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A Study of Acmeological Competencies Among Pre-Service Teachers Through Psychometric and Demographic Lenses

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Research Article

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Abstract

Background/purpose. Despite the contributions of existing literature, there is a clear deficiency in studies that systematically address the development of pedagogical acmeology skills as a core component of teacher training programs. This study aims to address this gap by examining pedagogical acmeology as a holistic approach to improving essential skills in future educators, aiming to understand how teacher training can be improved to meet contemporary educational demands.

Materials/methods. This study employed a validated psychometric survey instrument designed to measure acmeological competencies—self-regulation, resilience, self-efficacy, and collaborative skills—among pre-service teachers. Data were collected from 174 participants using a Google Form during the autumn semester of the 2024–2025 academic year. The survey development involved an iterative process with expert review and pilot testing. Confirmatory Factor Analysis was used for validation. Descriptive and inferential statistical methods, including Mann-Whitney U and Kruskal-Wallis tests, were used to analyze demographic group differences and factor relationships.

Results. Female pre-service teachers scored significantly higher than males in Self-Regulation and Reflective Practices and Self-Efficacy in Pedagogical Skills, while no gender differences were observed for Goal Orientation and Resilience or Collaborative Skills and Peer Learning. There were no significant correlations between age and the survey factors, and no significant differences were found across academic disciplines. The survey instrument demonstrated high reliability, with a Cronbach's alpha of 0.89 and validity, with all factors showing significant loadings in the Confirmatory Factor Analysis.

Conclusion. The findings highlight the importance of embedding acmeological skills in teacher education curricula to enhance professional excellence and adaptability in future educators. Gender differences observed in certain competencies suggest the need for targeted strategies to support male pre-service teachers.

1. Introduction

As the demands on educators continue to develop in an increasingly complex educational environment, preparing future teachers with both foundational knowledge and advanced pedagogical skills has become an important issue (Grossman et al., 2009). While traditional teacher training programs focus on content knowledge and basic teaching techniques, a critical gap exists in increasing higher-order competencies such as self-regulation, resilience, adaptability, and collaborative learning, which are all essential for modern, dynamic classroom instruction (Darling-Hammond, 2006). These competencies are collected under the concept of pedagogical acmeology, which focuses on the systematic development of peak professional abilities of educators. Pedagogical acmeology emphasizes personal growth, reflective practices, and resilience, allowing teachers to continually improve and adapt their teaching practices over time (Lekhu, 2023; Turgunbayeva et al., 2013).

Prior research has searched various aspects of teacher competencies, focusing on factors such as self-efficacy (Bandura, 1977), reflective practice (Schön, 1983), and social learning (Vygotsky, 1978). Each area contributes to teacher excellence, but few studies have integrated these competencies within a united framework of pedagogical acmeology. Studies in reflective practice indicate that teachers who engage in self-assessment and reflection demonstrate greater adaptability and effectiveness in the classroom (Schön, 1983). Additionally, research on social learning shows the benefits of collaborative learning environments, where pre-service teachers develop skills by engaging with peers and mentors (Vygotsky, 1978). While these studies address important components, there is limited research that connects these skills under a structured acmeological framework, particularly in teacher training.

Despite the contributions of existing literature, there is a clear deficiency in studies that systematically address the development of pedagogical acmeology skills as a core component of teacher training programs. Most existing studies treat competencies like self-efficacy, adaptability, and collaboration as isolated skills rather than interconnected elements of a comprehensive developmental model. Moreover, many teacher training programs lack structured tools to assess or enhance these competencies in a holistic way (Sarzhanova et al., 2024). This study aims to address this gap by examining pedagogical acmeology as a holistic approach to improving key skills in future educators, aiming to understand how teacher training can be improved to meet contemporary educational demands.

This study aims to examine pre-service teachers' current self-perceived acmeological competencies, specifically focusing on self-regulation, goal-setting, resilience, reflective practices, and collaborative learning. The significance of this study lies in its potential to inform teacher education programs, educational policymakers, and curriculum developers about the importance of adding acmeological competencies within training curricula. For teacher educators, this study can provide valuable results for effective methods to promote self-regulation, resilience, and reflective practices in pre-service teachers.

2. Literature Review

Pedagogical acmeology is an emerging field within educational science that focuses on strengthening teachers' teaching performance, professional resilience, and lifelong personal growth (Kuzmina et al., 2008). Acmeology, derived from the Greek word "acme," meaning the highest point or peak, originally emerged as a broader field studying peak human potential across various professions. In education, acmeology emphasizes the development of reflective, adaptive, and resilient skills that enable teachers to continuously grow and meet the dynamic challenges of modern classrooms (Derkach, 2013). As educational settings have become more complex and diverse,

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pedagogical acmeology addresses the need for teachers who can adapt to these changes and maintain high standards of teaching excellence.

Historically, pedagogical models focused primarily on content knowledge and basic teaching strategies. However, recent studies indicate that effective teaching also requires self-regulation, reflective practices, and adaptability (Darling-Hammond & Bransford, 2005). Pedagogical acmeology proposes an integrated framework where these competencies are not isolated skills but part of a holistic approach to teacher development. This framework supports the goals of contemporary education, which increasingly values soft skills and personal growth alongside traditional academic competencies.

2.1. Core Components of Pedagogical Acmeology

2.1.1. Self-regulation and reflective practices

Self-regulation and reflective practices are foundational to pedagogical acmeology, as they enable teachers to continually assess and improve their own teaching. Self-regulation, which involves setting personal goals, monitoring progress, and adjusting actions, is a key indicator of success in teaching. According to Bandura's (1977) theory of self-efficacy, self-regulated individuals are more likely to set challenging goals and continue through difficulties, an essential skill in the context of teaching. Studies indicate that self-regulated teachers demonstrate higher levels of adaptability and problem-solving, allowing them to effectively respond to diverse classroom situations (Zimmerman, 2000).

Reflective practice, introduced by Schön (1983), is another critical component. Reflection allows educators to learn from their experiences, both positive and negative, and develop a deeper understanding of their teaching methods. Reflective teachers are better equipped to adapt their strategies to meet the needs of their students, raising an environment of continuous improvement. Recent studies suggest that structured reflection activities in teacher training programs increase pre-service teachers' ability to evaluate their teaching practices (Farrell, 2015; Larrivee, 2008). By increasing both self-regulation and reflection, pedagogical acmeology encourages a growth mindset, where teachers view challenges as opportunities for development rather than obstacles (Begidova & Khazova, 2008).

Akkari and Lauwerier (2015) studied teacher education reform in the Arab world, highlighting the importance of adaptability and reflective practices in equipping teachers to meet new standards. Their research suggests that teachers who develop acmeological skills, such as adaptability and resilience, are more capable of moving between the complexities of reform and implementing new instructional practices effectively.

2.1.2. Goal orientation and resilience

Goal orientation and resilience are essential traits for teachers in today's challenging educational environments. Goal orientation refers to the ability to set and pursue specific professional objectives, while resilience is the capacity to persevere in the face of setbacks. These skills are particularly relevant in teaching, where educators often face unexpected challenges that require flexibility and determination. According to Dweck's (2006) research on growth mindset, individuals who view their abilities as malleable are more likely to set challenging goals and persist through setbacks. In the context of teaching, this mindset helps educators stay motivated and responsive to student needs.

Research on resilience in educators shows that resilient teachers are more effective in managing classroom stress and maintaining a positive outlook, which in turn benefits student outcomes (Tait, 2008). A recent study by Mansfield et al. (2014) found that resilience-building practices, such as

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reflective journaling and peer support, are associated with reduced burnout and increased teacher job satisfaction.

Day and Gu (2010) explored resilience among teachers in the United Kingdom, finding that reflective practices are crucial in helping teachers adapt to changing demands. This study aligns with pedagogical acmeology's emphasis on reflective and self-regulatory skills, indicating that teachers who engage in structured reflection are better equipped to handle stress and sustain professional growth. Similarly, Korthagen and Vasalos (2005) studied the impact of reflection-based professional development in the Netherlands, showing that reflective practices contribute significantly to teacher self-efficacy and resilience. Avalos (2011) researched teacher professional development in Chile, finding that teachers in under-resourced schools benefit significantly from training programs that incorporate resilience-building practices. O'Sullivan (2006) explored teacher training in Uganda, finding that programs emphasizing resilience and reflective practices help teachers cope with difficult working conditions. The study emphasized that building resilience and adaptability in African teachers is crucial, as many face high-stress environments with limited resources.

2.1.3. Self-efficacy and adaptive teaching

Self-efficacy—the belief in one's ability to succeed—is a basis of effective teaching. Teachers with high self-efficacy are more likely to take initiative, implement innovative teaching strategies, and persist through challenges. Bandura's (1977) concept of self-efficacy has been extensively studied in education, with research consistently showing that teachers who believe in their capabilities demonstrate higher levels of job satisfaction and effectiveness. High self-efficacy in teachers is linked to positive student outcomes, as confident teachers are more likely to engage students actively and address diverse learning needs (Akayuure & Akayuure, 2024; Javier-Aliaga et al., 2024; Tschannen-Moran & Hoy, 2001; Tucker et al., 2024).

Adaptive teaching refers to the ability to modify teaching strategies based on student needs and classroom dynamics. In the context of pedagogical acmeology, adaptive teaching is essential for developing resilient and effective educators. Research by Darling-Hammond (2006) suggests that adaptive teachers are better able to support diverse learners, supporting an inclusive and supportive learning environment.

Tschannen-Moran and Hoy (2001) conducted a seminal study on teacher self-efficacy, revealing that teachers with higher self-efficacy are more likely to adopt innovative instructional methods and adapt to diverse classroom needs. This research aligns with acmeological principles by highlighting the importance of self-efficacy as a foundational skill for teachers striving toward professional excellence. Furthermore, Darling-Hammond et al. (2017) examined adaptive teaching strategies in the United States, emphasizing that the ability to modify teaching practices based on student needs is crucial in diverse educational settings. Their findings indicate that adaptive teaching not only enhances student outcomes but also contributes to teacher satisfaction and professional growth.

2.1.4. Collaborative learning and peer engagement

Collaboration and peer learning are integral to pedagogical acmeology, as they provide opportunities for teachers to share views, gain new perspectives, and support one another in professional growth. According to Vygotsky's (1978) social learning theory, learning is inherently a social process, and individuals develop their skills most effectively through interaction with others. In teacher education, collaborative learning promotes the exchange of ideas and strategies, enabling pre-service teachers to learn from each other's experiences and reflections (Lave & Wenger, 1991).

Studies show that collaborative learning in teacher training enhances not only technical skills but also acmeological competencies like resilience and reflective practice (Ghomi et al., 2019). A study by Ronfeldt et al. (2015) found that teachers who engage in peer collaboration report higher levels

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of job satisfaction and effectiveness. Lo et al. (2012) discusses the pressures and expectations placed on teachers in East Asian and Chinese societies, highlighting how collaborative practices can help educators manage these demands. Their study suggests that when teachers engage in structured collaboration, they are better able to move between the problems of balancing cultural expectations with innovative teaching methods. Badri et al. (2016) examined the effects of collaborative professional development programs on teacher adaptability and effectiveness. Their study found that collaborative learning models, which allow teachers to learn from each other's experiences and insights, significantly improve adaptability and teaching quality. Their findings indicate the importance of advancing acmeological competencies through collaborative practices, particularly in rapidly changing educational systems like those in the UAE. Ochieng and Nganga (2019) investigated the role of peer support in teacher development in Kenya, finding that collaborative learning and mentorship significantly enhance teacher motivation and adaptability.

2.2. Implementing Pedagogical Acmeology

The application of pedagogical acmeology in teacher training has shown favorable results in improving professional excellence. A recent review by Hargreaves and Fullan (2012) highlighted the benefits of incorporating acmeological skills such as adaptability and resilience into teacher education. Teachers trained in acmeological practices are better equipped to handle classroom challenges, leading to improved student engagement and academic performance.

Furthermore, studies indicate that acmeological skills contribute to teacher retention, as teachers who feel confident in their ability to manage stress and adapt to change are less likely to experience burnout. For example, Day and Gu (2007) found that resilience-building practices in teacher education were associated with higher retention rates and greater job satisfaction.

Despite its potential benefits, the implementation of pedagogical acmeology poses several challenges. One criticism is the difficulty in measuring acmeological skills, as competencies like resilience and reflective practice are complex and multifaceted. Duckworth and Yeager (2015) argue that while soft skills are crucial, they are difficult to quantify and assess reliably.

Another challenge is the integration of acmeological practices within existing teacher education curricula. Many programs already have extensive requirements, and additional training on resilience, reflection, and adaptability may be considered burdensome. However, advocates of pedagogical acmeology argue that these skills are essential for long-term teacher success and should be prioritized (Buchek & Ermolenko, 2016).

2.3. Pedagogical Acmeology in Kazakhstan

Pedagogical acmeology has garnered increasing interest in Kazakhstan as the nation reforms its education system to meet the demands of a rapidly changing global reform. As Kazakhstan transitions towards a knowledge-based economy, there is a growing emphasis on preparing educators who are not only knowledgeable but also resilient, reflective, and adaptive. This need aligns well with the principles of pedagogical acmeology, which aim to support these exact competencies within educators (Baishymyrova & Sadykova, 2024; Bekzhanova et al., 2013).

Kazakhstan's Ministry of Education has prioritized resilience and adaptability in teacher education, particularly as the country implements reforms to increase educational quality and align with international standards. A significant initiative in this direction is the collaboration with the University of Cambridge's Faculty of Education, which has directly informed a substantial national program of educational reform in Kazakhstan between 2013 and 2020. This partnership has focused on teacher development, with over 242,896 school teachers participating in development programs between 2011 and 2018, leading to improvements in teaching and learning outcomes (University of Cambridge, 2021).

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The OECD's Education Policy Outlook 2021 also underscores Kazakhstan's efforts to improve educational quality, particularly in rural and disadvantaged schools. The report notes that Kazakhstan has developed a network of resource centers to support system-wide improvement in primary and secondary education. These centers provide support to teachers through assistance with specific pedagogical challenges and professional development and increasing resilience and adaptability among educators (OECD, 2021).

Furthermore, national consultations held in June 2022, organized by the Ministry of Education in collaboration with UNICEF and UNESCO, focused on transforming the education system. Experts discussed the need for changes to ensure all children have equal access to education and emphasized the importance of revising approaches to education to protect the right of every child to quality and affordable education (UNICEF Kazakhstan, 2022).

Research in Kazakhstan has stressed the importance of reflective practices and self-regulation among teachers. For example, Oryngaliyeva et al. (2022) devoted their article to the importance of self-regulation in the professional development of future teachers. They explain that the formation of self-regulation can be viewed as a person's ability to align their behavior with generally accepted moral norms, rules, values, and professional requirements. The study emphasized the necessity of self-regulation for future teachers, as it manifests in a teacher's active and effective attitude towards students, as well as towards their own social attitudes, experience, orientation, and interests. Particular attention was given to the fact that the foundations of self-regulation are established during professional training, which is a critical period for personality formation.

According to Skudnova (2012), the acmeological approach in psychological and pedagogical education emphasizes the development of essential skills such as resilience and adaptability. Skudnova argues that educators who possess these competencies are better equipped to handle the complexities of modern educational environments, including policy changes, curriculum updates, and classroom management challenges. Her findings show the value of pedagogical acmeology in increasing emotional resilience in teachers, indicating that acmeology-based training can enhance teachers' capacity to manage stress and respond effectively to the increasing demands of the educational system.

Collaborative learning and peer support are also essential aspects of pedagogical acmeology in Kazakhstan. Ayubayeva (2018) investigates the role of teacher collaboration in professional learning within Kazakhstani schools, stressing factors that enable and inhibit this process. Her study explores how recent educational reforms promote collaboration as a strategy for teachers to embrace innovation. Drawing on case studies from three schools, Ayubayeva finds that teachers' beliefs and values regarding collaboration are shaped by a legacy from the Soviet education system and current reform ambiguities. Despite these challenges, she suggests that the existing tradition of peer observation could improve a culture of collaboration if supported by an appropriate school organizational structure and conducive conditions. This study aligns with the principles of Vygotsky's (1978) social learning theory, indicating the importance of collaborative environments for professional growth.

3. Methodology

3.1. Participants

The study sample consisted of 174 participants, with a balanced representation of gender and diversity in age and discipline. Of the total participants, 56.3% were male, and 43.7% were female, reflecting a slightly higher proportion of male respondents. The majority of the participants were between 17 and 20 years old, with a few older participants aged up to 26 and a few participants were over 21 years old. In terms of disciplines, the participants represented a variety of academic

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backgrounds. The majority (64.4%) were from Pedagogy and Psychology. Additionally, 14.4% were focused solely on Pedagogy. Other disciplines accounted for 15.5% of the sample, indicating broader academic interests outside education and psychology. Lastly, 5.7% of participants were from Psychology.

3.2. Instrument Development

The survey instrument was developed through a systematic and iterative process to ensure its validity and reliability. Initially, the dimensions of the instrument were identified based on a review of relevant literature and theoretical frameworks. Using these dimensions as a foundation, the authors collaboratively wrote an initial pool of items designed to measure each construct. The items were then refined to improve clarity, relevance, and alignment with the identified dimensions.

After creating a preliminary set of items, the authors engaged in discussions to finalize the first rough version of the instrument. This version was reviewed by two experts in the field (one from Educational Psychology and one from Pedagogical Theory and Teacher Education), who provided feedback on the content, phrasing, and overall coherence of the items. Following expert review, three students were asked to read aloud and complete the survey while providing feedback. This step helped identify any ambiguities or difficulties in understanding the items, leading to further refinements. Through this rigorous process, the final version of the instrument was developed and ready for data collection and analysis.

Following the data collection, the instrument underwent psychometric analyses in this study, including reliability and validity evaluations. Based on these analyses, minor adjustments were made to improve the instrument's alignment with the constructs being measured. The finalized version of the instrument is provided in the appendix for reference.

3.3. Data Collection

Data were collected during the autumn semester of the 2024–2025 academic year using a Google Form survey, which allowed students to respond conveniently using their phones or laptops. The data collection process was conducted during regular course hours to ensure accessibility and maximize participation. The first author administered the survey, providing students with instructions and addressing any questions to ensure clarity and consistency in responses. This approach facilitated efficient data collection while minimizing disruptions to the participants' schedules. The digital format ensured a streamlined process and secure recording of responses for subsequent analysis.

3.4. Data Analyses

A combination of descriptive and inferential statistical methods was employed to analyze the data. Descriptive statistics, including means and standard deviations, were used to summarize demographic characteristics such as gender, age, and discipline, as well as responses to survey items. Confirmatory Factor Analysis (CFA) was conducted to validate the structure of the survey instrument and examine the relationships between observed variables and their corresponding latent constructs. Reliability analyses were performed to evaluate the internal consistency of the survey scales. Cronbach’s alpha was calculated for each factor to ensure that the items within each construct consistently measured the intended latent variable. For inferential analyses, statistical tests, such as Mann-Whitney U and Kruskal-Wallis, were conducted to explore differences across demographic groups where appropriate.

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4. Results

This section presents the findings of the study, including analyses of the survey's factor structure, reliability, and the relationships between demographic variables and survey constructs.

Table 1. Scale Reliability Statistics.

	Mean	SD	Cronbach's α	McDonald's ω
Scale	4.25	0.49	0.89	0.89

The reliability of the scale was evaluated using Cronbach's alpha and McDonald's omega, both of which yielded high values of 0.89, indicating excellent internal consistency. The mean score for the scale (1 to 5) was 4.25, with a standard deviation of 0.49, reflecting a relatively high level of agreement among respondents and moderate variability in responses.

The correlation heatmap displays the pairwise Pearson correlation coefficients between the survey items (Q1–Q20), with values ranging from -1 to 1. Positive correlations are shown in shades of green, with stronger correlations indicated by darker tones, while weaker correlations are represented by lighter shades closer to yellow.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q1	1																			
Q2	0.43	1.00																		
Q3	0.21	0.21	1.00																	
Q4	0.17	0.27	0.40	1.00																
Q5	0.37	0.48	0.42	0.39	1.00															
Q6	0.40	0.17	0.20	0.18	0.29	1.00														
Q7	0.19	0.18	0.24	0.19	0.22	0.36	1.00													
Q8	0.20	0.06	0.14	0.17	0.22	0.37	0.30	1.00												
Q9	0.15	0.06	0.24	0.15	0.24	0.41	0.36	0.43	1.00											
Q10	0.21	0.13	0.20	0.19	0.26	0.33	0.30	0.45	0.43	1.00										
Q11	0.17	0.13	0.20	0.10	0.19	0.33	0.30	0.27	0.27	0.22	1.00									
Q12	0.32	0.29	0.14	0.10	0.18	0.21	0.19	0.18	0.21	0.12	0.36	1.00								
Q13	0.32	0.27	0.18	0.02	0.34	0.33	0.10	0.32	0.21	0.22	0.33	0.45	1.00							
Q14	0.39	0.33	0.27	0.20	0.42	0.32	0.19	0.25	0.34	0.24	0.28	0.51	0.57	1.00						
Q15	0.31	0.18	0.26	0.21	0.43	0.32	0.18	0.16	0.19	0.10	0.33	0.49	0.45	0.58	1.00					
Q16	0.28	0.24	0.21	0.19	0.39	0.29	0.11	0.17	0.24	0.23	0.20	0.29	0.31	0.42	0.43	1.00				
Q17	0.35	0.21	0.29	0.16	0.44	0.31	0.22	0.23	0.31	0.21	0.29	0.38	0.44	0.49	0.48	0.49	1.00			
Q18	0.38	0.32	0.29	0.23	0.38	0.33	0.20	0.35	0.25	0.30	0.24	0.47	0.32	0.40	0.45	0.31	0.52	1.00		
Q19	0.33	0.27	0.26	0.16	0.32	0.23	0.20	0.27	0.23	0.20	0.27	0.43	0.24	0.37	0.39	0.37	0.44	0.63	1.00	
Q20	0.41	0.28	0.25	0.17	0.40	0.27	0.29	0.35	0.16	0.29	0.43	0.42	0.37	0.48	0.41	0.35	0.50	0.52	0.51	1.00

Pearson Correlation
-1.0 -0.5 0.0 0.5 1.0

Figure 1. Correlation Heatmap.

The heatmap reveals notable patterns in the relationships between items, with many moderate-to-strong positive correlations observed within clusters of items, particularly among items measuring similar constructs. For example, items such as Q14 and Q15 exhibit a strong correlation (0.58), indicating they are likely capturing related aspects of the same factor. Conversely, weaker correlations, such as between Q4 and Q9 (0.06), suggest minimal shared variance, which is expected if the items belong to different constructs.

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Table 2. Correlation Between Age and Factors of the Survey.

	Self-Regulation and Reflective Practices	Goal Orientation and Resilience	Self-Efficacy in Pedagogical Skills	Collaborative Skills and Peer Learning
rho	0.06	0.02	0.04	-0.04
df	172	172	172	172
p-value	0.45	0.811	0.624	0.576

The correlation between age and the factors of the survey was analyzed using Spearman's rho. The results indicated weak and non-significant correlations between age and all four factors.

Table 3. Mann-Whitney U Test for Discipline Variable.

Factors	Statistic	p
Self-Regulation and Reflective Practices	3019.50	0.031
Goal Orientation and Resilience	3690.50	0.920
Self-Efficacy in Pedagogical Skills	2912.50	0.013
Collaborative Skills and Peer Learning	3312.00	0.207

Table 4. Group Descriptives for Gender across Survey Factors.

Factors	Group	N	Mean	Median	SD	SE
Self-Regulation and Reflective Practices	Female	76	4.36	4.60	0.59	0.07
	Male	98	4.21	4.40	0.58	0.06
Goal Orientation and Resilience	Female	76	4.15	4.20	0.63	0.07
	Male	98	4.15	4.20	0.61	0.06
Self-Efficacy in Pedagogical Skills	Female	76	4.39	4.40	0.61	0.07
	Male	98	4.20	4.40	0.64	0.06
	Female	76	4.35	4.40	0.57	0.07

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Factors	Group	N	Mean	Median	SD	SE
Collaborative Skills and Peer Learning	Male	98	4.22	4.40	0.71	0.07

A Mann-Whitney U test was conducted to compare male and female students' perceptions of acmeology across four survey factors. The results revealed a significant difference in perceptions of Self-Regulation and Reflective Practices (U = 3019.50, p = 0.031), with female students (mean = 4.36, median = 4.60) scoring higher than male students (mean = 4.21, median = 4.40). Similarly, a significant difference was observed for Self-Efficacy in Pedagogical Skills (U=2912.50, p=0.013), with females (mean = 4.39, median = 4.40) reporting higher levels of self-efficacy compared to males (mean = 4.20, median = 4.40).

Table 5. Kruskal-Wallis Test for Discipline Variable Across Survey Factors

Factors	χ^2	df	p
Self-Regulation and Reflective Practices	1.82	4	0.769
Goal Orientation and Resilience	5.75	4	0.218
Self-Efficacy in Pedagogical Skills	3.50	4	0.477
Collaborative Skills and Peer Learning	4.15	4	0.386

A Kruskal-Wallis test was conducted to examine differences in perceptions of acmeology across four academic disciplines: pedagogy, psychology, pedagogy and psychology, and others. The results indicated no statistically significant differences for any of the factors.

4.1 Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) was conducted to evaluate the relationships between the survey items and their respective latent constructs.

Table 6. Factor Loadings.

Factor	Indicator	Estimate	SE	Z	p	Factor	Indicator	Estimate	SE	Z	p
Factor 1	Q1	0.37	0.05	7.07	<.001	Factor 3	Q14	0.68	0.06	11.55	<.001
	Q2	0.47	0.06	7.51	<.001		Q15	0.63	0.06	10.46	<.001
	Q3	0.47	0.07	6.52	<.001		Q13	0.56	0.06	9.2	<.001
	Q4	0.41	0.07	5.81	<.001		Q12	0.56	0.06	9.32	<.001
	Q5	0.78	0.07	10.4	<.001		Q11	0.38	0.06	5.95	<.001
Factor 2	Q10	0.54	0.07	7.89	<.001	Factor 4	Q20	0.66	0.06	10.21	<.001
	Q9	0.6	0.07	8.69	<.001		Q19	0.62	0.06	9.61	<.001
	Q8	0.57	0.07	8.35	<.001		Q18	0.7	0.07	10.67	<.001
	Q7	0.44	0.07	6.51	<.001		Q17	0.57	0.05	10.4	<.001
	Q6	0.53	0.07	8	<.001		Q16	0.41	0.06	7.48	<.001

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The results of the Confirmatory Factor Analysis (CFA) presented in Table 6 revealed that all indicators had statistically significant factor loadings ($p<0.001p < 0.001p<0.001$), demonstrating their meaningful contribution to their respective latent factors. For Factor 1, loadings ranged from 0.37 (Q1) to 0.78 (Q5), with Q5 being the strongest indicator and Q1 showing a weaker relationship with the factor. Similarly, for Factor 2, the loadings varied between 0.44 (Q7) and 0.60 (Q9), indicating a moderate to strong representation of the factor. Factor 3 displayed loadings ranging from 0.38 (Q11) to 0.68 (Q14), with Q14 strongly representing the factor, while Q11 exhibited a weaker association. Finally, Factor 4 showed loadings between 0.41 (Q16) and 0.70 (Q18), with Q18 as the most robust indicator. Despite some indicators showing relatively weaker loadings (e.g., Q1, Q11), all were above or near the acceptable threshold, and their statistical significance supports their inclusion in the model. These findings suggest that the observed variables effectively measure their intended constructs, supporting the validity of the factor structure.

Table 7. Model Fit and Fit Measures.

						RMSEA 90% CI	
χ^2	df	P	CFI	TLI	RMSEA	Lower	Upper
264.34	164	<.001	0.91	0.9	0.06	0.05	0.07

The model fit was evaluated using multiple indices to ensure a comprehensive assessment of the Confirmatory Factor Analysis (CFA) (Table 7). The chi-square test ($\chi2=264.34$, $df=164$, $p<.001$) indicated a statistically significant discrepancy between the observed and implied covariance matrices. However, given the sensitivity of the chi-square test to sample size, alternative fit measures were considered for a more robust evaluation. The Comparative Fit Index (CFI) was 0.91, and the Tucker-Lewis Index (TLI) was 0.90, both meeting the threshold of 0.90 for acceptable fit. The Root Mean Square Error of Approximation (RMSEA) was 0.06, with a 90% confidence interval of 0.05 to 0.07, indicating a good model fit, as values below 0.08 are commonly considered acceptable. Collectively, these indices suggest that the model fits the data well, capturing the relationships between latent factors and their indicators with minimal misfit.

Table 8. Factor Loadings – Modification Indices.

	Factor 1	Factor 2	Factor 3	Factor 4		Factor 1	Factor 2	Factor 3	Factor 4
Q1		2.78	**7.1**	**8.82**	Q14	1.81	0.34		0.28
Q2		5.34	0.27	1.42	Q15	0.47	2.94		0.56
Q3		0.84	0.12	0.01	Q13	0.09	0.47		2.11
Q4		0.05	4.28	3.85	Q12	3.97	1.82		0.21
Q5		0.04	0.01	0.02	Q11	0.04	**9.05**		1.44
Q10	0		1.49	0.22	Q20	0.05	0.03	0.85	
Q9	1.85		0.13	1.46	Q19	1.41	0.86	3.47	
Q8	1.15		0.09	0.05	Q18	0	0.44	2.2	
Q7	0.58		0.06	0	Q17	0	0.05	1.58	
Q6	3.69		4.38	2.45	Q16	1.76	0.11	2.31	

As shown in Table 8, revisions were made to Q1 and Q11 to enhance the clarity and alignment of the survey items with their intended constructs. The revisions to Q1 and Q11 were informed by their high modification indices, which indicated potential misalignment or overlap with unintended factors. For Q1, assigned to the factor Self-Regulation and Reflective Practices, modification indices revealed values of 7.10 for Factor 3 and 8.82 for Factor 4. This suggested that respondents might interpret the item as relating to self-efficacy or collaborative skills rather than solely self-regulation. To address this, the item was simplified to focus on personal goal-setting: "I set clear goals for myself

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before each teaching session." This change reduces ambiguity and ensures stronger alignment with the intended construct.

Similarly, Q11, assigned to Self-Efficacy in Pedagogical Skills, exhibited a high modification index of 9.05 for Factor 2 (Goal Orientation), indicating overlap with resilience-related constructs. To resolve this, the item was rephrased to explicitly focus on self-efficacy in classroom management: "I am confident in managing a classroom and keeping students engaged."

5. Discussion

This study examined the self-perceived acmeological competencies of pre-service teachers through the development and validation of a psychometric survey instrument. The findings contribute to understanding the relationships between demographic factors and key constructs of pedagogical acmeology, such as self-regulation, resilience, self-efficacy, and collaborative skills.

The psychometric analyses confirmed the validity and reliability of the instrument. The Confirmatory Factor Analysis (CFA) showed that all survey items significantly contributed to their respective latent constructs, with acceptable factor loadings and good model fit indices (CFI = 0.91, TLI = 0.90, RMSEA = 0.06). These results are similar to previous research on the importance of robust psychometric tools in assessing teacher competencies (Darling-Hammond et al., 2013). The high internal consistency of the scale, reflected by Cronbach's alpha and McDonald's omega values of 0.89, demonstrates the instrument's reliability in evaluating acmeological constructs.

The analysis showed significant gender differences in Self-Regulation and Reflective Practices and Self-Efficacy in Pedagogical Skills, with female students reporting higher scores than their male counterparts. These findings are consistent with studies indicating that women often demonstrate stronger reflective and self-regulatory practices in educational settings (Tyler et al., 2022). However, Sak (2015) found no significant differences in males' and females' sense of self-efficacy concerning student engagement or instructional strategies. The absence of significant gender differences in Goal Orientation and Resilience and Collaborative Skills and Peer Learning suggests that these competencies are consistent across genders, in line with earlier findings about their universal role in teacher training (Sanmartín et al., 2024).

The results indicated no significant correlation between age and the four survey factors, indicating that perceptions of acmeological competencies are stable across the age range of participants. Similarly, the Kruskal-Wallis test revealed no significant differences across disciplines, indicating that the constructs measured are relevant across academic backgrounds. These results reinforce the applicability of acmeological competencies in diverse educational contexts (Darling-Hammond & Bransford, 2005; Day & Gu, 2010). This finding aligns with the notion that these competencies are developed early in one's educational journey and remain stable throughout the formative years of teacher training. However, it is also possible that the limited age range of the participants (primarily between 17 and 26 years old) did not allow for a broader representation of generational differences that might influence the development of these competencies.

The absence of significant differences across academic disciplines (Pedagogy, Psychology, and others) is intriguing, as one might expect varying perceptions of competencies depending on the specific focus of study. This finding could indicate that the acmeological competencies measured in this study are universally applicable across disciplines. This suggests that teacher training programs in diverse fields might benefit from a holistic, integrated approach to acmeological skill development. Alternatively, the lack of disciplinary differences could reflect limitations in how the survey items captured discipline-specific nuances or the relatively equal distribution of disciplines in the sample.

Revisions to specific items, such as Q1 and Q11, based on modification indices, improved the alignment of these items with their intended constructs. This iterative approach reflects the

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importance of ongoing refinement in developing effective psychometric instruments (Duckworth & Yeager, 2015). By resolving ambiguities, these adjustments enhanced the precision and coherence of the survey, ensuring its effectiveness in evaluating acmeological competencies in future studies.

6. Conclusions, Implications, and Limitations

The findings have practical implications for teacher education programs. The validated instrument provides a structured method for assessing critical acmeological competencies essential for preparing educators to meet the demands of modern classrooms. The observed gender differences indicate a need for targeted strategies to support male pre-service teachers in building self-regulation and self-efficacy skills. Additionally, the consistency of perceptions across age and disciplines suggests that these competencies should be added to teacher training programs regardless of the student's backgrounds.

Teacher education curricula should emphasize reflective practices, resilience-building activities, and opportunities for collaborative learning, which have been shown to improve teacher effectiveness and professional development (Mansfield et al., 2014; Schön, 1983). Encouraging pre-service teachers to regularly document their experiences, thoughts, and challenges in their teaching practice can help them develop a habit of self-reflection. Teacher education programs can include collaborative modules where students collaborate on problem-solving tasks, lesson planning, or classroom management strategies. Structured group activities that require diverse perspectives can deepen their understanding of pedagogical concepts and enhance communication, empathy, and collaborative skills. Integrating resilience training into teacher education programs can help pre-service teachers build coping mechanisms for stress and adversity. Workshops focusing on stress management, mindfulness techniques, and positive psychology could be valuable. To foster self-efficacy, pre-service teachers should be encouraged to set specific, measurable goals for their development throughout their training. This could include personal goals related to classroom management, student engagement, or academic subject mastery.

While this study makes a meaningful contribution, it is not without limitations. The sample size, though adequate, limits the generalizability of findings to broader populations. Moreover, the reliance on self-reported data introduces the possibility of response bias. Future research should explore longitudinal approaches to track the development of acmeological competencies over time and their impact on teaching outcomes. Expanding the instrument to include qualitative measures, such as interviews or open-ended questions, could provide a deeper understanding of the nuances of acmeological development.

This study contributes to the emerging field of pedagogical acmeology by providing a validated tool for assessing essential teaching competencies and examining demographic variations. The findings highlight the importance of developing self-regulation, resilience, self-efficacy, and collaborative skills in teacher education. By adding these competencies into training programs, educators will be better equipped to address the challenges of contemporary classrooms, ultimately enhancing teaching quality and student success.

Declarations

Author Contributions. L.A: Supervising, data collection; G.S: Literature review, conceptualization. E.U: methodology, data analysis. G.I and K.M: review-editing and writing, original manuscript preparation. All authors have read and approved the published version of the article.

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