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Research Article

Redefining the impact of professional development in education with ProDES (Professional Development Evaluation Scale)

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Abstract: This study introduces the Professional Development Evaluation Scale (ProDES), a tool that has been developed to evaluate the impact of professional development as it relates to participants' Learning and Use of New Knowledge and Skills, Organisational Support, Student Learning Outcomes, and reactions. Grounded in Guskey's (2000) framework for evaluating Professional Development, ProDES was developed with data from five study groups in Turkey and underwent refinement across four factors. Exploratory and Confirmatory Factor Analyses confirmed the scale's structure, accounting for 62.72% of the total variance, with robust fit indices. Within this, ProDES demonstrated high internal consistency and test-retest reliability, with significant correlations validating its effectiveness. The scale's high internal consistency and test-retest reliability ensure that it can be used to make evidence-informed decisions that can foster more effective and supportive professional development activities. As a result, by identifying which professional development initiatives lead to improvements, those associated with professional development can use resources more efficiently, leading to enhanced school and system-wide improvements. Moreover, the use of ProDES can also help schools and education systems track progress over time, making ProDES an invaluable tool for continuous improvement and strategic planning.

1. INTRODUCTION

Education policymakers, researchers, and practitioners recognize the crucial role of professional development for school administrators and teachers (educational professionals responsible for the management and leadership of schools such as school principals, assistant principals, Heads of Departments, and inspectors) (Bredeson, 2000). Indeed, teachers and administrators require ongoing professional development to sustain their current professional skills, knowledge, and competencies and require new skills due to the changing roles and responsibilities they face as well as shortcomings in their pre-service training (Spillane et al., 2009). In other words, professional development serves as a strategy and policy tool for school

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improvement, with the assumption that practitioners need to acquire new knowledge and skills (Guskey, 2002a).

It is considered a fundamental component of successful educational reform and school improvement that should ultimately lead to, for example, changes in teachers' classroom practice, attitudes, beliefs, and student learning outcomes (Little, 1993). Professional development can also be viewed as a transformative process that encourages the attainment of high-value goals (Assor & Oplatka, 2003) as well as a lifelong as opposed to a once-off event for educators to meet the ever-changing needs of students (Diaz-Maggioli, 2004). In the case of education, it is conceptualized as a form of adult learning that supports the learning of administrators and teachers (Zepeda, 2011).

Desimone (2011) defines professional development as a complex series of interconnected learning opportunities, while Guskey (2000) describes it as a process and activities designed to enhance educators' professional knowledge, skills, and attitudes to promote the advancement of their students. Fullan (1994) has also highlighted the importance of investing in teachers' professional development for the implementation of planned change strategies. Indeed, there is a long-held view that the professional development of teachers and administrators should be at the heart of all plans and policies for school improvement (Adey, 2004; Barth, 1986; Blandford, 2004; Bredeson, 2000; Hallinger, 2003). In other words, for school development and quality education, it is an essential process for administrators and teachers to improve, change, and adapt their attitudes and behaviors (Easton, 2008), as well as enhance their knowledge, skills, and competencies. Although the potential contribution of professional development to school success has been well documented, and several studies have explored its causal effects (e.g., Garet et al., 2001; Wayne et al., 2008), research on its impact often tends to either theorize about it or rely on Quod Erat Demonstrandum (QED) findings. These studies frequently highlight the success of initiatives implemented by the researchers, often featuring overly positive accounts from participants involved. To concur with Bredeson (2000), it is not possible to demonstrate the impact of professional development without robust empirical evidence, which we strongly suggest is lacking in the professional development literature. In this regard, ethically sound "evaluation" of professional development activities or programs provided to administrators and teachers is significant and should be an integral part of professional development activities (Blandford, 2012).

To genuinely evaluate the impact of professional development, five critical pieces of information are needed: *(i)* participants' reactions to the professional development experience, *(ii)* knowledge and skills acquired by participants, *(iii)* school support for professional development, *(iv)* participants' use of newly acquired knowledge and skills in their professional practices, and *(v)* evidence of how professional development activities impact and benefit students (Guskey, 1999, 2000, 2002a). In this regard, high-quality data collection tools specifically designed to assess teachers' and administrators' perceptions or attitudes towards professional development activities or programs are required. Numerous data collection instruments have been developed or adapted to measure teachers' various aspects of professional development and in different contexts such as:

- self-efficacy (Yenen & Kılınç, 2021),
- attitudes towards professional development (Torff, Sessions, & Byrnes, 2005; Özer & Beycioğlu, 2010),
- perceptions of professional development (Mourão et al., 2014; Soine & Lumpe, 2014),
- continuous professional development of social and health care educators (Koskimäki et al., 2021),
- professional development needs (Shabani et al., 2018),
- factors influencing professional development processes (Saberi & Sahragard, 2019),

- participation in professional learning (Liu, Hallinger, & Feng, 2016; Gümüş, Apaydın, & Bellibaş, 2018),
- teachers' motivation for web-based professional development (Çakır & Horzum, 2014; Kao, Wu, & Tsai, 2011),
- professional development activities (Dijkstra, 2009; Eroğlu & Özbek, 2018; Eroğlu & Özbek, 2020; Kwakman,1999) and
- pre-service teachers' professional development (Zhu, 2015).

However, these data collection tools do not specifically focus on assessing teachers' and administrators' professional development. Additionally, there is a lack of data collection tools rooted in Guskey's (1999, 2000, 2002b) theoretical framework that directly address the evaluation of professional development. Therefore, the professional development scale developed in this research, referred to as the Professional Development Evaluation Scale (ProDES), has been specifically developed to address a gap in professional development research. More specifically, the scale that can be used by researchers, schools and professional development service providers can be used to evaluate:

- participants reactions to professional development activities/initiatives.
- participants acquired knowledge, skills and competencies gained from these activities.
- participants use of what they have learned/gained in their professional practices.
- the impact of the professional development on student learning outcomes.
- perceptions of organizational/administrative support.

2. METHOD

2.1. Research Design

This study was designed and conducted according to the survey design to develop a measurement tool to evaluate the professional development of teachers and administrators.

2.2. Study Groups and Data Collection

After obtaining ethical approval from the Istanbul Sabahattin Zaim University Research and Publication Ethics Committee (Decision No:2023-2023/04), data were collected through face-to-face interviews and Google Forms. For the purpose of developing the ProDES scale, this study involved voluntary participation of administrators and teachers. Data was collected using surveys from five study groups and included trial testing, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), test-retest reliability, and criterion validity analyses. Using convenience sampling, teachers and administrators working in public and state schools during the 2022-2023 academic year were selected for the development of ProDES. The choice of sampling strategy used was based on the requirement of obtaining the desired sample size for responding to a measurement tool (Robson, 2017).

The determination of the sample size for EFA and CFA is a topic of much debate in the literature. It is stated that a sample size of 5 to 10 times the number of items may be sufficient for factor analysis in scale development studies (Hair et al., 1998; Ho, 2006; MacCallum et al., 1999). Tabacknick and Fidell (2001), on the other hand, suggest that a sample size of at least 300 is appropriate. In this study, 586 and 478 participants were included in the EFA and CFA, respectively. Therefore, in line with the literature, the sample size used for the development of ProDES was sufficient for EFA and CFA. The information regarding the study groups used in the analysis is presented in Table 1.

When examining Table 1, the majority of participants in the study groups were female teachers working as teachers at the elementary school level. Additionally, the average age of participants in the pilot phase of the study was ±42.90 (*sd*=9.011), the average teaching experience was ±19.26 years (*sd*=8.594), and the average administrative experience was ±1.69 years (*sd*=4.241). For EFA, the average age of participants was ±37.17 (*sd*=8.497), the average

teaching experience was ±13.20 years (*sd*=8.398), and the average administrative experience was ±6.46 years (*sd*=5.581). For CFA, the average age of participants was ±39.59 (*sd*=8.412), the average teaching experience was ±15.41 years (*sd*=8.412), and the average administrative experience was ±755 years (*sd*=6.418). In terms of criterion validity, the average age of the participants was ±42.19 (*sd*=9.044), the average teaching experience was ±18.42 years (*sd*=8.855), and the average administrative experience was ±1.16 years (*sd*=4.689). For the test-retest application, the average age of the participants was ±43.78 (*sd*=9.333), the average teaching experience was ±19.26 years (*sd*=8.731), and the average administrative experience was ±1.45 years (*sd*=4.437). In summary, therefore, it can be observed that the study groups involved in the development of ProDES exhibit a heterogeneous structure in terms of age, experience, school type, and level of work.

Table 1. *Distribution of the study group according to demographic variables.*

		Trial		EFA		CFA		Criterion Validity		Test-retest	
Groups		*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Gender	Female	86	57.7	411	7.1	248	51.9	99	58.2	28	59.6
	Male	63	42.3	175	29.9	230	48.1	71	41.8	19	4.4
School Type	Preschool	12	8.1	45	7.7	44	9.2	22	12.9	2	4.3
	Elementary	52	34.9	238	4.6	208	43.5	64	37.6	45	95.7
	Middle	46	30.9	177	3.2	140	29.3	34	2.0	-	-
	High	39	26.2	116	19.8	82	17.2	50	29.4	-	-
	Other	-	-	10	1.7	4	.8	-	-	-	-
Position	Teacher	133	89.3	515	87.9	413	86.4	149	87.6	43	91.5
	Deputy P.	14	9.4	52	8.9	33	6.9	18	1.6	3	6.4
	Principal	2	1.3	19	3.2	32	6.7	3	1.8	1	2.1
Total		149	100.0	586	100.0	478	100.0	170	100.0	47	100.0

2.3. Scale Development Process

In the process of scale development, the steps recommended by Hinkin (1998) and Hinkin et al. (1997) were followed, including *(i)* item writing, *(ii)* content validity, *(iii)* determination and implementation of the sample size, (*iv)* exploratory and confirmatory factor analysis, *(v)* internal consistency/reliability, and *(vi)* criterion validity determination.

As part of the scale development process, a systematic literature review was conducted to examine the professional development of teachers and administrators (e.g., Campbell et al., 2004; Cohen, 2004; Guskey, 2003a, 2003b; Guskey & Yoon, 2009; Kirkpatrick & Kirkpatrick, 2006). Existing measurement tools developed or adapted into Turkish in this field were examined (Çakır & Horzum, 2014; Eroğlu & Özbek, 2018, 2020; Eroğlu, 2019; Gümüş et al., 2018; Koskimäki et al., 2021; Mourão et al., 2014; Saberi & Sahragard, 2019; Shabani et al., 2018; Torff et al., 2005; Yenen & Kılınç, 2021; Zhu, 2015).

A pool of 72 items was created and based on Guskey's (1999, 2000, 2002b) 5-level professional development evaluation model. During the item writing process, attention was given to ensuring that the items assessed the activities/programs that administrators and teachers engaged in for their professional development, focused on evaluating a single behaviour or action, avoided misinterpretation, and used expressions that the target audience could understand in terms of language and meaning. After checking the items, eight items were removed, and a draft form with 64 items was emailed to five experts in measurement evaluation, seven experts in educational administration, one expert in early childhood education, one expert in linguistics, and one expert in program development. These experts were provided with explanations about the research purpose and scale and were asked to evaluate each item. Based on feedback from these experts, the content validity ratio (CVR) and content validity index (CVI) suggested by Lawshe (1975) was calculated for each item. A trial sample was conducted

with 149 participants using the 43-item version. The final version of the scale was determined based on the feedback received from the target group during the trial implementation.

2.4. Data Analysis

Data obtained from 586 participants was used for EFA. To determine whether the data was suitable for factor analysis, assumptions such as outliers, missing values, normality, multicollinearity, and sufficient sample size were examined.

To detect outliers, z-scores were calculated for all individuals, and it was observed that they fell within the range of -2.58 to +1.90. No data points were outside the ±3 range (Tabachnick & Fidell, 2001). P-P plot, skewness, and kurtosis coefficients were also examined to check the assumption of normality. The item scores in the dataset had skewness and kurtosis values within the range of ±1.00. According to Çokluk et al. (2012), when the skewness and kurtosis values are within the ±1 range, the data are considered to follow a normal distribution.

Collinearity issues were examined through Pearson Product-Moment Correlation between the items, and a comparison of the lower and upper 27% groups was conducted to assess the discriminant validity of the items. Each item had a *t*-value greater than ±1.96, item-total correlation values ranged from r=.353 to r=.776, and there were no multicollinearity issues (p<.01). Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) tests were also used to test the suitability of the sample size and data for factor analysis.

Bartlett's test of sphericity was significant, and the KMO value was close to 1, indicating that the data were suitable for factor analysis. EFA began with Principal Component Analysis, followed by the Varimax Rotation Technique. In the analyses, an item loading estimation point of 0.50 was used, and items with loading values below 0.50 and items with cross-loadings on multiple factors were sequentially removed, of which the analyses were repeated after each item was removed. Factor loadings are ideally expected to exceed 0.40, particularly within multidimensional frameworks (Howard, 2016). Given that a substantial factor loading indicates a heightened association between an item and its corresponding factor (Kılıç, 2022), a factor loading threshold of 0.50 was employed in the present study.

CFA was conducted using data collected from 478 participants to confirm the 4-factor structure consisting of the 29 items identified in the EFA. Assumptions were tested to assess the suitability of the CFA data. There were no missing values in the dataset, the z-scores of the data ranged from -3 to +3, the skewness and kurtosis values of the item scores were within ±1.00, and the Pearson Product-Moment Correlations between the items were less than 0.80. Therefore, the dataset met the assumptions of no outliers, normality, and multicollinearity. The maximum likelihood (ML) method was used for parameter estimation of the CFA model. The utilisation of the Maximum Likelihood estimation method was prioritized in this study due to the normal distribution of the data and the attainment of a sizable sample. Maximum Likelihood is favoured for yielding more dependable parameter estimates under conditions where the assumptions are satisfied, and a substantial sample size is achievable, as stated by Helm Castro-Schilo and Oravecz (2017).

Item-total and item-rest correlations were also examined to determine the discriminant validity between items that measured the intended constructs and those that did not. Additionally, *t*-tests comparing the lower and upper 27% groups were conducted. Furthermore, to provide evidence for criterion validity, correlation values between the Professional Development Attitude Scale and the scale developed in this study were calculated for a study group consisting of 170 participants, with a three-week interval between measurements.

The scale developed by Torff et al. (2005) to measure teachers' attitudes towards professional development was adapted into Turkish by Özer and Beycioğlu (2010). The original scale consisted of nine items and a single dimension; however, in the Turkish adaptation, three items were removed from the scale. The items in the 5-point Likert scale are rated on a range from

"*Strongly Disagree*=1" to "*Strongly Agree*=5." The second item of the scale, "I consider the money spent on professional development programs for teachers to be wasted," was reverse scored. Cronbach's alpha reliability coefficient for this study's scale was 0.778. Additionally, the goodness-of-fit indices for confirmatory factor analysis were examined [χ^2/df= 19.603/8= 2.450; RMR= .093; SRMR= .038; GFI= .965; AGFI= .907; IFI= .965; CFI= .964; RMSEA= .093], and it was observed that the values were within acceptable limits.

Reliability requires that a measurement or measurement tool consistently reflects the construct it measures (Field, 2009). For this reason, reliability coefficients with different theoretical and statistical procedures were calculated (George & Mallery, 2009), and Cronbach's alpha, McDonald's Omega, Split-half, Equivalent forms, Guttman, and Sperman-Brown reliability coefficients were presented as evidence. Finally, Jamovi, IBM SPSS, and IBM AMOS software packages were used for data analysis. The significance level for statistical analysis was set at .05.

3. FINDINGS

3.1. Content Validity

Table 2 presents the calculated Content Validity Ratio (CVR) values for each item and the overall Content Validity Criterion (CVI) values obtained for the entire scale.

Table 2. *Lawshe's analysis results.*

Items	CVR	Items	CVR	Items	CVR	Items	CVR
1	0.867	12	0.733	23	0.600	34	1.000
2	0.600	13	0.867	24	0.867	35	0.733
3	1.000	14	0.733	25	0.867	36	0.733
4	0.867	15	1.000	26	0.867	37	0.867
5	0.857	16	1.000	27	0.867	38	1.000
6	1.000	17	0.867	28	1.000	39	1.000
7	1.000	18	0.867	29	0.857	40	0.867
8	1.000	19	0.733	30	0.867	41	0.867
9	1.000	20	0.733	31	0.867	42	1.000
10	0.867	21	0.867	32	1.000	43	0.733
11	0.867	22	0.867	33	1.000		
Content Validity Index (CVI)=0.860, Content Validity Ratio (CVR-N=15): 0.49							

According to the comparison based on Lawshe's (1975) recommended content validity ratio, in this study, the critical value for CVR was determined as 0.49 at a significance level of p=0.05. Consequently, 21 items were removed from the draft form based on this critical value. The CVI for the remaining 43 items was 0.86. In this sense, it can be concluded that the scale provides content validity.

3.2. Item Analysis

Prior to EFA, the total score for each participant was obtained. The upper 27% of the entire group, consisting of 158 participants, was selected as the high-score group, whereas the lower 27% of the entire group, consisting of 158 participants, was selected as the low-score group. Subsequently, t-test was performed between the two groups, and the t-test results are presented in Table 3.

When examining Table 3, it can be observed that the t-values of the items are significant (p<.01), and the t-values are greater than 1.96. Conducting item analysis and selecting the items that contribute the most to the scale enhances its validity (Erkuş, 2014; Özgüven, 2015). In this regard, it can be inferred that the items in the 43-item draft form were suitable for factor analysis.

Table 3. *The t-value (Item discrimination index) of the items in the* ProDES.

Items	*t*-value	Items	*t*-value	Items	*t*-value	Items	*t*-value
M1	-16.987	M12	-20.536	M23	-24.416	M34	-19.133
M2	-18.002	M13	-19.525	M24	-21.849	M35	-19.505
M3	-18.973	M14	-20.690	M25	-20.310	M36	-18.754
M4	-14.657	M15	-15.246	M26	-20.127	M37	-17.538
M5	-8.013	M16	-15.159	M27	-21.036	M38	-18.063
M6	-9.403	M17	-14.733	M28	-19.964	M39	-16.987
M7	-16.874	M18	-21.134	M29	-20.399	M40	-19.552
M8	-17.659	M19	-14.462	M30	-17.367	M41	-15.682
M9	-19.477	M20	-14.118	M31	-18.941	M42	-15.534
M10	-19.096	M21	-19.942	M32	-21.697	M43	-6.114
M11	-20.270	M22	-23.387	M33	-20.558		

3.3. Validity

Before conducting factor analysis, the sample size and suitability of the data for factor analysis were evaluated using measures of normality, the Kaiser-Meyer-Olkin Measure (KMO), Bartlett's Test of Sphericity, Nonadditivity, and Hotelling's T^2 Test.

Table 4. *The skewness and kurtosis coefficients of the datasets on which EFA and CFA were conducted.*

	EFA		CFA	
	Statistic	Std. Error	Statistic	Std. Error
Mean	2.8964	.02395	2.8462	.02489
Median	2.9302		2.8966	
Variance	.336		.387	
Std. Deviation	.57973		.62222	
Minimum	1.40		.31	
Maximum	4.00		4.00	
Range	2.60		3.69	
Interquartile Range	.80		.76	
Skewness	-.244	.101	-.528	.098
Kurtosis	-.491	.202	.711	.195

According to Table 4, the collected data for EFA fell within the range of ±1 for the skewness and kurtosis coefficients. Following George and Mallery (2016), data is considered to exhibit a normal distribution when skewness and kurtosis coefficients fall between ±1. To assess the collectability of the draft scale, a non-additivity test was conducted. To evaluate the additivity of the draft scale, the additivity test (Table 5) and Hotelling T Test (Table 6) were performed to determine whether there was a significant difference between the item averages. While Tukey's test of additivity tests the linear dependence between variables; Hotelling's T-square tests whether the means of the variables are equal (George & Mallery, 2016).

Table 5. *The ANOVA Tukey test conducted for nonadditivity.*

	Sum of Squares	*df*	Mean Square	*F*	*p*
Between groups	8454.181	585	14.452	40.817	.000
Within groups	897.071	42	21.359		
Nonadditivity	58.218[a]	1	58.218	111.757	.000

When examining Table 5, it can be seen that the probability of nonadditivity is p=.000, indicating that the scale does not possess the property of additivity (F=111.757; p<.01). When

examining the variability between measurements, significant differences were observed, but it is understood that the scale does not possess the property of additivity (F=40.817; p<.01).

Table 6. *Hotelling's T^2 testi.*

Hotelling's T-test square	F	$df1$	$df2$	p
170.085	6.168	26	413	.000

According to Table 6, it can also be observed that the item means are not equal to each other (F=6.168; p<.001). Since the item means show significant differences, this indicates that the items measuring different tendencies/attitudes/characteristics are perceived differently by a heterogeneous group, and the scale has more than one factor.

To perform factor analysis, it is recommended that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy should be equal to or greater than 0.60, indicating an acceptable level of sampling adequacy. Additionally, Bartlett's test of sphericity should produce a statistically significant result, suggesting that the variables in the dataset were sufficiently correlated for factor analysis (Tabachnick & Fidell, 2007). A KMO value above 0.80 indicates that the data set obtained from the sample is "very good" (Tavşancıl, 2002), and a significant result of Bartlett's Test indicates that the data are derived from multivariate normal distribution (Otrar & Argın, 2015). The KMO and Bartlett's test values for the dataset in which EFA and CFA analyses were conducted are presented in Table 7.

Tablo 7. *KMO and Barlett's test.*

		EFA	CFA
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.963	.963
Bartlett's Test of Sphericity	Approx. Chi-Square	16732.822	10952.581
	df	903	406
	p	.000	.000

When examining the suitability of the data for EFA and CFA in Table 7, it was determined that the KMO value is close to 1 and the result of Bartlett's Test is significant (EFA=χ^2=16732.822, df=903, p<.001; CFA=χ^2=10952.581, df=406, p<.001). These findings indicate that the sample size and data sets are sufficient for EFA and CFA (Hof, 2012; Tatlıdil, 2022). Validity allows us to obtain information about the property that the scale intends to measure (Thorndike & Thorndike-Christ, 2017). Therefore, Exploratory Factor Analysis (EFA) was conducted to identify the dimensions and number of factors, if any, related to the intended property of the scale (Brown & Moore, 2013). EFA begins with a principal component analysis. Eigenvalues are used to determine the factors (Tavşancıl, 2002). Eigenvalue indicates the amount of information obtained from a factor (DeVellis, 2014).

In factor analysis, factors with an eigenvalue of 1 or greater are included in the analysis (Büyüköztürk, 2012; Tavşancıl, 2002). In factor analysis, it is recommended to perform Varimax Rotation unless there are compelling reasons to determine the distribution of items across factors, as factor loading values of items affect the amount of explained variance, and it is desired to have high factor loading values for items (Büyüköztürk, 2002; Tabachnick & Fidell, 2007). In factor analysis, attention was paid to the factor loadings of items being at or above .50, items not loading on multiple factors, and a minimum difference of .10 between factor loading values for items loading on multiple factors (Çokluk et al., 2012; Tavşancıl, 2002). Following the principal component analysis, the Varimax Orthogonal Rotation technique was used, and no dimension restriction was applied in EFA to reveal the factor structure of the scale. Fourteen items were sequentially removed that had factor loadings below .50 and loaded on multiple factors (items 43, 11, 14, 13, 21, 4, 28, 18, 27, 12, 2, 6, 5, 29). Table 8 presents the factor eigenvalues and explained variance ratios obtained from EFA.

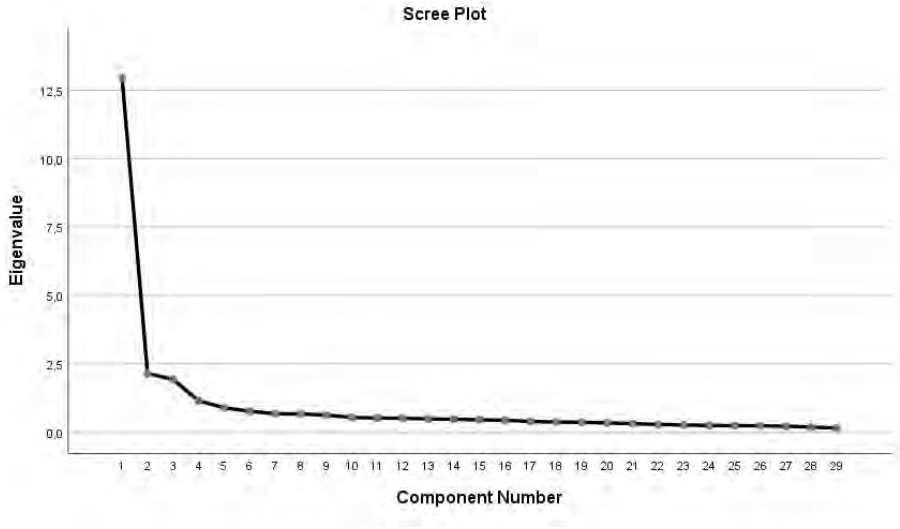
According to Table 8, four factors with eigenvalues above 1 accounted for 62.7% of the total variance. According to Özdamar (2016), it is considered sufficient for the total explained variance in the social sciences to be above 40%. The first factor had a higher eigenvalue and percentage of variance than the other factors. The first, second, third, and fourth factors accounted for 44.637%, 7.430 %, 6.671 %, and 3.984% of the total variance, respectively.

Table 8. *Eigenvalues.*

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	12.945	44.637	44.637
2	2.155	7.430	52.067
3	1.935	6.671	58.739
4	1.155	3.984	62.722

To provide additional evidence for the factor structure of the scale, a scree plot was constructed as shown in Figure 1.

Figure 1. *Post-EFA scree plot.*



The scree plot and explained variance ratios indicated that the scale had a 4-factor structure. The 4-factor structure, resulting from the EFA, accounted for 62.72% of the total variance. After determining the scale's 4-factor structure, the items' factor loadings were examined. Table 9 displays the items' distribution across factors and their factor loadings.

As shown in Table 9, the factor loadings of the items ranged from .543 to .847. The distribution of items across factors was examined, and the factors were named. The naming of these factors is based on theoretical knowledge (Özdamar, 2016; Tezbaşaran, 2008). Accordingly, the factor "Participants' Learning and Use of New Knowledge and Skills (PLUNKS)" consists of 9 items (1, 2, 3, 4, 5, 6, 11, 18, 19), the factor "Organization Support (OS)" consists of 3 items (7, 8, 9), the factor " Student Learning Outcomes (SLO)" consists of 6 items (10, 12, 13, 14, 15, 16), and the factor " Participants' Reactions (PaR)" consists of 11 items (17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29). Confirmatory Factor Analysis (CFA) is conducted to verify the accuracy of the structure identified by Exploratory Factor Analysis (EFA) (Byrne, 2012). CFA was performed to confirm the 4-factor structure resulting from the EFA, and the findings of CFA are presented in Figure 2, Table 10 and 11.

Table 9. *Rotation matrix.*

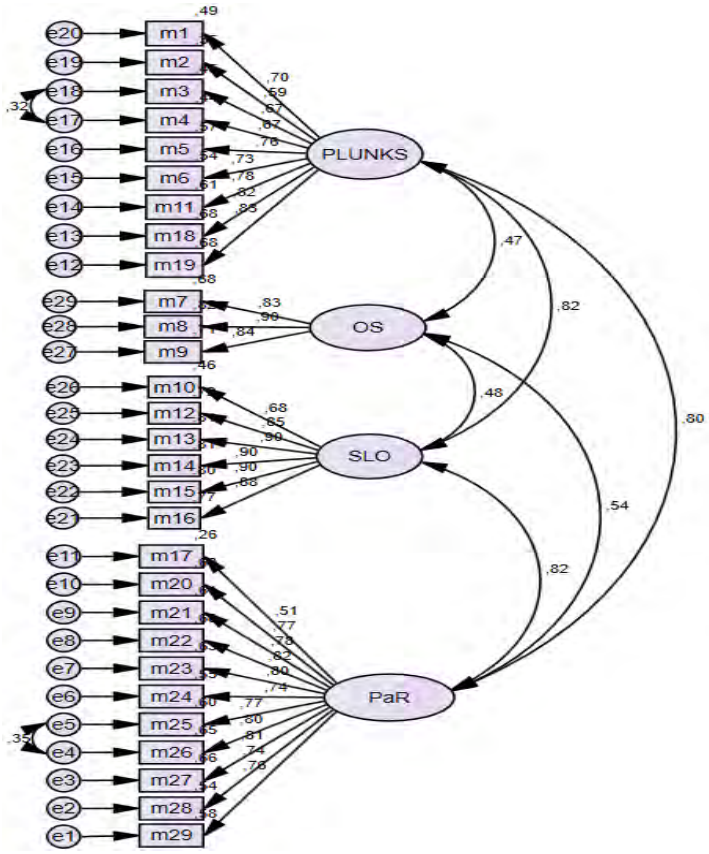
		Component			
Item No	New ranks	PaR	PLUNKS	SLO	OS
MG1	M1		.606		
MG3	M2		.696		
MG7	M3		.715		
MG8	M4		.679		
MG9	M5		.733		
MG10	M6		.724		
MG15	M7				.814
MG16	M8				.847
MG17	M9				.830
MG19	M10			.586	
MG20	M11		.655		
MG22	M12			.620	
MG23	M13			.680	
MG24	M14			.732	
MG25	M15			.722	
MG26	M16			.716	
MG30	M17	.543			
MG31	M18		.625		
MG32	M19		.562		
MG33	M20	.592			
MG34	M21	.662			
MG35	M22	.676			
MG36	M23	.556			
MG37	M24	.572			
MG38	M25	.659			
MG39	M26	.730			
MG40	M27	.705			
MG41	M28	.679			
MG42	M29	.700			
Eigen value		12.945	2.155	1.935	1.155
Explained Variance		44.637	7.430	6.671	3.984
Total variance			62.722		

In Figure 2, the interrelationships among the factors in the confirmatory factor analysis (CFA) of the professional development assessment scale are visually depicted along with the corresponding factor loadings of the individual items. The factor loadings, which represent the strength and direction of the relationships between the latent factors and observed variables, are presented in a standardized form and are shown in Figure 2. This graphical representation provides insights into the underlying structure of the scale and the extent to which each item contributes to the measurement of its respective factors.

Table 10. *Standardized factor loadings.*

Item No	Std. Factor Loadings	Item No	Std. Factor Loadings	Item No	Std. Factor Loadings
M1	0.697	M11	0.781	M21	0.782
M2	0.591	M12	0.851	M22	0.824
M3	0.671	M13	0.902	M23	0.796
M4	0.667	M14	0.901	M24	0.744
M5	0.756	M15	0.895	M25	0.773
M6	0.733	M16	0.877	M26	0.803
M7	0.827	M17	0.514	M27	0.813
M8	0.905	M18	0.822	M28	0.737
M9	0.840	M19	0.827	M29	0.765
M10	0.681	M20	0.772		

Figure 2. *The standardized factor loadings of the items in the CFA.*



The standardized factor loadings of the items included in the respective factor and the error variances of the items are shown in Table 10. Upon examination of the path diagram, it was found that the standardized factor loadings of the items under the factors were greater than 1.96 and statistically significant (p<.05). The standardized factor loadings of all items ranged from 0.514 to 0.905, and the error variance was found to be less than 0.630. The factor loadings of the 29 items on the scale were high, and the error variances were low; no items were removed from the scale. Goodness-of-fit indices were examined to evaluate the model as a whole, and the recommended cut-off values for goodness-of-fit indices and the fit values of the model are presented in Table 11.

Table 11. *Recommended criterion values for fit indices and fit values obtained from CFA.*

Index	Excellent	Acceptable	Scale Indexes	Evaluation
χ^2/df	$0 \leq \chi^2/df < 2\text{-}3$	$3 < \chi^2/df \leq 5$	1068.58/367=2.912	Excellent
GFI	.95≤GFI≤ 1.0	.90≤ GFI <95	.861	Acceptable
NFI	.95≤ NFI ≤1.0	.90 ≤NFI<.95	.905	Acceptable
IFI	.95≤ TLI ≤1.0	.90 ≤TLI<.95	.935	Acceptable
CFI	.95≤ CFI ≤1.0	.90 ≤CFI<.95	.935	Acceptable
RMSEA	RMSEA ≤.05	.05<RMSEA≤.08	.063	Acceptable
RMR	RMR≤.05	.05<RMR ≤.08	.032	Excellent
SRMR	SRMR≤.05	.05<SRMR ≤.08	.044	Excellent

In the CFA, multiple fit indices were used to evaluate the model. From Table 11, it can be observed that the χ^2 value divided by the degrees of freedom (χ^2/df) is 2.912. When considering the other fit indices of the scale, NFI, IFI, and CFI values greater than 0.90 indicate an acceptable fit. RMSEA, RMR, and SRMR values also indicated a good fit. Overall, when considering the obtained fit values in CFA, it can be concluded that the scale, consisting of 29 items and four factors, demonstrates a good fit to the data (Bentler & Bonett, 1980; Hu &

Bentler, 1999; Jöreskog, 2004; Kline, 2016; MacCallum, Browne, & Sugawara, 1996; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Schumacker & Lomax, 2010), confirming the scale structure obtained from EFA.

To provide evidence of criterion validity, the correlation between the ProDES and the Attitude Scale for Professional Development (ASPD) was calculated and presented in Table 12.

Table 12. *Criterion validity correlation values.*

		PLUNKS	OS	SLO	PaR
ASPD	*r*	.595**	.232**	.493**	.469**
	p	.000	.002	.000	.000
	N	170	170	170	170

** $p<.01$

According to Table 12, the correlation values between the ASPD and the ProDES range from 0.232 to 0.595. Criterion validity refers to comparing a newly developed measurement tool with a previously validated and reliable instrument that measures the same or similar attributes (Seçer, 2015). Therefore, it can be stated that the Professional Development Evaluation Scale measures the evaluations of administrators and teachers regarding their professional development activities. Multi-group CFA analysis was also conducted to determine measurement invariance. The results are given in Table 13.

Table 13. *Measurement invariance results.*

	$\chi^2(p<.05)$	*df*	CFI	RMSEA	TLI	SRMR	ΔCFI	ΔRMSEA
Configural Invariance	1479.473	742	0.928	0.05 (0.046-0.054)	0.921	0.049	-	-
Metric Invariance	1557.567	767	0.923	0.051 (0.047-0.054)	0.918	0.06	0.005	-0.001
Scalar Invariance	1969.936	792	0.885	0.061 (0.058-0.064)	0.882	0.07	0.038	-0.01

As shown in Table 13, the model-data fit in configural invariance is acceptable or excellent [$\chi^2(742)=1479.473$ ($p<.05$); CFI=0.928; RMSEA=0.05 (0.046-0.054); TLI=0.921; SRMR=0.049] was determined (Çokluk et al., 2021; Hu & Bentler, 1999; Şen, 2020) and the metric invariance stage was started. The differences between the CFI and RMSEA fit indices obtained at the configural invariance and metric invariance stages are within the criteria of $\Delta CFI \leq .01$, $\Delta RMSEA \leq .015$. After metric invariance was achieved, the scalar invariance stage was started. As a result of the analysis, the model-data fit in scalar invariance [$\chi^2(792) = 1969.936$; ($p<.05$); CFI=0.885; RMSEA=0.061 (0.058-0.064); TLI=0.882; SRMR=0.079] reached the metric invariance stage. It was observed that the difference values were worsened according to the $\Delta CFI \leq .01$, $\Delta RMSEA \leq .015$ criteria. Therefore, since the scalar invariance stage could not be achieved, strict invariance analysis was not performed.

3.4. Reliability Findings

One of the critical points to consider in scale development research is reducing the error rate within the total variance of the developed scale and increasing the proportion of true variance (Cohen & Swerdlik, 2015). As the error rate decreases, the reliability of the test increases (Seçer, 2015; Sönmez & Alacapınar, 2016). To achieve this, reliability evidence of the scale is reported through item-total and item-remainder correlation analyses, *t*-tests for the lower and upper group 27% groups, Cronbach's alpha, McDonald's Omega, split-half reliability, equivalent form's reliability, Guttman and Sperman-Brown coefficients, and test-retest analyses. According to these coefficients, two kinds of reliability evidence are obtained. With these coefficients, proof of reliability was obtained in terms of the internal consistency and stability of the scale.

Item-total and item-remainder correlation analyses were conducted to determine the necessity of the items in the scale and their contributions to the total score. To determine the necessity of the items in the scale and their contribution to the total score, correlation analyses between item-total, item-remainder (Table 14), and factors (Table 15) were performed.

Table 14. *The results of the item-total and item-remainder correlation analyses.*

PLUNKS			OS			SLO			PaR		
Item No	Item-total	Item-residual	Item No	Item - total	Item - residual	Item No	Item - total	Item - residual	Item No	Item - total	Item residual
1	.679**	.539**	7	.894**	.515**	10	.686**	.543**	17	.664**	.592**
2	.723**	.537**	8	.911**	.526**	12	.835**	.759**	20	.753**	.691**
3	.743**	.549**	9	.886**	.516**	13	.865**	.754**	21	.771**	.687**
4	.732**	.567**				14	.850**	.694**	22	.793**	.695**
5	.798**	.639**				15	.855**	.709**	23	.703**	.656**
6	.774**	.589**				16	.825**	.680**	24	.706**	.650**
11	.785**	.662**							25	.774**	.663**
18	.759**	663**							26	.792**	.648**
19	.765**	.725**							27	.792**	.691**
									28	.699**	.605**
									29	.736**	.623**

** $p<.01$

Table 15. *Correlation analysis results between factors.*

	1	2	3	4
1-PLUNKS	-			
2-OS	.440**	-		
3-SLO	.683**	.419**		
4- PaR	.643**	.495**	.755**	-

Correlation is significant at the 0.01 level (2-tailed), N=586

As shown in Table 14, the item-total test correlation values ranged from 0.664 to 0.911, and the item-remainder correlation values ranged from 0.515 to 0.759. Additionally, in Table 15, the interfactor correlation values ranged from 0.419 to 0.755. Correlation indicates the level and degree of relationship between items (Baykul, 2015) and/or the relationship within the dataset (Best & Kahn, 2017). When evaluating correlation coefficients, they are interpreted as follows: 0-0.29, weak or low, 0.30-0.64 moderate, 0.65-0.85 strong/high, and 0.85-1.00 very strong/very high (Ural & Kılıç, 2013). The item-total and item-remainder correlation coefficients suggest that the items in the scale are internally consistent and necessary (Cohen & Swerdlik, 2015; Özgüven, 2015). The item-total correlation values determine whether each item can be included in the total score. When an item has a low correlation coefficient, indicating a low impact on the total score, it is considered to be removed from the scale. In the item-remainder correlation, the effect of removing an item on the total score is examined, and if removing an item does not result in a significant change in the score, that item is removed (Özdamar, 2016). Based on the item-total and item-remainder correlation coefficients, it can be concluded that all items and factors in the scale demonstrate "moderate" and "high" levels of significance, indicating their relevance and importance for the scale. In other words, item-total and item-remainder correlations of 0.40 and above suggest that the items adequately measure the intended structure and effectively discriminate the intended attribute. Independent group *t*-tests should be conducted to assess the discriminant validity of scale items, distinguish between lower and upper group, or compare groups (Altunışık et al., 2004; Baker, 2016). To determine whether

the items and factors were discriminant, a 27% lower-upper group *t*-test was performed of which the findings are presented in Table 16.

Table 16. *27% lower and upper t-test.*

	Lower-uppergroups	N	Mean	Sd	*t*	*df*	*p*
1	Lower groups	158	2.32	.824	-14.936	314	.000
	Upper groups	158	3.55	.624			
2	Lower groups	158	2.23	.866	-15.229	314	.000
	Upper groups	158	3.58	.698			
3	Lower groups	158	2.47	.720	-15.673	314	.000
	Upper groups	158	3.68	.649			
4	Lower groups	158	2.49	.812	-15.935	314	.000
	Upper groups	158	3.73	.546			
5	Lower groups	158	2.46	.803	-18.790	314	.000
	Upper groups	158	3.80	.402			
6	Lower groups	158	2.55	.794	-16.806	314	.000
	Upper groups	158	3.78	.470			
7	Lower groups	158	1.90	1.004	-14.760	314	.000
	Upper groups	158	3.43	.832			
8	Lower groups	158	2.06	.942	-15.056	314	.000
	Upper groups	158	3.50	.740			
9	Lower groups	158	2.28	1.040	-14.019	314	.000
	Upper groups	158	3.65	.649			
10	Lower groups	158	2.03	.938	-13.932	314	.000
	Upper groups	158	3.36	.751			
11	Lower groups	158	2.31	.756	-20.745	314	.000
	Upper groups	158	3.77	.454			
12	Lower groups	158	2.09	.825	-22.727	314	.000
	Upper groups	158	3.77	.425			
13	Lower groups	158	2.01	.740	-24.267	314	.000
	Upper groups	158	3.70	.461			
14	Lower groups	158	1.91	.908	-21.934	314	.000
	Upper groups	158	3.70	.486			
15	Lower groups	158	2.06	.879	-19.650	314	.000
	Upper groups	158	3.66	.516			
16	Lower groups	158	2.04	.809	-21.465	314	.000
	Upper groups	158	3.66	.489			
17	Lower groups	158	2.01	.971	-17.355	314	.000
	Upper groups	158	3.60	.618			
18	Lower groups	158	2.42	.832	-18.796	314	.000
	Upper groups	158	3.81	.409			
19	Lower groups	158	2.30	.720	-23.187	314	.000
	Upper groups	158	3.82	.399			
20	Lower groups	158	1.66	.914	-20.662	314	.000
	Upper groups	158	3.53	.674			
21	Lower groups	158	1.83	.925	-19.500	314	.000
	Upper groups	158	3.54	.596			
22	Lower groups	158	1.71	.876	-19.268	314	.000
	Upper groups	158	3.44	.709			
23	Lower groups	158	2.26	.783	-19.596	314	.000
	Upper groups	158	3.69	.478			
24	Lower groups	158	2.20	.892	-17.956	314	.000
	Upper groups	158	3.66	.502			
25	Lower groups	158	1.70	.907	-18.481	314	.000
	Upper groups	158	3.44	.761			
26	Lower groups	158	1.71	.919	-18.343	314	.000
	Upper groups	158	3.38	.683			

27	Lower groups	158	1.92	.896	-19.826	314	.000
	Upper groups	158	3.59	.566			
28	Lower groups	158	2.22	.886	-16.943	314	.000
	Upper groups	158	3.64	.567			
29	Lower groups	158	1.92	.944	-16.701	314	.000
	Upper groups	158	3.44	.653			
PLUNKS	Lower groups	158	2.395	.463	-30.216	314	.000
	Upper groups	158	3.725	.301			
OS	Lower groups	158	2.080	.857	-17.207	314	.000
	Upper groups	158	3.524	.614			
SLO	Lower groups	158	2.023	.532	-31.342	314	.000
	Upper groups	158	3.640	.369			
PaR	Lower groups	158	1.921	.43	-36.132	314	.000
	Upper groups	158	3.540	.357			

When examining the differences in item mean scores between the lower and upper groups it can be observed that the differences in item mean scores and factors between the lower and upper groups were statistically significant at the p=0.001 level for all items and factors. Therefore, it can be concluded that all items and factors in the scale were discriminant. Reliability refers to the consistency of obtaining similar or identical results from the measurement tool in repeated administration. In other words, it provides an indication of the consistency of scores obtained from the measurement tool (Thorndike & Thorndike-Christ, 2017). The results of the reliability analyses conducted for this purpose are listed in Table 17.

Table 17. *ProDES reliability coefficients.*

ProDES	Cronbach	McDonald's	First-Second Half	Spearman-Brown	Guttman	Split Half	Total Items
1-PLUNKS	0.902	0.904	.829-.849	.872	.862	0.870	9
2-OS	0.878	0.880	.838-999	.871	.756	0.824	3
3-SLO	0.900	0.905	.780-.860	.894	.893	0.877	6
4- PaR	0.919	0.920	.859-.864	.890	.886	0.914	11

To assess the reliability of the scale, Cronbach's alpha, McDonald's Omega, split-half, equivalent forms, Guttman, and Spearman-Brown coefficients were calculated. Cronbach's alpha coefficients for the 29-item, 4-factor scale ranged from .878 to .919, McDonald's omega coefficients ranged from .880 to .920, Cronbach's alpha coefficients for the first and second halves ranged from .780 to .999, Spearman-Brown coefficients ranged from .871 to .894, and Guttman coefficients ranged from .756 to .893. Additionally, the correlation coefficients for the equivalent forms ranged from .824 to .914. On a Likert-type scale, reliability coefficients should be as close to 1 as possible (Baykul, 2015; Tezbaşaran, 2008). Reliability coefficients above α>0.75 indicate a "high degree" of reliability (Kalaycı, 2010; Özdamar, 2016). These findings provide evidence that the scale has high overall reliability. To determine the stability and consistency reliability of the scale, it was administered twice to 170 administrators and teachers at three-week intervals. The correlation coefficients obtained from the test-retest application are presented in Table 18 and Table 19.

In Table 18, the inter-item correlation values in the test-retest application ranged from r=.347 to .769, in Table 19 while the inter-factor correlation values ranged from r=.567 to r=.769. The correlation values obtained from the test-retest application helped us assess the consistency of the scale over time (Kline, 2016). The stronger the correlation, the higher is the reliability (DeVellis, 2014). In this regard, the emerged correlation values indicate that the scale items and subdimensions demonstrate consistency.

Table 18. *Test-retest correlation values.*

Items	PLUNKS	Items	OS	Items	SLO	Items	PaR
1	.514	7	.578	10	.418	17	.446
2	.639	8	.388	12	.470	20	.405
3	.565	9	.516	13	.484	21	.657
4	.347			14	.355	22	.703
5	.427			15	.402	23	.424
6	.729			16	.367	24	.769
11	.482					25	.557
18	.360					26	.470
19	.366					27	.680
						28	.480
						29	.594

Table 19. *Test-retest correlation between factors.*

1-PLUNKS	.705**
2-OS	.576**
3-SLO	567**
4- PaR	.769**

** $p<.01$

4. DISCUSSION and CONCLUSION

Considering the positive effects of professional development on the quality of education and, ultimately, on student outcomes, it is evident how important and necessary professional development is for education systems (King, 2014). However, improving and enhancing teachers' knowledge, skills, and competencies through high-quality professional development means investing in school and student outcomes both directly and indirectly (Sancho et al., 2024).

However, a review of the literature reveals that many professional development initiatives that purport to bring about some forms of positive change are reported on by the researchers or organisations who have provided the professional development with limited evidence (that quite frequently takes the form of interview data) to substantiate the findings. Furthermore, data collection tools developed or adapted for teachers' and administrators' professional development mostly focus on either a single dimension or a specific aspect of professional development. Thus, the absence of a multidimensional data collection tool for professional development is a significant gap in the evaluation of professional development. In light of this lacuna in the research, the purpose of this research was to develop a valid and reliable scale for evaluating the professional development of administrators and teachers (Appendix).

Furthermore, the majority of scales used in research on professional development are related to teachers' attitudes towards professional development (e.g., Çakır & Horzum, 2014; Eroğlu. & Özbek, 2018, 2020; Eroğlu, 2019; Gümüş et al., 2018; Koskimäki et al., 2021; Mourão et al., 2014; Saberi & Sahragard, 2019; Shabani, et al., 2018; Torff et al., 2005; Yenen & Kılınç, 2021; Zhu, 2015). These scales, referring to teachers' attitudes towards professional development, served as an important resource for the development of the scale in the present study. In particular, the scale development process that was based on Guskey's (1986, 2000, 2002b) model of the teacher change process and Guskey's (1999, 2000, 2002a) framework for evaluating professional development, which encompasses five dimensions: Participants' learning, participants' use of new knowledge and skills, organization support and change, participants' reactions, and student learning outcomes.

According to these dimensions, an item pool of 72 items was created. The items were evaluated in terms of language and expression and 8 items were removed. The 64-item draft form was sent to 15 experts. Experts' opinions were evaluated according to the CVR and CVI criteria of the Lawshe technique, and 21 items that did not meet these criteria were removed. Content validity was ensured through the evaluation of 64 items by 15 experts, resulting in the creation of a preliminary version consisting of 43 items guided by expert opinions.

Data was collected from five different study groups along with a pilot study for the validity and reliability of the scale. Normality, KMO, and Bartlett's test values for the EFA and CFA datasets were examined, and the data were found to be suitable for factor analysis. The ANOVA Tukey Test for Nonadditivity conducted on the EFA dataset showed that total scores could not be obtained from the scale, but analysis and evaluation could be conducted using scores derived from factors. Guskey (1999, 2000) evaluates professional development at 5 levels. Since each level in Guskey's professional development evaluation model evaluates different characteristics, it supports not taking a total score from the scale. In this respect, the nonadditivity feature of the scale seems to be compatible with the theoretical background. Although the scale developed in the current study was designed as 5-dimensional, a 4-dimensional structure was obtained as a result of EFA. In Guskey's model, levels 2 and 4 are combined into one dimension. Hotelling's T^2 Test revealed that the items were perceived differently by the heterogeneous group. The EFA conducted on the data collected from the first study group, which consisted of 586 participants, resulted in a four-factor structure with 29 items, where the eigenvalues were above 1. Based on the literature, the factors were named "Participants' Learning and Use of New Knowledge and Skills (PLUNKS), Organization Support (OS), Student Learning Outcomes (SLO), and " Participants' Reactions (PaR)." This four-factor structure explains 62.7% of the total variance. To confirm the structure, CFA was conducted on the second study group consisting of 478 participants, and the fit indices (χ^2/df ratio, NFI, IFI, CFI, GFI, RMSEA, RMR, and SRMR) reached acceptable levels. Criterion validity was established by examining the correlation between the scale and the teachers' attitudes towards the Professional Development Scale, and it was found that the correlation between these two scales was significant. The positive correlation between the two scales can also be considered an indicator of concurrent validity.

A 27% lower and upper group analysis was conducted to determine the discriminant validity of scale items. The results of the lower and upper group analyses indicated that the t-value was significant, and the discriminant values were high for all items. In other words, the item discriminant values of the ProDES indicate that it can be used to assess the professional development of administrators and teachers, as all items yielded significant differences between the lower and upper groups. The item-total and item-remainder test correlation values suggest that the scale items are important and necessary. To determine the reliability of the scale, reliability coefficients were calculated using Cronbach's alpha, McDonald's Omega, Split-half, Equivalent halves, Guttman, and Sperman-Brown methods, and it was concluded that the scale has high reliability, allowing administrators and teachers to evaluate their professional development activities/programs reliably. The final version of the scale is presented in the Appendix. In conclusion, a scale with high validity and reliability for evaluating the professional development of administrators and teachers was provided in the literature. The validated and reliable ProDES can be used by practitioners and researchers in various applications and studies involving different variables. For the scale to be applicable Türkiye and internationally, future studies should test its validity through confirmatory factor analysis and calculate reliability coefficients as evidence of measurement consistency. Educational administrators, policymakers, and researchers can use this scale to evaluate professional development activities or programs in which administrators and teachers participate.

As a result, the scale consists of 29 items and four subscales, measured on a 5-point Likert scale. The scale is evaluated as "*Strongly Disagree*=0, *Disagree*=1, *Agree*=2, *Mostly Agree*=3, and

Strongly Agree=4". The subscales included 9 items (1, 2, 3, 4, 5, 6, 11, 18, 19) in the " Participants' Learning and Use of New Knowledge and Skills (PLUNKS)" subscale, 3 items (7, 8, 9) in the " Organization Support (OS)" subscale, 6 items (10, 12, 13, 14, 15, 16) in the " Student Learning Outcomes (SLO)" subscale, and 11 items (17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29) in the " Participants' Reactions (PaR)" subscale. A total score could not be obtained from the scale, and there were no reverse-scored items. When comparing the subscales, their arithmetic mean was used for the evaluation. The sum of scores obtained by teachers and administrators from the subscales represents the evaluation of the quality quantity, value importance, administrative support, and contribution to students in the professional development in which they participate (degree of possessing the desired characteristic).

In general, a low score obtained by administrators and teachers from the ProDES indicates a lower level of possessing the desired characteristic, whereas a high score indicates a higher level of possessing the desired characteristic. The 30th item in the scale measures the general evaluation of teachers and administrators' professional development activities. Therefore, the 30th item was evaluated separately.

In conclusion, the scale's high internal consistency and test-retest reliability ensures that it can be used to make evidence-informed decisions that can foster more effective and supportive professional development activities. Furthermore, by identifying which professional development initiatives lead to improvements, those associated with professional development can use resources more efficiently, leading to enhanced school and system-wide improvements. Finally, the use of ProDES can also help schools and education systems to track progress over time, making ProDES an invaluable tool for continuous improvement and strategic planning across various levels of education systems.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number**: İstanbul Sabahattin Zaim Üniversitesi, 30.05.2023-E.54478.

Contribution of Authors

Mustafa Özgenel: Investigation, conception, methodology, analysis, and writing the original draft. **Martin Brown:** Investigation, conception, supervision, critical review, validation. and writing the original draft. **Joe O'Hara:** Supervision and proofreading. **Metin Özkan:** Software, data analysis, and visualization.

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APPENDIX-A

	Mesleki Gelişim Değerlendirme Ölçeği (MGDÖ) Turkish Version	Hiç katılmıyorum	Katılmıyorum	Biraz Katılıyorum	Çoğunla katılıyorum	Tamamen katılıyorum
1	Katıldığım mesleki gelişim etkinliklerinden öğrendiklerimin mesleki uygulamalarımda bir fark yarattığını düşünürüm.	0	1	2	3	4
2	Mesleki gelişim etkinliklerine katılmak için zaman ayırırım.	0	1	2	3	4
3	Öğrencilerime daha faydalı olmak için mesleki gelişim etkinliklerine katılırım.	0	1	2	3	4
4	Katıldığım mesleki gelişim etkinlikleri esnasında meslektaşlarımla iş birliğinde bulunarak kendimi geliştirmeye çalışırım.	0	1	2	3	4
5	Katıldığım mesleki gelişim etkinliklerinde edindiğim kazanımların okulda/sınıfta başarılı bir şekilde uyguladığımda mesleki gelişime yönelik tutumum olumlu yönde gelişir.	0	1	2	3	4
6	Katıldığım mesleki gelişim etkinliklerinin sonunda kendimi iyi hissederim.	0	1	2	3	4
7	Görev yaptığım okuldaki yöneticiler, okul temelli mesleki gelişim faaliyetleri düzenler.	0	1	2	3	4
8	Görev yaptığım okuldaki yöneticiler, eğitimcilerin mesleki gelişimini takip eder.	0	1	2	3	4
9	Görev yaptığım okuldaki yöneticiler, eğitimcilerin mesleki gelişim etkinliklerine katılmasını teşvik eder.	0	1	2	3	4
10	Katıldığım mesleki gelişim etkinlikleri öğrenci temelli istenmeyen davranışların (okulu bırakma ve disiplin vb.) azalmasını sağlar.	0	1	2	3	4
11	Mesleki gelişim etkinliklerinden edindiğim deneyimleri başarılı/etkili bir şekilde sınıfta/okulda uyguladığımda kendimi geliştirmeye yönelik çok daha fazla istek duyarım.	0	1	2	3	4
12	Katıldığım mesleki gelişim etkinlikleri öğrencileri (derse katılım, sınıf içi davranışlar ve öğrenme motivasyonları) olumlu etkiler.	0	1	2	3	4
13	Katıldığım mesleki gelişim etkinlikleri, öğrencilerin eğitim-öğretime yönelik tutumlarını olumlu etkiler.	0	1	2	3	4
14	Katıldığım mesleki gelişim etkinlikleri öğrencilerin performansını olumlu etkiler.	0	1	2	3	4
15	Katıldığım mesleki gelişim etkinlikleri öğrencilerin duyuşsal gelişimini destekler.	0	1	2	3	4
16	Katıldığım mesleki gelişim etkinlikleri öğrencilerin fiziksel/psiko-motor gelişimine katkı sağlar.	0	1	2	3	4
17	Katıldığım mesleki gelişim programlarının sonunda değerlendirme yapılır.	0	1	2	3	4
18	Mesleki gelişim etkinliklerinden edindiğim deneyimleri okulda/sınıfta başarıyla uyguladığım zaman bu tür etkinliklere katılma konusunda isteğim artar.	0	1	2	3	4
19	Mesleki gelişim etkinlikleri, öğretmenlerin/yöneticilerin değişim ve gelişmelere uyum sağlamasını destekler.	0	1	2	3	4
20	Mevcut mesleki gelişim etkinlikleri güncel mesleki ihtiyaçlarımı karşılar.	0	1	2	3	4
21	Mesleki gelişim etkinliklerinde amaca uygun materyaller ve araç-gereçler kullanılır.	0	1	2	3	4
22	Mesleki gelişim etkinlikleri eğlencelidir.	0	1	2	3	4
23	Mesleki gelişim etkinlerini anlamlı bulurum.	0	1	2	3	4
24	Mesleki gelişim etkinliklerinde hedeflenen bilgi ve becerileri kazandığımı düşünüyorum.	0	1	2	3	4
25	Mesleki gelişim planlayıcıları, öğretmenlerin bireysel öğrenme özelliklerini dikkate alır.	0	1	2	3	4
26	Mesleki gelişim planlayıcıları, öğretmenlerin mesleki gelişimle ilgili yaşadıkları problemlere göre düzenleme yaparlar.	0	1	2	3	4
27	Mesleki gelişim eğitimcileri, yeni bilgi ve becerileri sınıfa/okula nasıl aktaracağım konusunda fikirler sunar.	0	1	2	3	4
28	Katıldığım mesleki gelişim etkinlerinde görev alan eğitimciler alanlarında yetkin kişilerdir.	0	1	2	3	4
29	Katıldığım mesleki gelişim etkinliklerinde ortaya çıkan sorunlar hızlı bir şekilde çözülür.	0	1	2	3	4
30	Lütfen şu ana kadar katıldığınız mesleki gelişim etkinliklerini genel anlamda değerlendirerek 0-100 arasında bir puan vererek değerlendiriniz:	.....				

APPENDIX-B

	Professional Development Evaluation Scale (ProDES) English Version	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree
1	I think what I learned from the professional development activities I've attended made a difference in my professional practice.	0	1	2	3	4
2	I spare time to attend professional development activities.	0	1	2	3	4
3	I participate in professional development activities to be more beneficial to my students.	0	1	2	3	4
4	I try to improve myself through cooperation with my colleagues in the professional development activities I attend.	0	1	2	3	4
5	My attitude towards professional development develops in a positive way when I successfully apply the gains I've achieved in the professional development activities at school/class.	0	1	2	3	4
6	I feel good at the end of the professional development activities I attend.	0	1	2	3	4
7	The administrators at my school organize school-based professional development activities.	0	1	2	3	4
8	The administrators at my school follow the professional development of teachers.	0	1	2	3	4
9	The administrators at my school encourage educators to participate in professional development activities.	0	1	2	3	4
10	The professional development activities I attend contribute in reducing undesirable student behaviors (dropping out of school and discipline, etc.) in my school.	0	1	2	3	4
11	When I successfully/effectively apply the experiences I gained from professional development activities in the classroom/school, I feel much more willing to improve myself.	0	1	2	3	4
12	The professional development activities I attend positively affect my students (increased class participation, desirable classroom behaviors and learning motivations).	0	1	2	3	4
13	The professional development activities I attend positively affect students' attitudes towards teaching and learning.	0	1	2	3	4
14	The professional development activities I attend positively impact students' performance.	0	1	2	3	4
15	The professional development activities I attend support students' emotional development.	0	1	2	3	4
16	The professional development activities I attend contribute to students' physical/psycho-motor development.	0	1	2	3	4
17	Evaluation is made at the end of the professional development programs I attended.	0	1	2	3	4
18	My desire to participate in such activities increases when I successfully apply the experiences I gained from professional development activities at school/classroom.	0	1	2	3	4
19	Professional development activities support teachers/administrators to adapt to changes and developments.	0	1	2	3	4
20	Present professional development activities meet my current professional needs.	0	1	2	3	4
21	Appropriate materials and tools are used in professional development activities.	0	1	2	3	4
22	Professional development activities are fun.	0	1	2	3	4
23	I find professional development activities meaningful.	0	1	2	3	4
24	I think I've acquired the knowledge and skills targeted in professional development activities.	0	1	2	3	4
25	Professional development planners take into account the individual learning characteristics of teachers.	0	1	2	3	4
26	Professional development planners make adjustments according to the problems teachers/administrators experience with professional development.	0	1	2	3	4
27	Professional development trainers provide insights into the ways through which the transfer of novel knowledge and skills to the classroom/school take place.	0	1	2	3	4
28	The trainers involved in the professional development activities I attend are qualified individuals in their fields.	0	1	2	3	4
29	Problems that arise in the professional development activities I participate in are resolved quickly.	0	1	2	3	4
30	Please evaluate the professional development activities that you have participated in so far and give a score between 0-100, considering them in a general sense:	.....				