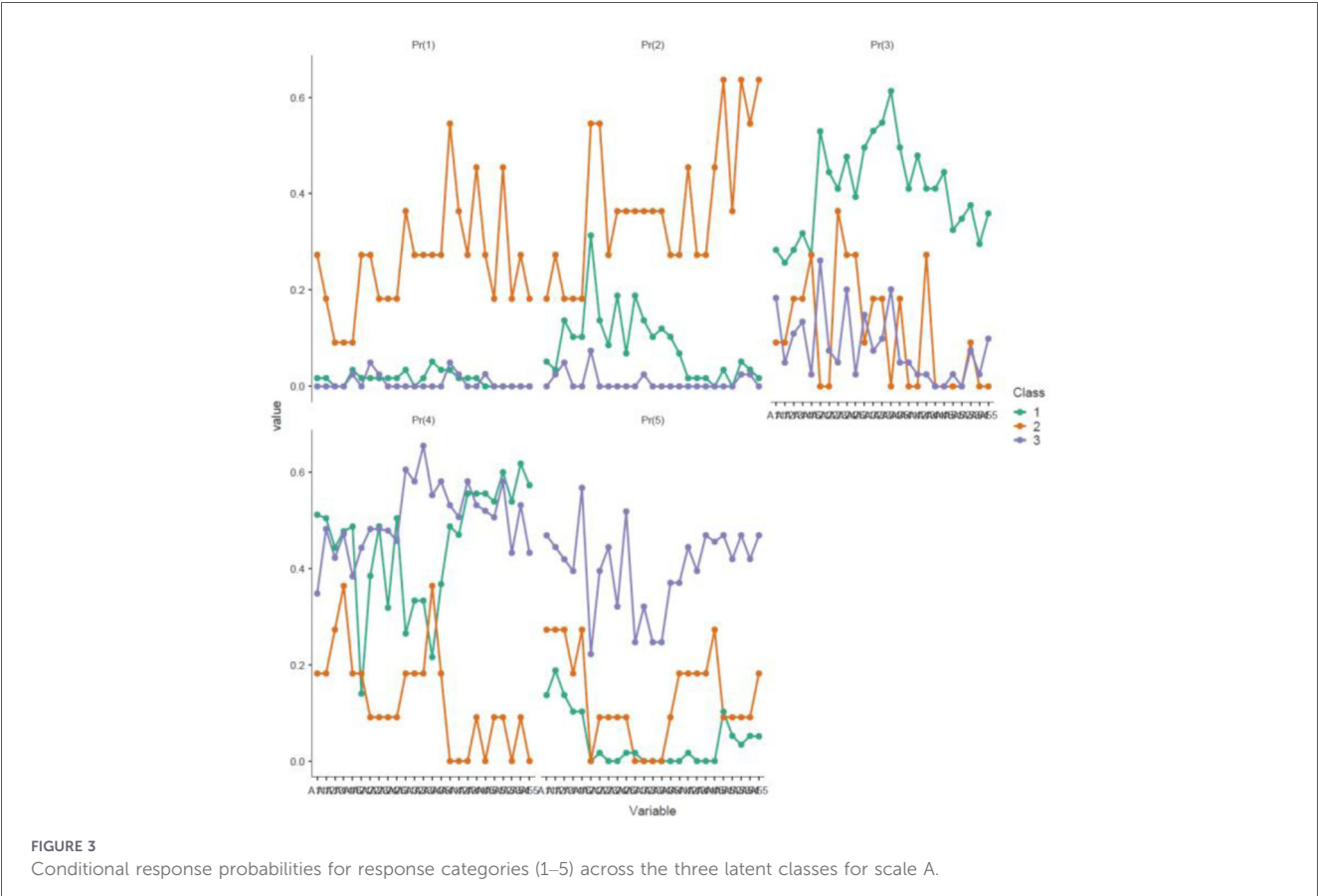


TABLE 3 Model comparison indices for latent class models for scale B.

Class	AIC	AIC3	BIC	SABIC	CAIC	Log-likelihood	χ^2	G ²
1	12,876.57	12,976.57	13,215.94	12,899.04	13,315.94	−6,338.29	1.26E + 54	10,439.35
2	10,917.68	11,118.68	11,599.8	10,962.83	11,800.8	−5,257.84	4.07431E + 20	8,349.2

Scale C: managerial potential of pre-service teachers

Another LCA was conducted to identify subgroups of respondents based on their perceived managerial potential as pre-service teachers. The analysis used the items from Scale C, which assess leadership self-efficacy, initiative and proactive behavior, decision-making responsibility, change readiness, and interpersonal influence. Table 4 presents the model comparison results for the one-, two-, and three-class solutions.

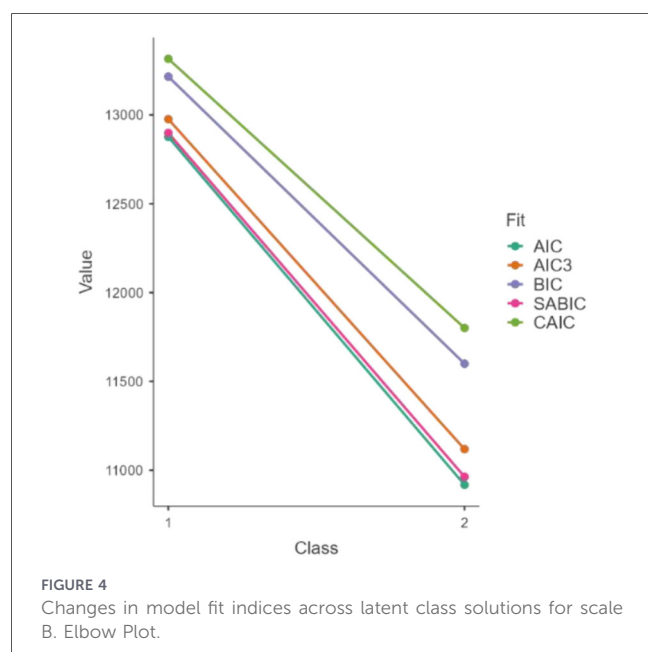
The results show a clear improvement in model fit as the number of classes increases. The three-class model yields the lowest values for AIC, AIC3, BIC, SABIC, CAIC, and G², indicating the best fit among the tested solutions. In addition, the log-likelihood increases substantially from the one-class to the three-class solution, suggesting that the three-class model better captures heterogeneity in respondents' perceptions of managerial potential.

To visually support the model comparison results presented in Table 4, the changes in information criteria across class solutions were examined.

Figure 7 illustrates the variation of AIC, AIC3, BIC, SABIC, and CAIC across the one-, two-, and three-class models. All indices decrease substantially as the number of classes increases, showing improved model fit. The lowest values are observed for the three-class solution, further supporting the selection of the three-class model as the optimal solution for Scale C.

To interpret the characteristics of the identified groups, the conditional response probability profiles for each latent class were examined.

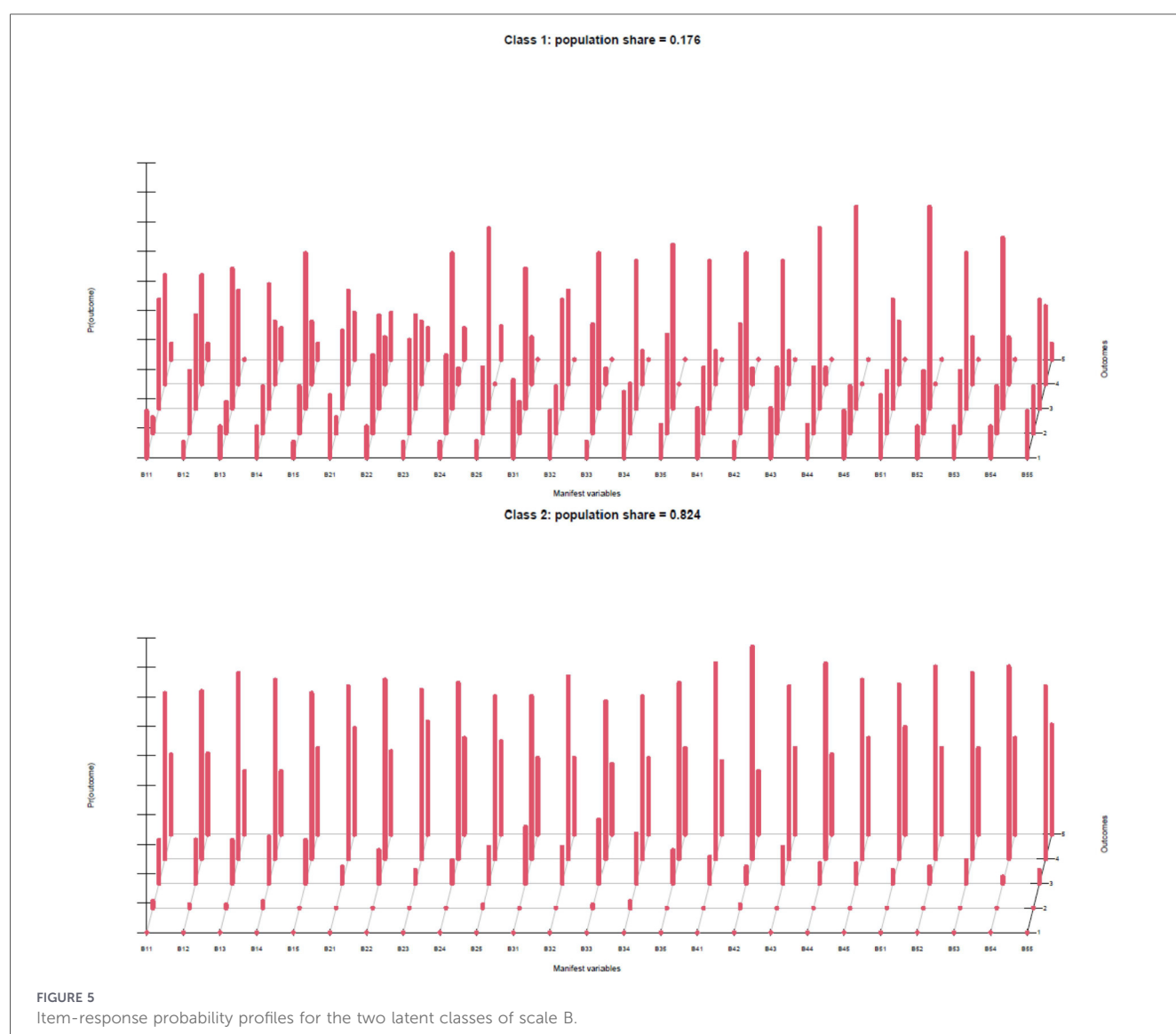
Figure 8 presents the conditional response probabilities for each item across the three latent classes. Class 1 represents the largest group (57.4%) and shows relatively high probabilities for the upper response categories, showing a generally strong level of perceived managerial potential. Class 2 (15.7%) demonstrates more moderate response probabilities across items, suggesting comparatively lower perceived managerial readiness. Class 3 (26.9%) displays consistently high probabilities for the upper response categories, showing a strong perception of leadership self-efficacy, initiative, decision-making responsibility, and readiness for change among this group.



To further examine the response tendencies of the identified latent groups, the conditional probabilities for each Likert response category were analyzed (Figure 9).

Figure 9 displays the probability of selecting each response category [Pr(1)–Pr(5)] across all items for the three latent classes. Class 1 shows the highest probabilities for the upper response category (5), indicating very strong perceived managerial potential. Class 2 shows higher probabilities for mid-level response categories (particularly category 3), reflecting moderate levels of perceived managerial potential. Class 3 shows relatively higher probabilities for response category 4, indicating a generally positive but slightly less extreme agreement compared with Class 1. The three-class solution revealed three distinct profiles reflecting different levels of managerial potential among pre-service teachers.

Class 1 (Very High Managerial Potential Profile (57.4%): This largest group shows very high probabilities for the highest response category across most items. Respondents in this class demonstrate strong leadership self-efficacy, initiative, decision-making confidence, and readiness for change, indicating a very



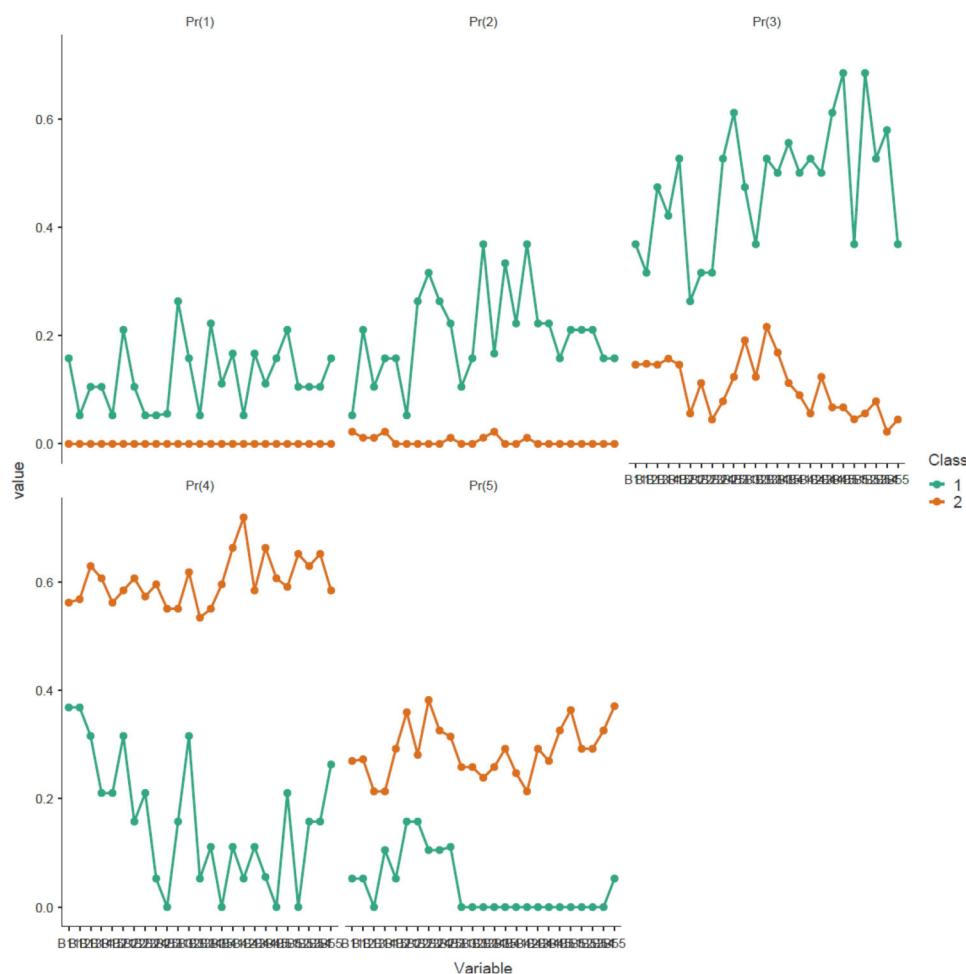


FIGURE 6

Conditional response probabilities for response categories (1–5) across the two latent classes for scale B.

strong perception of their managerial potential in future school settings.

Class 2 (Moderate Managerial Potential Profile (15.7%)): This smaller group shows higher probabilities for mid-level response categories. Participants in this class report moderate levels of managerial potential, showing that while they recognize some leadership capabilities, their confidence in managerial roles is less pronounced compared with other groups.

Class 3 [High Managerial Potential Profile (26.9%)]: This group demonstrates high probabilities for response category 4 across many items. Respondents in this class show strong but slightly less extreme perceptions of managerial potential compared with Class 1, reflecting positive readiness for leadership, initiative, and collaborative influence.

Discussions

The findings of this study provide views about how pre-service teachers perceive leadership-related preparation during their teacher education programs. The identification of distinct latent profiles across pedagogical opportunities, school manager literacy, and managerial potential indicates that leadership readiness among pre-service teachers is not uniform but varies across groups of students. While most participants reported relatively strong managerial literacy and leadership potential, the presence of smaller groups with more limited opportunities and lower perceived competence shows that leadership development experiences may not be equally distributed within teacher education programs.

TABLE 4 Model comparison indices for latent class models for scale C.

Class	AIC	AIC3	BIC	SABIC	CAIC	Log-likelihood	χ^2	G ²
1	12,857.09	12,957.09	13,196.45	12,879.55	13,296.45	−6,328.55	2.25E + 51	8,478.43
2	10,324.28	10,525.28	11,006.4	10,369.43	11,207.4	−4,961.14	3.44E + 37	6,078
3	8,548.1	8,850.1	9,572.97	8,615.93	9,874.97	−3,972.05	3.42309E + 17	4,770.79

The findings generally align with previous research showing that teacher education programs increasingly incorporate leadership and managerial competencies into teacher

preparation. Prior studies have emphasized that pre-service teachers benefit from pedagogical experiences that include leadership-related coursework, problem-based tasks, and school-based practicum activities (e.g., York-Barr and Duke, 2004; Wenner and Campbell, 2017). The identification of different latent profiles in Scale A supports earlier research indicating that the availability and intensity of leadership learning opportunities vary across teacher education programs, which may influence how strongly pre-service teachers perceive their preparation for managerial responsibilities.

Beyond pedagogical opportunities, the findings also revealed important patterns related to leadership-related competencies. The results for school manager literacy (Scale B) are also consistent with studies showing the importance of developing teachers' competencies in areas such as communication, organizational planning, and ethical decision-making (Bush, 2011; Hallinger and Heck, 2010). The presence of a dominant high-literacy class shows that many pre-service teachers feel relatively confident in these competencies, supporting previous findings that teacher education increasingly recognizes leadership as part of teachers' professional roles. However, the existence of a smaller group with moderate levels of literacy reflects findings from earlier studies indicating that leadership-related knowledge and skills are not uniformly developed among teacher candidates.

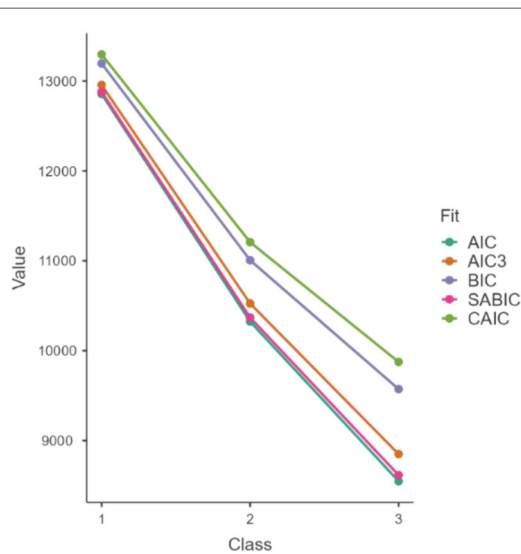


FIGURE 7
Changes in model fit indices across latent class solutions for scale C. Elbow Plot.

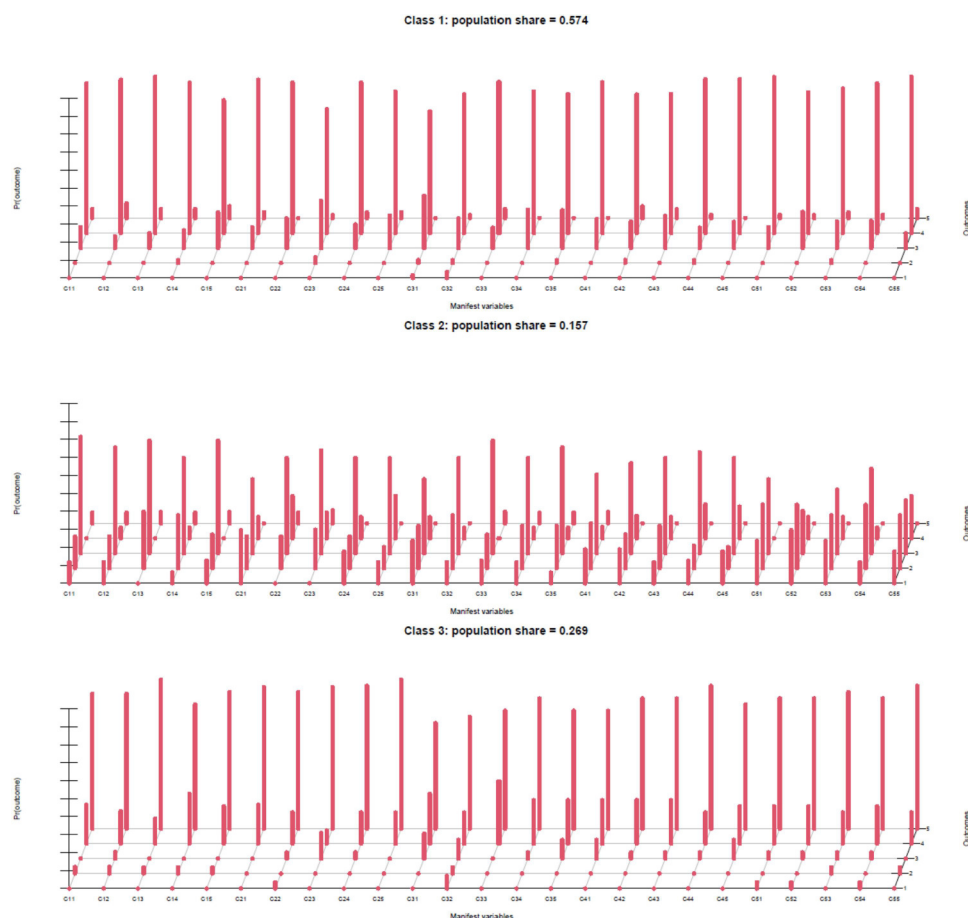


FIGURE 8
Item-response probability profiles for the three latent classes of scale C.

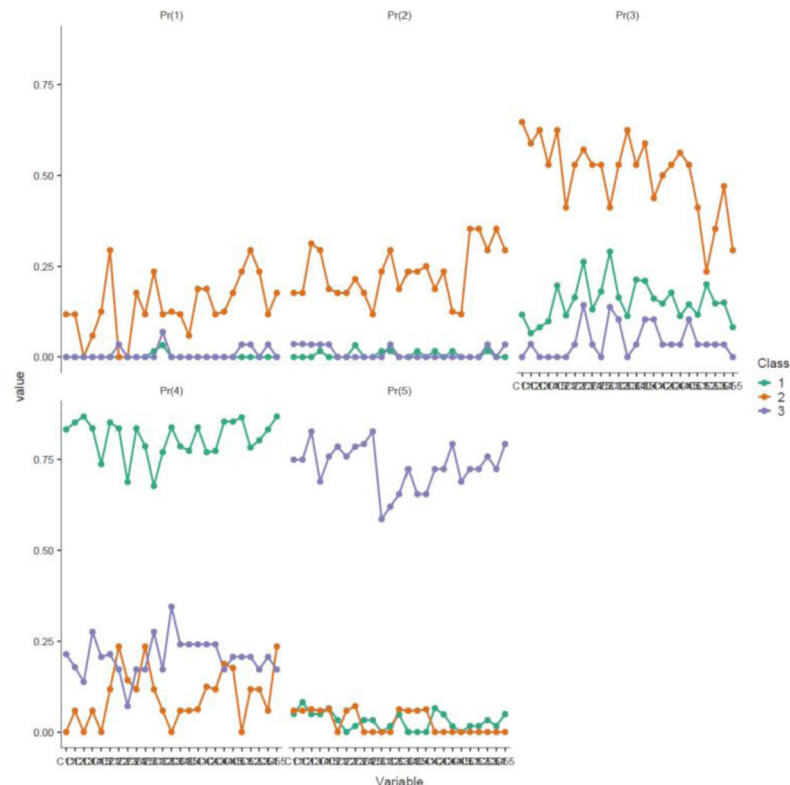


FIGURE 9
Conditional response probabilities for response categories (1–5) across the three latent classes for scale C.

Similarly, the findings for managerial potential (Scale C) correspond with research on teacher leadership and professional agency, which suggest that many teacher candidates demonstrate strong motivation to participate in school improvement and leadership activities (Harris and Muijs, 2005; Katzenmeyer and Moller, 2009). The identification of groups with high and very high managerial potential supports the idea that teacher education can increase leadership self-efficacy and initiative. At the same time, the presence of a moderate-potential group shows the need for continued support in developing confidence in leadership and decision-making roles. The results reinforce previous research stressing that teacher leadership development should be systematically embedded in teacher education programs.

The existence of different latent profiles indicates that while many pre-service teachers experience meaningful opportunities to develop leadership-related competencies, these opportunities are not consistently distributed across all participants. From a theoretical perspective, this shows the importance of integrating teacher leadership and educational management frameworks more systematically within teacher education curricula. Educationally, the results imply that programs can better support the development of managerial competencies by incorporating leadership-focused coursework, problem-based learning, school-based management experiences, mentoring, and reflective practice. Strengthening these components may help ensure that pre-service teachers develop strong pedagogical skills and acquire the organizational, strategic, and interpersonal competencies necessary to contribute to school leadership and improvement initiatives.

The results imply several practical implications for universities and teacher training institutions seeking to strengthen leadership preparation in teacher education. First, curricula can be improved by integrating explicit coursework into school leadership, educational management, and decision-making processes within teacher preparation programs. Second, practicum experiences should provide opportunities for teacher candidates to observe and participate in school-level organizational activities, such as planning meetings, administrative tasks, or school improvement initiatives. Third, structured mentoring systems can support the development of leadership competencies by providing guidance, feedback, and reflective discussions with experienced educators and school administrators. Finally, teacher education programs can incorporate leadership training activities, such as case studies, simulations, collaborative projects, and problem-based learning tasks that address real school management challenges.

Two limitations should be considered when interpreting the findings of this study. First, the LCA was conducted separately for each of the three scales, which allowed the identification of distinct profiles within each construct but did not directly test the relationships among pedagogical opportunities, school manager literacy, and managerial potential within a unified model. Future studies could employ structural equation modeling or latent profile structural models to examine these relationships more comprehensively. Second, latent class solutions are model-based and partly sample-dependent, meaning that the number and characteristics of the identified classes may vary across different samples or educational

contexts. Therefore, the class structures identified in this study should be interpreted cautiously and validated in future studies with different teacher education populations.

Conclusions

This study examined pedagogical opportunities, school manager literacy, and managerial potential among pre-service teachers using LCA. The results revealed distinct latent profiles across all three scales, indicating that teacher candidates differ in how they perceive leadership-related learning opportunities and their readiness for managerial responsibilities in educational settings. While most respondents reported moderate to strong opportunities to engage with leadership-related pedagogical experiences, a smaller subgroup perceived limited exposure to such opportunities within their teacher education programs.

The findings also showed that the majority of pre-service teachers perceive themselves as possessing relatively strong school manager literacy and managerial potential, including competencies related to communication, organizational planning, ethical leadership, and decision-making. At the same time, the presence of smaller groups with more moderate perceptions shows that leadership preparation may not be equally developed among all teacher candidates.

Overall, the study shows the importance of systematically integrating leadership and managerial skill development into teacher education programs. Strengthening leadership-focused coursework, practicum experiences, mentoring, and reflective activities may help ensure that pre-service teachers are better prepared to contribute to classroom teaching and to leadership and organizational processes within schools.

Data availability statement

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

Ethics statement

Ethical approval for this study was obtained from the Expert Committee (Ethics Committee) of Yessenov University, Faculty of Pedagogy. 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

AY: Writing – original draft, Conceptualization. SM: Supervision, Writing – review & editing. RŽ: Methodology, Writing – review & editing. DA: Writing – original draft, Validation. LM: Formal analysis, Writing – review & editing.

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The author(s) declared that this work 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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