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Research Article

Assessing readiness and attitudes: Scale development for online practicum in teacher education in the digital society

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ABSTRACT

The aim of this study is to develop a valid and reliable instrument that measures pre-service teachers' readiness and attitudes towards online teaching practice. The sample of the study consisted of 411 pre-service teachers studying at a Russian university. 87.7% of the participants were female and 12.3% were male. When the age groups are analyzed, the 18-19 age group is 33.3%, the 20-21 age group is 32%, the 22-23 age group is 22.9% and the 24 and over age group is 11.8%. 83.2% of the participants had previous online teaching experience. During the scale development process, expert opinion was obtained and validity and reliability analyses were conducted. Exploratory factor analysis and confirmatory factor analysis revealed that the scale had a three-factor structure: online teaching self-efficacy (11 items), online professional support and collaboration (8 items), and attitude towards online teaching and perception of development (5 items). This three-factor structure explained 67.1% of the total variance. The reliability coefficients of the scale ranged between 0.841 and 0.956 for the sub-dimensions. As a result of the latent profile analysis, the participants were categorized into six different profiles: competent and enthusiastic group (37%), high performance group (20%), collaboration-focused group (1%), moderate adaptation group (29%), low motivation group (4%), and open to development group (10%). The findings show that the developed scale is a valid and reliable tool that can be used to assess pre-service teachers' online teaching readiness and attitudes.

Keywords: online practicum, teacher education, scale development, readiness, attitudes, digital society

INTRODUCTION

The digital transformation has impacted many areas of education (Bonfield et al., 2020; Hai et al., 2021). Teaching and learning practices in teacher education programs have also been affected by this transformation (Flores & Swennen, 2020; Quezada et al., 2020). The COVID-19 pandemic accelerated this transformation, requiring rapid adaptation to online teaching-learning environments (Brinia & Psoni, 2022; Kidd & Murray, 2020). This change has made clear how vitally important it is to know how ready preservice teachers are for online learning and how they see online practiexperiences.

Although previous studies have looked at many facets of online teacher preparation, the thorough knowledge of pre-service teachers' readiness and attitudes toward online practice experiences is much lacking. Earlier studies generally focused on specific aspects including technological integration (Liu & Kleinsasser, 2023), mentoring support (McGarr, 2021; Swanson, 2023), or pedagogical changes (Morrison & Sepulveda-Escobar, 2021). However, there is obviously no thorough assessment tool available that simultaneously examines multiple facets of online practice readiness and attitudes.

The need for such a comprehensive assessment tool is especially evident considering the different nature of online teaching competencies. Among the competencies pre-service teachers have to gain in various sectors are technological integration (Jin, 2023), online pedagogical strategies (Saito & Tangkiengsirisin, 2023), and virtual classroom administration (Choi & Park, 2022). Furthermore, influencing their professional development and educational strategies are their opinions on online learning (Ogegbo et al., 2024).

This study aims to produce and validate a thorough scale to evaluate pre-service teachers' views on and readiness for online practical experiences. The study has as follows its particular goals:

1. To determine the basic dimensions of pre-service teachers' readiness and attitudes toward online practicum experiences.
2. Develop a psychometrically sound instrument to measure these dimensions
3. Validate the instrument through rigorous statistical analysis
4. Examine the implicit profiles of preservice teachers based on their responses.

The value of this study is in its capacity to give program managers and teacher educators a consistent instrument for evaluating preservice teachers' online preparedness. Kennedy and Archambault (2012) rightly point out that a strong basis in online pedagogy and instructional design is required, not enough emphasis on technology itself. Therefore, our study satisfies this desire by developing a comprehensive assessment tool including many aspects of preparation and perceptions on online learning.

Theoretically, current research stressing the importance of experiential learning (Korucu-Kış, 2021), technology integration (Shao et al., 2024), mentoring assistance (Kanwal et al., 2023), and reflective practices (Syarifah & Fadhilah, 2022) in online teacher education constitutes the theoretical basis of the research. By combining these multiple elements into one tool and provides practical ideas for improving teacher preparation efforts in the digital age, this study adds to the body of knowledge on online teacher education.

The Components of Online Practicum

Practicum (**Appendix A**), also known as internship experience or clinical practice, is considered an essential component of professional preparation programs in education, health, social services, law, accounting, and engineering (Hulme et al., 2022). Teaching practicum constitutes a critical element of the teacher preparation process and is seen as a highly valued component by pre-service teachers, mentors and university supervisors (Brown et al., 2015; Ferrier-Kerr, 2009; Kidd & Murray, 2020). In this context, the main purpose of the practicum is to provide pre-service teachers with the opportunity to apply their theoretical knowledge and gain experience in the field. Online practicum refers to a structured virtual learning experience that allows students to apply their theoretical knowledge in real or simulated environments under the supervision of experienced professionals (Brinia & Psoni, 2022; Ersin et al., 2020; Hulme et al., 2022; Jukić &

Žižanović, 2024). This innovative approach represents a version of the traditional practicum model adapted to the requirements of the digital age. The components in significant part help to maintain the quality of teacher education and equip pre-service teachers for challenges in the classroom. The research covered in this paper underline the need for mentorship, technological integration, experiential learning, and reflective practices in online internship programs (Ali & Nath, 2023; Brinia & Psoni, 2022; Kidd & Murray, 2020; Pappa, 2021). The development of these elements clarifies how best to apply online tools in teacher preparation.

Experiential learning

By combining theoretical knowledge with actual experiences, pre-service teachers using experienced learning help to equip themselves for the real world. Virtual experiences let pre-service teachers digitally experience significant events, therefore providing them with priceless learning opportunities. Kolb's experiential learning cycle suggests that this approach allows pre-service teachers to actively gain domain-specific competencies (Korucu-Kış, 2021) and thus enhance their knowledge and skills. Mixed reality simulations help experiential learning by letting pre-service teachers practice their teaching skills in a controlled but realistic environment and gain feedback (Luke et al., 2023). Emphasizing the requirement of complete pedagogical techniques using technology in online learning, Carrillo and Flores (2020) stress how teachers and students should develop their technical capabilities by means of targeted training.

Technology integration

Effective integration of technology is critical to the success of online teacher education. Cloud-based platforms facilitate collaborative project-based learning among pre-service teachers, mentors and students, expanding the learning and teaching repertoire of all stakeholders (Liu & Kleinsasser, 2023). The effective use of online platforms helps pre-service teachers to document their teaching experiences and build the theoretical foundation of these experiences (Shao et al., 2024). Morrison and Sepulveda-Escobar (2021) state that pre-service teachers should be equipped with the knowledge and skills to cope with technological challenges and thus support innovative teaching practices. Jin (2023) states that the ability of pre-service teachers to adapt to both online and traditional teaching methods enables them to be prepared for different teaching contexts.

Mentoring and support

Providing pre-service teachers with direction in online practices helps them to grow professionally, hence mentoring is rather important. By means of feedback, best practice modeling, and support of teaching and classroom management skill development, mentors offer an efficient mentoring process (McGarr, 2021; Swanson, 2023). Moreover, fostering collaboration among teachers supports professional development by creating a supportive learning community (Hertz et al., 2022). Pappa (2021) emphasizes the importance of providing early guidance to increase the motivation of pre-service teachers, especially in specialized areas such as content and language integrated learning. Kanwal et al. (2023) stated that effective supervision and mentoring are critical for the professional development of pre-service teachers. Moore and Hong (2022) argue that virtual internships allow teachers to prepare in a way that increases their self-efficacy.

Reflective practices

Reflective practices enable pre-service teachers to critically evaluate their teaching experiences and thus engage in a process of continuous improvement. Pre-service teachers using structured reflection techniques can closely review their experiences and instructional strategies (Kim, 2020). Peer and mentoring comments enhance the reflective process and help to shape several points of view (Luke et al., 2023). Reflective techniques, according to Syarifah and Fadhilah (2022), help pre-service teachers become more ready for online learning environments and foster ongoing development in teaching quality. Giner-Gomis et al. (2023) also emphasize that despite the challenges posed by the pandemic, the adaptation of teaching practices enriches the theoretical and practical training of pre-service teachers and the value of reflection in this process.

Collaborative learning environments

Creating collaborative learning environments is of great importance for developing a sense of community among pre-service teachers. Pre-service teachers' experiences during online activities can improve both their professional growth and learning. Tekin and Tunaz (2023) assert that teaching techniques help future teachers to combine theory and practice in actual classroom settings, therefore facilitating their development. Aboomar et al. (2018) stress that the collaborative character of online learning helps to offer high-quality education by means of peer support and sharing of best practices.

Thus, good online practice in teacher education is defined by the combination of technology integration, structured aid and supervision, reflective practice, and cooperative learning environments. These components equip pre-service teachers with the tools and confidence required to succeed in all sorts of educational settings and help them develop professionally.

Pre-Service Teachers' Views and Attitudes Toward Online Practicum

Preservice teachers' opinions and attitudes on online practice in pre-service teacher education vary greatly depending on different opportunities and challenges (Ersin et al., 2020; Jukić & Žižanović, 2024). Accelerated by the COVID-19 pandemic, the move to online practice has forced preservice teachers to adapt to new educational environments, thereby profoundly influencing their confidence in technology, their views on online pedagogical techniques, and their love for the teaching profession (Brinia & Psoni, 2022; Kidd & Murray, 2020; Saraç et al., 2022). These experiences were shaped by critical factors such as technology integration, mentoring and professional skills development.

Pre-service teachers exhibited high levels of acceptance and intention to use virtual reality classrooms due to their social influence and confidence in the technology, especially in the context of science education (Ogegbo et al., 2024). Their confidence in using this technology effectively and the assistance they received from their social surrounds helped to support their positive attitude to virtual reality classrooms. In this situation, pre-service teachers' attitudes about new technologies and their will to practice changed. Although the use of technology in online placements offers the opportunity to expand their teaching repertoire, it is also considered as a challenge that requires more study and adaption to manage these intricate operations (Brinia & Psoni, 2022; Liu & Kleinsasser, 2023; Saraç et al., 2022).

Virtual practice placements depend much on guidance and support for mentoring mentors; so, directly affects how teaching tactics and classroom management approaches change (McGarr, 2021; Swanson, 2023). Pre-service teachers get specific aid from mentors in areas like one-to-one feedback, pedagogical strategy development, and problem-solving guidance toward online classroom management. Through virtual environments, preservice teachers underlined the need to establish significant professional ties supporting efficient teaching and classroom administration (Hoppin et al., 2023). Technology integration into instructional techniques and mentor collaboration are two important elements that let pre-service teachers have better experiences (Düzgün & Kaşkaya, 2023; Mohebi et al., 2022).

Online applications motivated creativity and enabled pre-service teachers to develop cognitive capacities despite the early challenges in terms of the pedagogical expertise needed for virtual learning (Alkandari, 2024). These initial challenges include inadequacies in the creation of online course materials, lack of knowledge on the use of digital pedagogical tools, and inexperience in engaging students. In addition, factors such as lack of direct supervision and feedback during online practices could negatively affect professional development (Abdul Kadir & Abdul Aziz, 2021).

Pre-service teachers were uncomfortable about lack of preparation and experience with online teaching environments; some of them worried about online field practice (Alkandari, 2024). They had to deal with technical problems (Saraç et al., 2022). Particularly underlined were difficulties maintaining student participation and creating appropriate support structures (Jin, 2023). In addition, pre-service teachers felt less competent in managing classroom dynamics due to the lack of face-to-face interaction in online practices (Choi & Park, 2022).

In distance online learning, the problems of prioritizing textual communication over verbal communication have been raised and the necessity of effective course design and instructional dialogue to support learner autonomy has been emphasized (Ali & Nath, 2023). Kennedy and Archambault (2012) stated that focusing

solely on technology is insufficient for effective teaching in online environments and pointed to the importance of a solid foundation in online pedagogy and instructional design. This view is in line with the findings of Saito and Tangkiengsirisin (2023) who stated that practicum experiences should combine educational theories with real-life classroom practices to support pre-service teachers' professional development.

In conclusion, while pre-service teachers recognize the importance of online practicum as an appropriate adaptation to contemporary educational needs, their attitudes towards this educational model are mixed, reflecting both the potential benefits and challenges of this model. The effectiveness of online practicum experiences depends on the provision of adequate support, pedagogical training and opportunities for meaningful interaction between mentors and peers. As education systems continue to evolve in the post-pandemic era, these findings can guide the design of more flexible and adaptive teacher education programs.

METHODOLOGY

The purpose of this study is to construct a scale that will be used to examine the readiness and attitudes of preservice teachers with regard to online practical teaching experiences. According to DeVellis (2017), the research in question was designed using a methodical research design, which followed the procedures involved in the production of psychometric scales. During the development of the scale, a thorough literature review was conducted to investigate previous studies on pre-service teachers' experiences with online teaching (Konig et al., 2020), technology integration competencies (Tondeur et al., 2019), and attitudes toward online teaching (Scherer et al., 2021). As a result of this review, key dimensions of online teaching practice were identified and an item pool was created. Expert opinion was sought to ensure the content validity of the item pool. Experts from the fields of teacher education, educational technology, and assessment and evaluation evaluated the items for content, comprehensibility, and technical competence. Necessary adjustments were made in accordance with the expert opinions and the trial form of the scale was prepared (Lawshe, 1975). A two-stage approach was used to test the construct validity of the scale (Brown, 2015). In the first stage, the factor structure of the scale was revealed through exploratory factor analysis (EFA).

Data Collection Process

Item pooling and comprehensibility

The scale development process was based on the diagram shown in **Figure 1**. Studies in the literature related to students' online practicum were examined. The preliminary version of the scale consisted of 34 items. These items were then pilot tested for comprehensibility with a group of 18 students from different teaching programs. The feedback from these students showed that the majority of the students stated that the comprehensibility of 2 items was low. The item "my online course materials are sufficient" was not understood in terms of sufficiency in terms of quantity and quality. This item was corrected as "I feel adequate in using the technological tools necessary for online teaching". The other item, "online courses increase students' achievement", was removed from the scale because it was thought that it was not directly related to my experience as a teacher, although it was my own experience. The results related to the other steps are presented in the findings.

Sample

The study has two distinct sample groups. The first sample consisted of 18 pre-service teachers who were studying in different programs during the pilot study. The sample in which the main study was conducted consisted of 411 pre-service teachers. 87.7% of the participants were female and 12.3% were male. This is similar to the distribution of students in the university population. When the age groups are analyzed, the 18-19 age group is 33.3%, the 20-21 age group is 32%, the 22-23 age group is 22.9%, and the 24 and above age group is 11.8%. 83.2% of the participants had previous online teaching experience. Analyzing the amount of time the participants spent on the Internet, 17.7% spent between 1-3 hours, 54.4% spent between 4-6 hours, and 27.9% spent between 7 and more hours. The average technology literacy of the participants is 7.33 (± 1.72) out of 10. Participants consider themselves to be technologically competent.

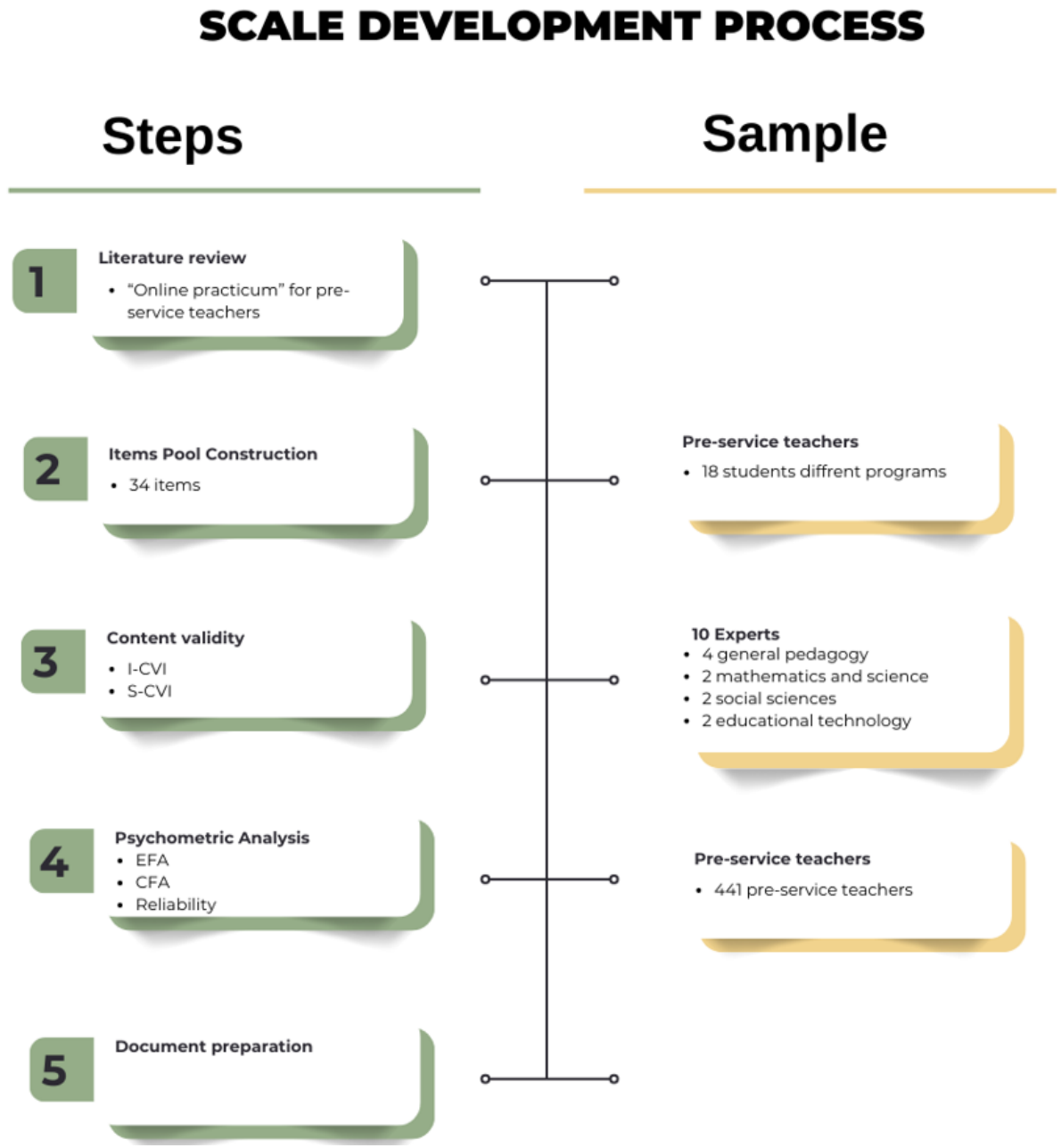

Figure 1. Data collection process (created by the authors)

Data Analysis

The analytic process in this study comprised a systematic approach to assessing the scale's psychometric qualities and identifying important trends in pre-service teachers' responses (Brown, 2015; DeVellis, 2016).

In the first phase, a comprehensive content validity assessment was conducted through expert ratings. For a panel of 10 experts, an item content validity index (I-CVI) was calculated for each item with an acceptance threshold of 0.78 (Yusoff, 2019). Scale content validity index/average (S-CVI/Ave), and scale content validity index/universal agreement (S-CVI/UA) were calculated to assess the overall validity of the scale.

Factor structure was examined through the sequential application of EFA and confirmatory factor analysis (CFA). Prior to EFA, the factorability of the data was assessed using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure. In accordance with the recommendations (Williams et al., 2010), the maximum likelihood extraction method with varimax rotation was used. Factor identification decisions were based on the following multiple criteria factor loadings (threshold > 0.4), scree plot analysis, theoretical consistency, and explained variance.

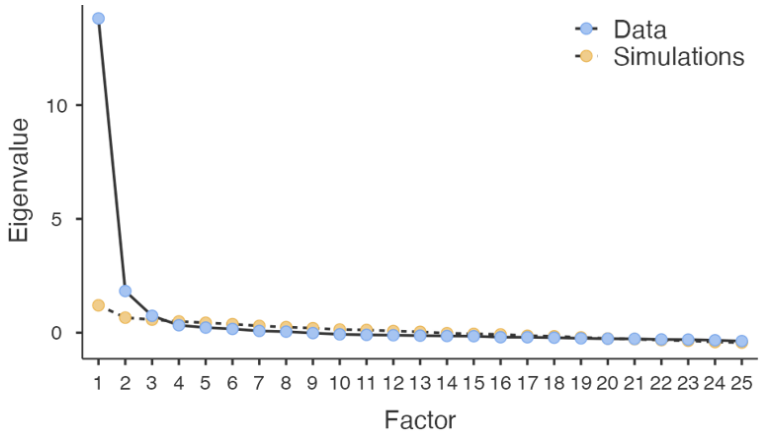

Figure 2. Scree plot (created by the authors)

Various fit indices were used to assess model adequacy in CFA: χ^2/sd ratio, comparative fit index (CFI), Tucker-Lewis index (TLI), square root of standardized residual means (SRMR), root mean square error of approximation (RMSEA). Model improvements based on modification indices were applied while maintaining theoretical justification (Brown, 2015). Internal consistency reliability was assessed using both Cronbach's alpha and McDonald's omega coefficients, in accordance with current recommendations in the psychometric literature for the use of multiple reliability indicators (Trizano-Hermosilla & Alvarado, 2016). The reliability analysis was conducted individually for each subscale identified by component analysis.

Key trends in the responses of the pre-service instructors were identified by means of a latent profile analysis. Model selection was based on various information metrics, including Bayesian information criterion (BIC), Akaike information criterion (AIC), sample size adjusted Bayesian information criterion (SABIC), entropy values, and integrated complete likelihood (ICL). Models with varying numbers of classes (2-6) were systematically tested to find the ideal solution that balances model fit and interpretability, as recommended in the mixed modeling literature (Williams & Kibowski, 2016). All analyses were carried out utilizing the Jamovi (2.6.17) program. Factor analysis and reliability tests were carried out using standard statistical procedures, whereas latent profile analyses were carried out with contemporary mixed modeling approaches.

FINDINGS

Content Validity

The items were subjected to content validity assessment with expert opinion. The scale was circulated among six experts carefully selected for their expertise in science education and educational technology. The panel consisted of 10 experts: 2 experts in educational technology, 4 experts in general pedagogy, 2 experts in mathematics and science, and 2 experts in social sciences. These experts evaluated each item on a binary scale: 1 for "appropriate" and 0 for "not appropriate". The I-CVI was calculated for each item and the possible range was between 1 (indicating consensus agreement) and 0.50 (indicating lower levels of agreement). The minimum acceptable I-CVI was 0.78 when 10 experts participated in the evaluation process. According to the result of the analysis "online practicum popularized the teaching profession" -0.63, "online practicum practice is successful" -0.63, and "I am more competent online to carry out the teaching profession professionally" -0.50. After these exclusions, the I-CVI values of the revised scale ranged from 1 to 0.88, indicating a high level of expert agreement on the content validity of the remaining items. The S-CVI/Ave, a measure of the overall validity of the scale items, was 0.99. In addition, the S-CVI/UA was 0.90. The obtained indices reflect a solid consensus on the appropriateness of the content of the scale. Given these satisfactory content validity assessments, the process progressed to further psychometric analyses.

Exploratory Factor Analysis Results

Bartlett's test of sphericity and KMO values were calculated to determine whether the data of the scales were factorizable (**Figure 2**). Bartlett's test of sphericity ($\chi^2 = 6282$, df = 435, $p < .001$) and KMO were obtained as 0.955. Accordingly, it was understood that the data were suitable for EFA. A 4-factor structure was obtained

Table 1. Factor loading based on EFA

Items	Factor 1	Factor 2	Factor 3	Uniqueness
I_10	0.801			0.199
I_4	0.786			0.275
I_3	0.767			0.317
I_12	0.766			0.238
I_11	0.762			0.249
I_9	0.751			0.232
I_7	0.738			0.260
I_8	0.722			0.299
I_2	0.719			0.359
I_6	0.615			0.438
I_1	0.598			0.542
I_5	0.527			0.547
I_29		0.753		0.208
I_28		0.745		0.241
I_27		0.744		0.227
I_26		0.737		0.214
I_30		0.712		0.263
I_25		0.666		0.28
I_24		0.629		0.239
I_23		0.623		0.343
I_18			0.769	0.243
I_19			0.689	0.285
I_16			0.572	0.443
I_14			0.506	0.572
I_21			0.475	0.722

before rotation. Factor loading was taken as a critical value of 0.4. It was determined that the factor loadings of some items were below 0.4. 'Maximum likelihood' extraction method was used in combination with a 'varimax' rotation. After the rotation process, the items that were still below 0.4 (item 13 and item 15) were removed. In addition, items (17, 20, and 22) that had different factor loadings and the difference between the factor loadings was less than 0.1 were also removed from the scale. Finally, Bartlett's test of sphericity (χ^2 = 5256, df = 300, $p < .001$) and KMO were recalculated as 0.955. As can be seen in the scree plot, the number of factors was 3.

Table 1 shows the factor loading based on EFA. Items between 1-12 were collected in factor 1. The items in this factor focus on the technological, pedagogical and communicative competencies required for online teaching.

Factor loadings ranged from 0.527 to 0.801 and showed a strong structure. When the content of the items is analyzed, it covers pre-service teachers' skills in online course management, material preparation, student participation and evaluation. This factor was named as "online teaching self-efficacy". In factor 2, 8 items between 23-30 were collected. The items in this factor focus on professional support mechanisms such as collaboration with colleagues, receiving technical support and sharing experiences in the online teaching process. Factor loadings ranged from 0.623 to 0.753 and showed a consistent structure. This factor can be named as "online professional support and collaboration". In factor 3, 5 items (14, 16, 18, 19, and 21) were collected. The items in this factor reflect the attitude towards online teaching, excitement and perception of contribution to professional development. Factor loadings ranged between 0.475 and 0.769. This factor can be named as "attitude towards online teaching and perception of development". This three-factor structure points to a holistic measurement tool that covers online teaching competence, professional support mechanisms and attitudinal dimensions.

The three-factor structure explained 67.1% of the total variance, indicating the construct validity of the instrument (as shown in **Table 2**). When the individual contributions of the factors are analyzed, it is seen that the first factor plays a dominant role with a variance explanation rate of 29.5%, followed by the second factor with 22.1% and the third factor with 15.5%. This distribution shows that the relative power of the factors exhibits a balanced pattern and each factor contributes significantly to the structure. The SS loadings values of 7.36, 5.54, and 3.86, respectively, support that the factors form a statistically strong structure. The fact that

Table 2. Explained variance by factors

Factor	SS loadings	% of variance	Cumulative %
Online teaching self-efficacy	7.36	29.5	29.5
Online professional support and collaboration	5.54	22.1	51.6
Attitude towards online teaching and perception of development	3.86	15.5	67.1

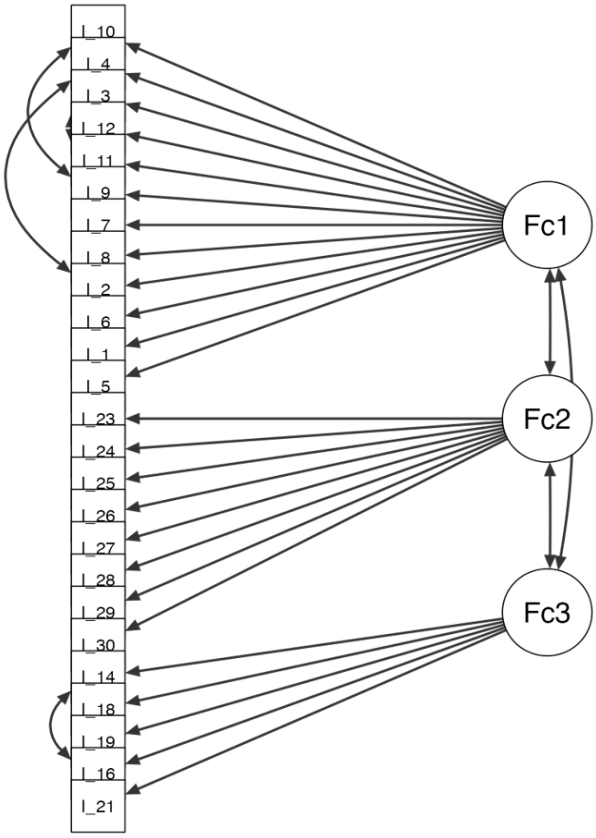

Figure 3. Path diagram based on CFA(created by the authors)

the cumulative variance explanation ratio is above the 60% threshold value generally accepted for psychometric measurement tools indicates that the construct validity of the scale is at a satisfactory level. The fact that the variance explanation ratios between the factors show a reasonable distribution reveals that the multidimensional structure of the scale is robustly represented and that no factor is dominant to the extent that it overshadows the others.

Confirmatory Factor Analysis Results

The three-factor structure obtained as a result of the EFA was tested with CFA. In the CFA process, fit indices were calculated for the fit level of the model with the data. First, the fit indices of the model were calculated as $\chi^2/df \approx 3.05$ (831/272), CFI = 0.885, TLI = 0.874, SRMR = 0.0514 and RMSEA = 0.0964 (confidence interval: 0.0890-0.104). These values indicate that the fit indices of the model are not adequate, especially since CFI and TLI are below the expected threshold value of 0.90. This indicates that the model does not fit the data well enough and requires improvement.

Modifications suggested by the software (see **Figure 3**) were also applied to the model. These modifications included relationship adjustments to further improve the fit of the model. Factor loadings were checked again. Since the factor loading of item 6 fell below 0.3, it was removed from the scale and the procedures continued. The recalculated model fit indices were obtained as follows: $\chi^2/df \approx 2.36$ (619/262), CFI = 0.927, TLI = 0.916, SRMR = 0.0491 and RMSEA = 0.0785 (confidence interval: 0.0705-0.0865). These results indicate that the modifications significantly improved the model fit and the model met the acceptable fit criteria. In particular, CFI and TLI values exceeded the threshold value of 0.90 and RMSEA and SRMR values fell within acceptable limits.

Table 3. Factor loadings based on CFA

Factor	Indicator	Estimate	SE	Z	p
Online teaching self-efficacy	I_10	0.988	0.0599	16.48	< .001
	I_4	0.828	0.0586	14.12	< .001
	I_3	0.817	0.0619	13.19	< .001
	I_12	0.921	0.0584	15.78	< .001
	I_11	0.965	0.0591	16.32	< .001
	I_9	0.821	0.0561	14.63	< .001
	I_7	0.781	0.0605	12.90	< .001
	I_8	0.944	0.0614	15.38	< .001
	I_2	0.890	0.0641	13.88	< .001
	I_6	0.733	0.0662	11.07	< .001
	I_1	0.591	0.0569	10.38	< .001
	I_5	0.673	0.0706	9.54	< .001
Online professional support and collaboration	I_23	0.893	0.0647	13.80	< .001
	I_24	0.921	0.0627	14.70	< .001
	I_25	0.944	0.0626	15.09	< .001
	I_26	0.840	0.0558	15.07	< .001
	I_27	0.872	0.0535	16.32	< .001
	I_28	0.923	0.0598	15.44	< .001
	I_29	0.902	0.0614	14.68	< .001
	I_30	0.927	0.0568	16.32	< .001
Attitude towards online teaching and perception of development	I_14	0.739	0.0682	10.83	< .001
	I_18	1.013	0.0731	13.86	< .001
	I_19	0.960	0.0632	15.19	< .001
	I_16	0.837	0.0653	12.81	< .001
	I_21	0.544	0.0823	6.61	< .001

Table 4. Cronbach's and McDonald's coefficient

Factor	Cronbach's alpha	McDonald's omega
Online teaching self-efficacy	0.950	0.942
Online professional support and collaboration	0.956	0.953
Attitude towards online teaching and perception of development	0.841	0.843

According to **Table 3**, the standardized factor loadings of the items in the first factor ranged from 0.591 to 0.988. While item I_10 had the highest factor loading (β = 0.988, SE = 0.0599, Z = 16.48, p < .001), item I_1 had a relatively low factor loading (β = 0.591, SE = 0.0569, Z = 10.38, p < .001). The Z values of all items in the factor are above 9.54 and statistically significant. The second factor shows rather strong and consistent factor loadings. The standardized loadings of the items range from 0.840 to 0.944, with item I_25 having the highest factor loading (β = 0.944, SE = 0.0626, Z = 15.09, p < .001). Every item in the second factor has low standard errors and high Z values (13.80-16.32). In the third factor, the factor loadings of the components varied from 0.544 to 1.013. Item I_18 exhibited the highest factor loading (β = 1.013, SE = 0.0731, Z = 13.86, p < .001), whereas item I_21 demonstrated a lower factor loading (β = 0.544, SE = 0.0823, Z = 6.61, p < .001). The standard error values varied between 0.05 and 0.08 for all components, demonstrating the dependability of the estimates. All Z values over the crucial threshold and p < .001 signify the statistical significance of the factor structure.

Reliability Results

For the reliability analysis of the scale, Cronbach's alpha was calculated in the EFA data set and McDonald's omega coefficients were calculated in the CFA data set (**Table 4**). The Cronbach's alpha coefficient calculated for the "online teaching self-efficacy" factor was 0.950 and McDonald's omega coefficient was 0.942, indicating that the factor has excellent reliability. The second factor, "online professional support and collaboration", had the highest reliability coefficients, with a Cronbach's alpha of 0.956 and McDonald's omega of 0.953, indicating that the factor had exceptional internal consistency. Although the values obtained for the third factor "attitude towards online teaching and perception of development" were lower than the other two factors (α = 0.841, ω = 0.843), they were above the threshold value of 0.70 accepted for psychometric measurement tools. Cronbach's alpha and McDonald's omega coefficients for all three factors support the

Table 5. Model indices for latent profile analysis

Model	Classes	LogLik	AIC	AWE	BIC	CAIC	CLC	KIC	SABIC	ICL	Entropy
1	2	-1575	3171	3301	3212	3222	3153	3184	3180	-3285	0.760
1	3	-1447	2922	3104	2979	2993	2895	2939	2934	-3050	0.851
1	4	-1416	2868	3104	2942	2960	2834	2889	2885	-3057	0.800
1	5	-1393	2831	3119	2921	2943	2788	2856	2851	-3049	0.810
1	6	-1343	2739	3080	2845	2871	2689	2768	2763	-2891	0.938
2	2	-1559	3143	3313	3196	3209	3119	3159	3155	-3253	0.811
2	3	-1411	2862	3124	2944	2964	2824	2885	2880	-2993	0.886
2	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	6	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	2	-1413	2852	3022	2906	2919	2828	2868	2864	-3003	0.660
3	3	-1406	2847	3069	2916	2933	2814	2867	2862	-3056	0.716
3	4	-1385	2812	3087	2898	2919	2771	2836	2831	-3072	0.715
3	5	-1355	2760	3088	2862	2887	2712	2788	2783	-2916	0.917
3	6	-1363	2784	3164	2902	2931	2727	2816	2810	-3079	0.768
6	2	-1354	2746	2995	2824	2843	2709	2768	2763	-3001	0.485
6	3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
6	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
6	5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
6	6	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

reliability consistency and psychometric robustness of the instrument. In the light of these findings, it is concluded that all subscales of the scale have a high level of reliability and can provide consistent measurements.

Latent Profile Analysis

In order to compare the models created for the latent profile analysis, the basic criteria BIC, entropy and ICL measures were examined (**Table 5**). In Model 1, the lowest BIC value (2845) is found in the 6-class model. At the same time, entropy = 0.938 is very high in the 6-class solution. This means a very good class separation. The ICL value is given as -2891. The lowest BIC for model 3 is in the 5-class solution (BIC = 2862, entropy = 0.917). This is also good, but the BIC is slightly higher (i.e., worse) and the entropy slightly lower than the 6-class solution for model 1. The 2-class solution for model 6 gives the lowest BIC value in **Table 5** with BIC = 2824. However, the entropy here is quite low at = 0.485. This shows that although the 2-class solution summarizes the data in the best way (in terms of BIC), the classes are not clearly separated from each other. In other words, it is difficult to distinguish between the classes in practical terms. Overall, the model 1 (6-class) solution provides both a low BIC (2845) and a very high entropy (0.938). This shows that the model not only provides a good fit but also separates the classes quite clearly. Other criteria such as ICL and AIC also support the idea that this solution is reasonably good.

Pre-service teachers in grade 6 showed consistent and high mean scores on all three dimensions (self-efficacy: 3.57, professional support: 4.0, attitude: 3.47) (**Figure 4**). Because of this balanced and high-performance profile, this group was named the “competent and enthusiastic group”. This name reflects both the group’s competence and their positive attitude toward online instruction. 37% of students fall into this group.

Class 5 had the highest mean scores in all dimensions (self-efficacy: 4.41, professional support: 4.87, attitude: 4.35). It is particularly noteworthy that they showed a very high average in the dimension of professional support and cooperation. Because of this superior performance profile, the group was named the “high performance group”. This name emphasizes the group’s outstanding performance in all areas. 20% of the students belong to this group.

The 4th class pre-service teachers have a very high mean (4.78) especially in the dimension of professional support and collaboration. Because of this characteristic, they can be called the “collaborative focused group”. This name reflects the importance they attach to professional support and collaboration. It represents 1% of the students.

Figure 4. Sub-dimension measurement results based on the classes (created by the authors)

The pre-service teachers in the 3rd class show average scores in all dimensions (self-efficacy: 2.97, professional support: 3.05, attitude: 2.85). Because of this mid-level profile, the group was named the "intermediate adaptation group". This name refers to the group's moderate level of adaptation to online instruction. This group consists of 29% of the total students.

Class 2 showed low scores in all dimensions (self-efficacy: 1.61, professional support: 1.22, attitude: 1.44). They were named the "low motivation group" because they had the lowest average, especially in the professional support dimension. This name reflects the group's low interest and motivation towards online teaching. This group made up 4% of the total students.

Class 1 student teachers scored below average in all dimensions (self-efficacy: 2.66, professional support: 2.19, attitude: 2.11). However, because they scored higher than class 2, they were referred to as the "open to development" group. This name reflects the group's current status and potential for development. In total, 10% of the students belong to this group.

DISCUSSION

In this study, a comprehensive scale measuring pre-service teachers' readiness and attitudes towards online teaching practice was developed. The psychometric properties of the scale showed that the three-factor structure is a valid and reliable measurement tool.

The first factor, "online teaching self-efficacy", measures preservice teachers' technological and pedagogical competencies. This finding is in line with studies emphasizing the importance of technology integration and pedagogical strategies in pre-service teachers' online teaching process (Liu & Kleinsasser, 2023; Saito & Tangkiengsirisin, 2023). Moreover, as Kennedy and Archambault (2012) point out, effective online teaching requires not only technology but also a solid foundation of online pedagogy and instructional design.

The second factor "online professional support and collaboration" reveals the importance of mentoring and collegial support. This finding is in line with studies indicating that effective mentoring and supervision processes are critical for the professional development of pre-service teachers (Kanwal et al., 2023; McGarr, 2021; Swanson, 2023). As Hertz et al. (2022) emphasized, collaboration among teachers strengthens professional development by creating a supportive learning community.

The third factor "attitude towards online teaching and perception of development" measures the affective characteristics of pre-service teachers towards online teaching. The emergence of this dimension is consistent with studies indicating that pre-service teachers' attitudes towards online teaching differ (Ersin et al., 2020; Jukić & Žižanović, 2024). As Brinia and Psoni (2022) noted, the transition to online practices during the COVID-19 pandemic deeply affected pre-service teachers' confidence in technology, their perspectives on online pedagogical approaches, and their love for the teaching profession.

The results of the latent profile analysis showed that pre-service teachers were categorized into six different profiles. The largest group (37%), the "competent and enthusiastic group", showed consistent and high scores in all dimensions. This finding is in line with studies showing that some preservice teachers successfully adapt to online teaching (Ogegbo et al., 2024). The presence of positive profiles such as the "high performance group" (20%) and the "collaborative group" (1%) is consistent with research highlighting the potential benefits of online teaching (Alkandari, 2024).

However, the presence of low-performing profiles such as "low motivation group" (4%) and "open to improvement group" (10%) suggests that some pre-service teachers have difficulties in adapting to online teaching. This finding is in line with studies reporting difficulties in online teaching such as technical problems (Saraç et al., 2022), difficulty in ensuring student engagement (Jin, 2023), and lack of face-to-face interaction (Choi & Park, 2022).

The presence of the "intermediate adaptation group" (29%) indicates that a significant number of pre-service teachers are moderately prepared for online teaching. This finding is in line with studies reporting that preservice teachers have mixed attitudes towards online teaching (Ali & Nath, 2023; Düzgün & Kaşkaya, 2023).

The three-factor structure of the scale and high reliability coefficients reflect the multidimensional nature of online teaching readiness. This result is in line with the literature emphasizing that online teacher education consists of different components such as technology integration (Shao et al., 2024), mentoring support (Kanwal et al., 2023) and reflective practices (Syarifah & Fadhilah, 2022).

Results of the latent profile analysis revealed a heterogeneous structure reflecting the degree of pre-service teachers' readiness and perspectives about online learning. This suggests that while developing teacher preparation courses, pre-service instructors with different profiles should consider their needs. As Moore and Hong (2022) recommend, virtual internships should be scheduled to increase pre-service teachers' self-efficacy.

The findings of this study can support the development of elements of online learning for projects aiming at teacher education. Pre-service instructors especially for low-performance profiles might create extra support networks. As Tekin and Tunaz (2023) stress, educational practices should assist future teachers to blend theory with practice in real-world classroom contexts.

CONCLUSION

In this study, a valid and reliable instrument was developed to measure pre-service teachers' readiness and attitudes towards online teaching practice. The developed scale shows a three-factor structure: online teaching self-efficacy, online professional support and collaboration, attitude towards online teaching and

perception of development. These factors comprehensively reflect the main components of online teacher education.

The construct validity of the scale was examined with EFA and CFA. EFA revealed that the three-factor structure explained 67.1% of the total variance. This rate shows that the scale has a strong structure. CFA results also support that the model fits the data well. Reliability analyses of the scale revealed that all sub-dimensions had high internal consistency.

The results of latent profile analysis showed that pre-service teachers had six different profiles in terms of their readiness and attitudes towards online teaching. These profiles reveal that pre-service teachers have different needs in the adaptation process to online teaching. Especially the presence of high performing groups shows that online teaching applications can be realized successfully.

Recommendations

In line with the findings of this study, several suggestions were developed. In terms of teacher education programs, it is important to integrate courses to develop online teaching competencies into the programs. In this context, more emphasis should be placed on technology integration and online pedagogy. Regular mentoring support should be provided to pre-service teachers and peer support should be encouraged by creating collaborative learning environments.

For practitioners, it is recommended that pre-service teachers' readiness levels for online teaching should be assessed regularly. Individualized support mechanisms should be developed for pre-service teachers with different profiles, and technological infrastructure and technical support services should be strengthened. It is also important to provide safe practice environments for online teaching experience.

Within the scope of the recommendations developed for researchers, the scale should be tested in different sample groups. It is recommended to examine the relationships between pre-service teachers' online teaching performances and scale scores and to investigate the factors affecting the transitions between profiles with longitudinal studies. In addition, the scale should be adapted to different languages and cultures to expand its usage area.

Limitations

This study has some important limitations. In terms of sampling, the majority of the participants are female pre-service teachers and the majority of the sample is concentrated in certain age groups. This situation limits the generalizability of the findings. From a methodological point of view, the fact that the data collection process was carried out with a cross-sectional approach and the scale development process was limited to self-reported data are seen as important limitations. The low number of participants in some profiles in the latent profile analysis is also a limitation that should be considered in interpreting the results. In terms of content, focusing the scale items on general online teaching competencies and excluding subject-specific online teaching competencies constitute a limitation. In addition, the inability to control the differences in technological infrastructure should also be considered as a factor that may affect the results. These limitations should be taken into consideration in future studies and the findings should be evaluated within this framework. In particular, studies to be conducted with different sample groups will strengthen the validity and reliability evidence of the scale and expand its usage area. In addition, it is recommended that the psychometric properties of the scale be examined in more detail through longitudinal studies and mixed method research.

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participating in the study. Participants were informed that they could withdraw from the research at any time without providing a reason and that this would not result in any negative consequences for them.

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APPENDIX A: INFORMATION ON THE USE OF THE SCALE

Items Removed During the Factor Analysis Process

- Item 13. “Doing online teaching practice makes me anxious.”
- Item 15. “Teaching online scares me.”
- Item 17. “I am confident in teaching online.”
- Item 20. “Online teaching is a must-have competence for today’s teachers.”
- Item 22. “I should be ready to teach online in the future.”

Subdimensions and Items

Online teaching self-efficacy

- Item 1. “I feel competent in using the technological tools necessary for online teaching.”
- Item 2. “I feel ready to teach on online platforms (Zoom, Google Meet, etc.).”
- Item 3. “I can prepare digital materials to be used in online teaching.”
- Item 4. “I can use technological tools for student engagement in an online environment.”
- Item 5. “I can deal with technical problems such as the Internet connection.”
- Item 7. “I believe that I can conduct effective classroom management in online environment.”
- Item 8. “I can plan student-centered online courses.”
- Item 9. “I can communicate effectively with students in an online environment.”
- Item 10. “I can do assessment and evaluation in online teaching.”
- Item 11. “I can provide student motivation in online environment.”
- Item 12. “I can apply different teaching methods in online courses.”

Online professional support and collaboration

- Item 23. “Online teaching will become an essential part of the teaching profession.”
- Item 24. “Online teaching experience improves my ability to interact with students.”
- Item 25. “I can get sufficient support from instructors during the online application process.”
- Item 26. “I can collaborate with my peers online.”
- Item 27. “I can get technical support during the online implementation process.”
- Item 28. “I can reach people I can consult about the problems I experience in online teaching.”
- Item 29. “I can share experiences with colleagues online.”
- Item 30. “I can receive guidance during the online implementation process.”

Attitude towards online teaching and perception of development

- Item 14. “I am eager to gain online teaching experience.”
- Item 16. “I believe that online teaching practice will contribute to my professional development.”
- Item 18. “I am excited to teach online.”
- Item 19. “Online teaching experience improves my teaching skills.”
- Item 21. “Online teaching practice can replace face-to-face practice.”

Scoring

The scale is a 5-point Likert scale:

- 1 = Strongly disagree
- 2 = Disagree
- 3 = Partially agree
- 4 = Agree
- 5 = Strongly agree

Mean score calculation for each sub-dimension:

- Online teaching self-efficacy: Total score of 11 items/11
- Online professional support and collaboration: Total score of 8 items/8
- Attitude towards online teaching and perception of development: Total score of 5 items/5

Suggestions for Use

1. Each sub-dimension should be evaluated separately.
2. Sub-dimension scores vary between 1-5.
3. High scores indicate positive status in the related dimension.
4. Sub-dimensions can be used independently of each other.
5. It is recommended to use all sub-dimensions together.

Table A1. Online practicum scale for pre-service teachers

Items	1	2	3	4	5
1. I feel competent in using the technological tools necessary for online teaching.					
2. I feel ready to teach on online platforms (Zoom, Google Meet, etc.).					
3. I can prepare digital materials to be used in online teaching.					
4. I can use technological tools for student engagement in an online environment.					
5. I can deal with technical problems such as internet connection.					
6. I have the necessary competencies for online teaching.					
7. I believe that I can conduct effective classroom management in online environment.					
8. I can plan student-centered online courses.					
9. I can communicate effectively with students in an online environment.					
10. I can do assessments and evaluations in online teaching.					
11. I can provide student motivation in online environment.					
12. I can apply different teaching methods in online courses.					
13. Doing online teaching practice makes me anxious.					
14. I am eager to gain online teaching experience.					
15. Teaching online scares me.					
16. I believe that online teaching practice will contribute to my professional development.					
17. I am confident in teaching online.					
18. I am excited to teach online.					
19. Online teaching experience improves my teaching skills.					
20. Online teaching is a must-have competence for today's teachers.					
21. Online teaching practice can replace face-to-face practice.					
22. I should be ready to teach online in the future.					
23. Online teaching will become an essential part of the teaching profession.					
24. Online teaching experience improves my ability to interact with students.					
25. I can get sufficient support from instructors during the online application process.					
26. I can collaborate with my peers online.					
27. I can get technical support during the online implementation process.					
28. I can reach people I can consult about the problems I experience in online teaching.					
29. I can share experiences with colleagues online.					
30. I can receive guidance during the online implementation process.					