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The Perceived Effectiveness of Feedback Scale: Validity and Reliability Study¹

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Abstract

The aim of this study was to develop a valid and reliable measurement tool for evaluating the perceived effectiveness of feedback. A total of 662 pre-service teachers from a variety of grade levels and teacher education programs participated in the study. This process was methodically executed in three sequential stages: item development, scale development, and scale evaluation. The factor structure of the assessment tool was examined using exploratory and confirmatory factor analysis. Initially, exploratory factor analysis (EFA) was conducted with a dataset collected from 334 undergraduate students, followed by a confirmatory factor analysis (CFA) with a separate set of 328 undergraduate students. The results of the EFA indicated the presence of a three-factor structure comprising cognitive, metacognitive, and affective dimensions that corresponds to the theoretical framework. The CFA further demonstrated that the model's fit indices significantly exceeded the acceptable thresholds, thus validating the model's construct validity. Furthermore, the reliability analyses yielded satisfactory results, as evidenced by the Cronbach's Alpha and Omega coefficients for the scale dimensions, which were found to be within the acceptable ranges. As a result of the factor analyses, a valid and reliable 30-item Likert-type measurement instrument with three dimensions has been established with the goal of assessing feedback effectiveness.

Keywords: feedback scale, feedback perceptions, scale development, the effectiveness of feedback

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Introduction

Feedback is defined as the information related to one's performance or understanding provided by an agent such as a teacher, peer, adult, etc. (Hattie & Timperley, 2007), which refers to the systematic transfer of information aimed at bridging the gap between learners' current performance and targeted performance levels (Voerman et al., 2012). Effective feedback in instructional contexts is all post-response information provided to learners, not only to inform them about their current state of learning or performance but also to guide cognitive processing, support metacognitive regulation, and sustain or enhance motivation, with the ultimate aim of enabling effective self-regulated learning and task mastery (Narciss, 2008).

This comprehensive conceptualization underscores feedback's multifaceted nature, encompassing cognitive, metacognitive, and affective dimensions that work synergistically to enhance learning outcomes (Wisniewski et al., 2020; Yang et al., 2021). The cognitive dimension involves providing information that helps learners correct errors, develop an accurate understanding, and improve retention of knowledge (Kutasi, 2023). The metacognitive dimension supports learners in developing awareness of their learning processes and strategies (Callender et al., 2015; Labuhn et al., 2010), while the affective dimension addresses motivational aspects, self-efficacy, and emotional regulation (Charalampous & Darra, 2024; Wang et al., 2019).

Research on effective feedback has consistently demonstrated that it must fulfill multiple functions to maximize learning outcomes. Narciss and Huth's (2004) foundational framework establishes that effective feedback must serve three essential functions: cognitive (supporting information processing and error correction), metacognitive (enhancing learning strategy development and self-regulation), and affective (maintaining motivation and positive learning attitudes). This multifunctional approach is further elaborated by Narciss (2008), who demonstrates that feedback strategies in learning contexts must integrate these dimensions to achieve optimal educational outcomes. Hattie and Timperley's (2007) seminal model complements this framework by identifying three critical feedback questions that align with cognitive and metacognitive functions: "Where am I going?" (feed up), "How am I going?" (feed back), and "Where to next?" (feed forward). Shute's (2008) comprehensive review of formative feedback effectiveness emphasizes the importance of cognitive processing support, while Brookhart's (2008) framework highlights that effective feedback practices must address multiple learning dimensions simultaneously. Furthermore, Kluger and DeNisi's (1996) feedback intervention theory demonstrates that feedback effectiveness depends significantly on its motivational impact and emotional consequences for learners. Thus, effective feedback should simultaneously support cognitive processing and error correction (Shute, 2008; Wisniewski et al., 2020), enhance metacognitive awareness and self-regulation (Molin et al., 2020; Nicol & Macfarlane-Dick, 2006), and maintain learners' motivation, self-efficacy, and positive attitudes (Akolgo et al., 2025; Pekrun, 2006; Schunk & Zimmerman, 2007).

Given this multidimensional nature, effective feedback constitutes a fundamental element of quality education, promoting student achievement and enhancing teaching practices. However, research findings indicate significant challenges pertaining to the quality, fairness, and effectiveness of feedback processes in higher education contexts (e.g., Deeley et al., 2019; Ostaeyen et al., 2023). These issues underscore the necessity for systematic approaches that address the perceptions of feedback among students and educators, fostering constructive and practical communication. Therefore, the development of appropriate tools to

evaluate and improve feedback practices will significantly contribute to the improvement of educational processes by increasing students' engagement, motivation, and self-regulation skills.

Problem Situation

Research on feedback has indicated the presence of various issues. Specifically, feedback from lecturers has been found to be of medium and low quality in terms of performance, fairness, and elaboration (Ostaeyen et al., 2023). Furthermore, it has been determined that feedback is not characterized by constructive and systematic features (Nugraheny et al., 2016). It is emphasized that the feedback provided to students is inconsistent and dissatisfactory (Deeley et al., 2019) and inadequate (Sinclair & Cleland, 2007), as well as vague and overly critical (Păduraru, 2023).

A salient issue concerns the discrepancy in the perception of feedback between educators and students. Research has indicated that students' perceptions of written feedback differ from educators' intentions (Dowden et al., 2013) and that educators' perceptions of their feedback are more positive than those of students (Henderson et al., 2019). This discrepancy in perception has been identified as a significant factor contributing to students' limited comprehension of the purpose and application of feedback (Glazzard & Stones, 2019). The presence of limited feedback literacy has been demonstrated to exert a detrimental effect on students' processing (Carless & Boud, 2018) and can influence engagement (Winstone et al., 2017). One-way written feedback can hinder students' perception, self-efficacy, and motivation (Agricola et al., 2019) and impede the establishment of inclusive dialogue (Chang, 2014). For example, an eye-tracking study revealed that only 4.5% of 424 feedback examples were processed, and one-third were not noticed at all (Tärning et al., 2020).

In the Turkish higher education context, it has been revealed that pre-service teachers experience significant barriers in accessing feedback (Yüksel, 2007), instructors do not provide feedback frequently, timely, and sufficiently enough (Kumral & Saracaloglu, 2011; Şahin, 2015), and pre-service teachers need more detailed and applicable feedback (Öntaş & Kaya, 2019). This situation demonstrates a clear absence of a balanced and systematic feedback system to support students' professional development.

To enhance the effectiveness of feedback within higher education in cognitive, metacognitive, and affective domains, it is essential to ascertain the effectiveness of prevailing feedback practices. Thus, the development of a valid and reliable measurement tool that addresses feedback in these three dimensions is paramount. However, the existing feedback scales in the literature have limitations in addressing the effectiveness of feedback in terms of cognitive, metacognitive, and affective aspects.

Following a comprehensive review of the literature, a total of eight scales related to feedback in English and Turkish were identified. Among these scales, the scales adapted by Kara et al. (2018) and developed by Ocak and Karafil (2020) are not suitable for university students for a variety of reasons. Kara et al.'s (2018) scale focuses on physical education contexts with elementary students, emphasizing nonverbal teacher behaviors and motor performance feedback rather than academic learning feedback, while Ocak and Karafil's (2020) scale was designed for high school students. The scale adapted into Turkish by Kartol and Arslan (2021) is intended for university students, but it is insufficient to cover all dimensions of feedback, as it focuses solely on feedback orientation (utility, accountability, social

awareness, and self-efficacy) rather than measuring the perceived effectiveness of feedback across cognitive, metacognitive, and affective functions. Similarly, the scales developed by Akkuzu and Uyulgan (2014), Baydas Onlu et al. (2022), and Beydoğan (2016) are limited in their capacity to evaluate the functions of feedback (e.g., cognitive, metacognitive, and affective) holistically due to their factor structure or narrow focus on specific contexts (e.g., teaching practice course). This review demonstrates that the existing scales are inadequate for providing a comprehensive evaluation of the functions of feedback in terms of cognitive, metacognitive, and affective dimensions. Consequently, there is an evident necessity to develop a novel multi-dimensional (cognitive, metacognitive, and affective) measurement tool for assessing learners' perceived feedback effectiveness that is grounded in a robust theoretical framework.

Purpose and Significance of the Study

This study aims to develop a valid instrument for assessing the perceived effectiveness of feedback practices. Building upon the theoretical framework established by Narciss and Huth (2004), this study employs their multidimensional framework of feedback functions to develop a comprehensive measurement instrument. According to Narciss and Huth (2004), effective feedback must fulfill three essential functions to maximize its educational impact:

- Cognitive function includes providing information that supports learners' knowledge construction, error correction, and information processing. This function addresses the 'what' aspect of learning by helping students understand content, identify misconceptions, and build accurate domain knowledge.
- Metacognitive function refers to feedback that supports learners' awareness and regulation of their learning processes. This function helps students develop strategic thinking, self-monitoring skills, and the ability to plan, monitor, and evaluate their learning strategies effectively.
- Affective function involves feedback's role in maintaining and enhancing learners' motivation, self-efficacy, and positive attitudes toward learning. This function addresses the emotional and motivational dimensions that influence learning engagement and persistence.

The present study operationalizes these three theoretical functions as distinct but interrelated dimensions of feedback effectiveness. By developing a scale that captures learners' perceptions across all three functions, this research provides a comprehensive tool for evaluating feedback practices in educational contexts and contributes to our understanding of how different aspects of feedback influence learning outcomes.

Assessing learners' perceptions of feedback effectiveness is of critical importance to a multitude of aspects inherent to the educational process. Firstly, students' perceptions of feedback directly impact the extent to which they utilize it, thereby influencing the quality of the learning process. To comprehend the effectiveness of feedback strategies employed by educators, it is imperative to investigate students' perceptions, thus facilitating the identification of more effective methods. Secondly, feedback perception exerts a significant influence on students' motivation, with positive and constructive feedback fostering a heightened desire to learn, while negative feedback can have an adverse effect. Furthermore, effective feedback enables students to more effectively manage their learning processes and develop their self-regulation skills. Consequently, the development of a valid and reliable instrument to measure

students' perceptions of feedback effectiveness is paramount to enhancing the quality of education. Such a measurement tool would contribute to the enhancement of teachers' feedback practices and the enrichment of students' learning experiences.

Method

Research Design

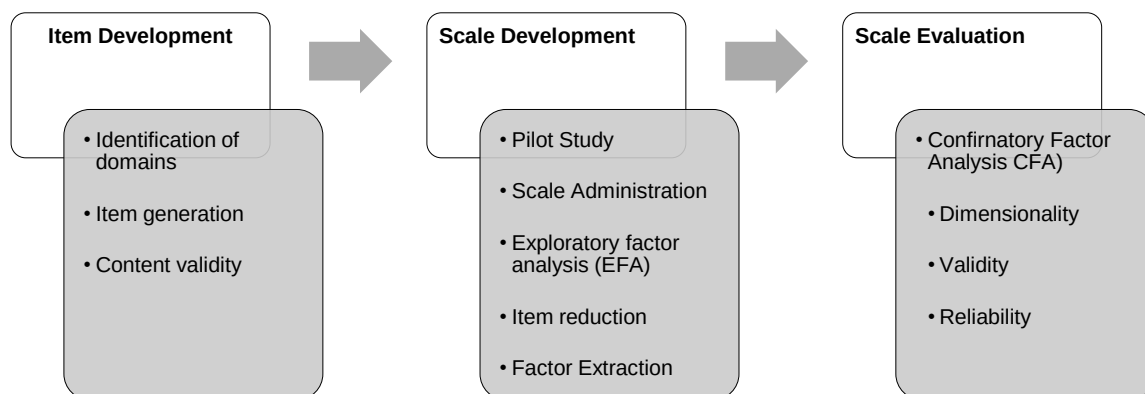
The objective of this study is to develop a valid and reliable measurement tool for evaluating learners' perceived feedback effectiveness. The data necessary to ascertain the psychometric properties of the feedback scale were collected using the cross-sectional survey method. The cross-sectional survey method was selected due to its capacity to facilitate the collection of data from a substantial sample group within a constrained timeframe, thereby enabling the attainment of the requisite large sample size necessary for conducting factor analysis. This method enables a comprehensive analysis of the participants' feedback perceptions within a specified time period.

Scale Development Process

The scale development process was carried out in three stages as 'item development', 'scale development' and 'scale evaluation' in accordance with the framework proposed by Boateng et al. (2018), as shown in Figure 1.

Figure 1

The Process of Scale Development



The item development process includes establishing the structure of the scale and ensuring the content validity evidence of the items. In the initial phase of the process, the scale's objective was determined in accordance with the research's aim. Subsequently, the authors identified three dimensions a priori as 'cognitive,' 'metacognitive,' and 'affective' in accordance with the theoretical framework of Narciss and Huth (2004). According to Narciss and Huth (2004), one of the three main dimensions that determine the effectiveness and value of feedback is the function of the feedback. For feedback to be effective and valuable, it must

fulfill three basic functions: cognitive, affective, and metacognitive. Thus, the authors specified the dimension of feedback as follows:

- Cognitive Effectiveness: This dimension relates to the extent to which feedback helps students correct their mistakes, develop correct solutions, and improve their comprehension and information processing skills.
- Metacognitive Effectiveness: This dimension pertains to the degree to which feedback effectively guides students in organizing their learning process and contributes to the development of their learning strategies.
- Affective Effectiveness: This dimension refers to the extent to which feedback enhances students' motivation, learning efforts, self-efficacy, and attitudes.

Following the definition of the dimensions, the process of item development was initiated. In this context, the items were created using the "deductive" method (Boateng et al., 2018, p. 3). Initially, a preliminary scale consisting of 3 dimensions, 39 items (including two control items, M22 and M32), and 5 categories (strongly disagree - strongly agree) was developed by examining studies focused on feedback in the literature and existing scales (Brookhart, 2008; Narciss and Huth, 2004; Narciss, 2008). Subsequently, this draft scale was sent to 7 experts with doctoral degrees in the field of educational sciences (3 in Curriculum and Instruction, 2 in Measurement and Evaluation, and 2 in Psychological Counseling and Guidance). Experts were asked for their views on the items' relevance and clarity in relation to the attribute being measured. The content validity ratio for each item was determined based on expert opinion using the formula proposed by Lawshe (1975), and subsequently, the content validity index for the overall scale was determined (see Appendix 1).

After the item development was completed, a pilot study was conducted with 30 teacher candidates prior to performing exploratory factor analysis. Following this pilot study, individual participants were interviewed to confirm whether the items were comprehensible from the students' perspectives and to gather information regarding the response processes. At this stage, item reduction and factor extraction processes were conducted to assess whether the developed items aligned with the theoretically predetermined structure.

Upon completion of the scale development phase, the process proceeded to the scale evaluation phase. In the scale evaluation phase, the scale was administered to the selected sample. The implementation of the confirmatory factor analysis involved 328 participants from various class levels and teacher education programs who had not participated in the exploratory factor analysis. Subsequently, the scale was assessed for its dimensionality, validity, and reliability.

Participants

The scale development process involved a total of 662 pre-service teachers from different teaching programs and grade levels, 334 EFA and 328 CFA. The sample sizes for EFA and CFA were determined based on the established guidelines in the literature. For EFA, the sample size of 334 participants meets Tabachnick and Fidell's (2013) recommendation of at least 300 participants for reliable factor analysis. For CFA, the sample size of 328 participants meets Anderson and Gerbing's (1988) recommendation of at least 150 participants for confirmatory factor analysis and satisfies Bentler and Chou's (1987) criterion of at least 5-10 participants per estimated parameter. Data for the EFA and CFA were collected from different groups of students at different times. Two separate samples were

employed for EFA and CFA to provide stronger evidence for the stability and replicability of the factor structure across different groups (Boateng et al., 2018; Worthington & Whittaker, 2006). The distribution of participants by gender, program, and grade level is shown in Table 1.

Table 1

Distribution of Participants by Gender, Grade Level, and Department

	CFA		DFA	
	<i>n</i>	%	<i>n</i>	%
Gender				
Male	169	50.60	163	49.70
Female	165	49.40	165	50.30
Grade Level				
2 nd Grade	121	36.23	110	33.54
3 rd Grade	137	41.02	135	41.16
4 th Grade	76	22.75	83	25.30
Department				
Primary Education	76	22.75	99	30.18
Foreign Languages	65	19.46	57	17.38
Computer and Inst. Technologies	17	5.08	24	7.32
Math. and Science Education	20	5.99	33	10.06
Turkish and Social Studies	57	17.07	42	12.80
Fine Arts	23	6.89	33	10.06
Psych. Counselling and Guidance	56	16.77	23	7.01
Special Education	20	5.99	17	5.18
Total	334		328	

Table 1 demonstrates that the participants in the EFA and CFA applications are uniformly distributed by gender and grade level. The distribution across departments is proportional and reflective of the overall population.

Data Collection Process

The data for the study were collected at the Faculty of Education of a state university in the autumn semester of 2023-2024. After the research was approved by the ethics committee, the data collection process was carried out in two stages: EFA and CFA. EFA data were collected face-to-face from 334 pre-service teachers using the paper and pencil method. CFA data were collected through Google Docs in the classroom environment under the guidance of the researcher.

Data Analysis

The data was examined for compliance with the univariate and multivariate normality assumptions after being transferred to Excel and subsequently to the Jamovi application. JAMOVI was preferred in this study based on several methodological and practical reasons. First, it is an open-source and free software that enables parallel analysis-based factor extraction without requiring additional programs, ensuring more accurate factor retention decisions. Second, it offers various robust estimation methods (e.g., MLR and WLSMV) when multivariate normality assumptions are violated. Lastly, it allows researchers to conduct EFA and CFA in a single platform, maximizing efficiency and minimizing the potential data transfer

errors. By dividing the 'kurtosis' and 'skewness' values (.56 and 1.29, respectively) by the standard error, the normality analysis yields values ranging from -2 to +2, suggesting that the data follows a normal distribution. Similarly, the histogram graph showed no kurtosis or skewness.

Furthermore, multivariate normality was analyzed using the Mardia Test for the CFA (see Table 2). The results of the Mardia Test indicated that the data set did not meet the requirements of multivariate normality. Consequently, Maximum Likelihood Robust (MLR), a method that is more resilient to violations of multivariate normality, was selected as the extraction method for the analysis in CFA (Yuan & Bentler, 2000).

Table 2

Mardia Test Result for Multivariate Normality

Coefficient	z	χ^2	df	p
Skewness	162.30	8872.20	4960	< .001
Kurtosis	1158.83	41.09		< .001

Following the normality analyses, Bartlett's sphericity test and the Kaiser-Meyer-Olkin (KMO) sampling adequacy criterion test were conducted to assess the factorizability of the data set. The analysis revealed a KMO value of .96, and Bartlett's test of sphericity produced significant results ($\chi^2(435) = 5993.13$, $p < .001$). The statistics indicate that the data is appropriate for factor analysis (Pallant, 2020).

Ethical Issues

This study was executed in compliance with the permission obtained from Anadolu Üniversitesi University Ethics Committee Commission (Date: 24.06.2022, Number: 329898), and voluntary consent for participation was obtained from all participants.

Findings

Exploratory Factor Analysis

In the EFA phase, the authors utilized principal axis factoring (PAF) to evaluate whether the items were distributed to the theoretically established model. The oblique rotation method "promax," which considers potential correlations among factors, was chosen as the rotation technique (Flora et al., 2012). Subsequent to the implementation of the promax rotation, the procedure for identifying the number of factors proceeded.

In determining the number of factors, the authors preferred the parallel analysis method, which has been proven to provide more reliable results compared to other methods such as the K1 rule and Cattell's scree plot (Hayton et al., 2004; Kılıç, 2022). The initial EFA with promax rotation was conducted to examine the factor structure of all 37 items (excluding control items M22 and M32). The initial analysis resulted in four factors, as shown in Table 3.

Table 3*Summary of Initial Four-Factor Structure*

Factors	Eigenvalues	% of Variance	Cumulative %
1	16.50	20.89	20.89
2	1.58	16.06	36.94
3	0.76	13.86	50.80
4	0.62	2.88	53.68

Table 4 presents the complete factor loading matrix from the initial four-factor EFA solution, including all 37 items before item elimination. This table shows the distribution of items across the four factors that emerged from the initial analysis, along with their respective factor loadings and uniqueness values.

Table 4*Factor Loadings and Uniqueness Values from Initial Four-Factor EFA Solution*

		Factors				Uniqueness
No	Items	1	2	3	4	
1	M1			0.81		0.32
2	M2			0.74		0.34
3	M3			0.41		0.53
4	M4			0.52		0.44
5	M5		0.48			0.41
6	M6		0.35	0.33		0.60
7	M7		0.40		0.48	0.46
8	M8		0.45		0.60	0.33
9	M9		0.35		0.41	0.44
10	M10			0.39		0.49
11	M11			0.42		0.42
12	M12		0.30	0.43		0.39
13	M13		0.48			0.61
14	M14		0.31			0.47
15	M15		0.45			0.62
16	M16		0.55			0.52
17	M17		0.70			0.50
18	M18		0.83			0.42
19	M19		0.83			0.34
20	M20		0.69			0.38
21	M21		0.48			0.61
22	M23	0.61				0.51
23	M24	0.72				0.51
24	M25	0.74				0.38
25	M26	0.74				0.44
26	M27	0.63				0.42
27	M28	0.44	0.47			0.51
28	M29	0.59				0.53
29	M30	0.60				0.41
30	M31	0.61			0.31	0.43
31	M33	0.67				0.43
32	M34	0.65				0.42
33	M35	0.77				0.47
34	M36	0.65				0.41
35	M38	0.85				0.32
36	M39	0.60				0.39
37	M37	--	--	--	--	0.94

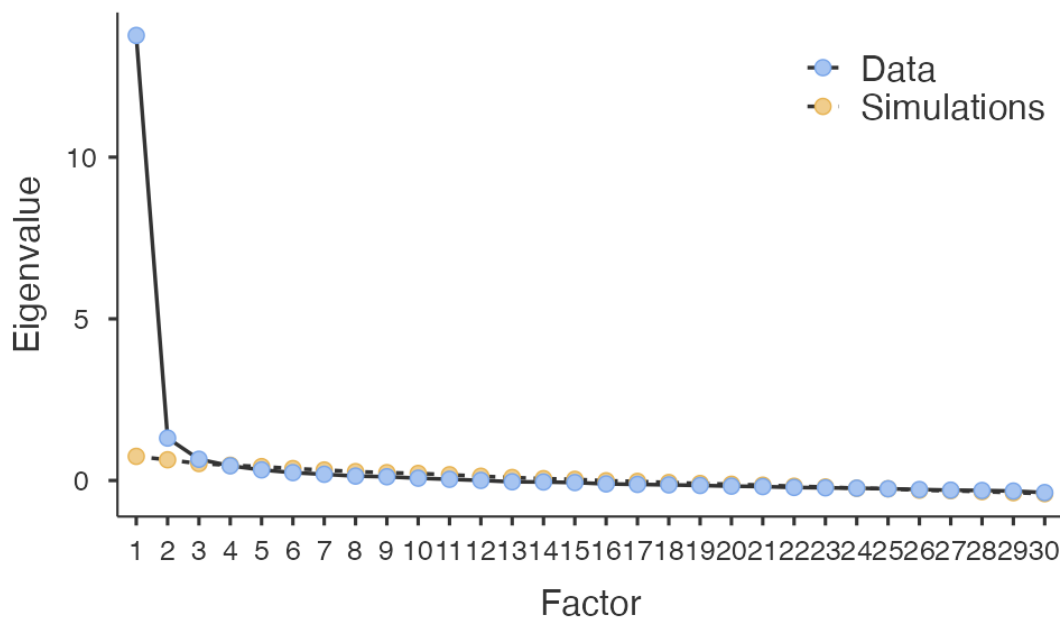
Note. 'Principal axis factoring' extraction method was used in combination with a 'promax' rotation

Upon analyzing the factor table, the items are initially grouped into four dimensions. These dimensions account for a cumulative variance ratio of 53%. However, this four-dimensional structure does not align with the theoretical framework or the simulation data generated from the parallel analysis shown in Figure 2. As evident from Table 4, several items demonstrated problematic loading patterns: M37 failed to load significantly on any factor; items M6, M7, M8, M9, M12, M28, and M31 showed cross-loadings across multiple factors; and items M13, M14, M15, M16, M17, M18, M19, M20, and M21 loaded together, forming an uninterpretable fourth factor.

Given the uninterpretable fourth factor, parallel analysis scree plot results indicated that a three-factor structure was more appropriate. The results of the parallel analysis indicated that a three-factor structure can be achieved based on the eigenvalues obtained through simulation. The analysis demonstrated that the number of factors produced by parallel analysis aligns with the three-dimensional structure that is "a priori" categorized as "cognitive", "metacognitive", and "affective" as shown in Figure 2.

Figure 2

Scree Plot Produced by Parallel Analysis



Following the parallel analysis recommendation for a three-factor solution, the factor loading matrix was examined, and items with cross-loadings across multiple factors or factor loadings below .30 were eliminated. In the initial stage, M6, which exhibited cross-loadings, along with M37, which failed to load significantly on any factor, were eliminated from the scale. Following this elimination, the remaining items, M7, M8, M9, and M21, formed a separate, uninterpretable fourth factor that did not align with the theoretical framework. Additionally, M28 continued to show cross-loadings across multiple factors. Since this four-factor configuration contradicted both the theoretical framework and parallel analysis results, items M7, M8, M9, M21, and M28 were subsequently eliminated. Following these eliminations, a theoretically coherent three-factor structure was obtained, with results presented in Table 5.

Table 5*Three-Factor Structure Derived From Parallel Analysis*

Factors	Eigenvalues	Variance Explained	Total Variance
1	13.50	24.71	24.71
2	1.31	15.13	39.84
3	0.66	13.63	53.47

The parallel analysis suggested a 3-dimensional structure, which accounts for 53.47% of the total variance in accordance with the theoretical framework. The correlations between the factors were found to be at an acceptable level (0.72, 0.74, 0.75). When analyzed in terms of eigenvalues, a two-factor solution may be more appropriate. However, although the eigenvalue is less than 1, some researchers suggest that factors with eigenvalues close to 1 should not be disregarded in certain situations. Fabrigar et al. (1999) emphasized that the K1 rule can be affected by sample size and model complexity, stating that factors with eigenvalues close to 1 should be retained if they align with the theoretical framework. Similarly, Costello and Osborne (2005) and Kline (1994) stressed that the eigenvalue rule should be interpreted flexibly for factors that explain significant variance and make a theoretically meaningful contribution to the research. The parallel analysis revealed that three factors explained 53.47% of the total variance, exceeding the 50% threshold commonly accepted in social sciences. Excluding the third factor would reduce the total variance explained by the model and diminish its explanatory power. Moreover, the fit indices comparison revealed that the three-factor solution demonstrated superior model fit (RMSEA = 0.06, TLI = 0.91) compared to the two-factor solution (RMSEA = 0.07, TLI = 0.86). Therefore, given the high variance and superior fit indices of the third factor, which aligns with the theoretical framework, it was deemed necessary to retain it for both theoretical and conceptual fit, leading to a preference for a three-factor solution. Upon accepting the three-factor solution, the item factor loadings and uniqueness values for each item were analyzed (Table 6).

Table 6*Factor Loadings and Uniqueness Value of Items Related to Three-Factor Solution*

		Factors			Uniqueness
No	Items	1	2	3	
		Affective Effectiveness	Cognitive Effectiveness	Metacognitive Effectiveness	
		24.71*	15.13*	13.65*	
1	M38	0.86			0.34
2	M35	0.81			0.47
3	M25	0.74			0.38
4	M24	0.73			0.52
5	M26	0.72			0.46
6	M34	0.70			0.46
7	M36	0.70			0.41
8	M33	0.66			0.47
9	M31	0.65			0.48
10	M30	0.64			0.44
11	M27	0.63			0.44
12	M39	0.60			0.40

Table 6*(Continued)*

13	M23	0.58			0.54
14	M29	0.57	0.56		0.55
15	M1		0.93		0.35
16	M2		0.88		0.34
17	M4		0.67		0.45
18	M3		0.59		0.54
19	M11		0.52		0.43
20	M12		0.52		0.40
21	M10		0.52		0.48
22	M6		0.48		0.60
23	M18			0.88	0.39
24	M19			0.84	0.32
25	M17			0.71	0.49
26	M20			0.59	0.40
27	M16			0.51	0.52
28	M21			0.46	0.65
29	M13			0.39	0.62
30	M15			0.39	0.63

Note. 'Principal axis factoring' extraction method was used in combination with a 'promax' rotation

*Explained variance for factors

Analysis of the factor loadings revealed that all items exhibited loadings close to or above .40 (e.g., M13, M15). Additionally, the majority of the items demonstrated low uniqueness values (ranging between .30 and .50), indicating that they are well explained by the underlying factors. However, certain items (M21 and M13) displayed higher uniqueness values, suggesting they are less strongly associated with the measured factors. Overall, the high factor loadings and low uniqueness values provide robust evidence supporting the structural validity of the instrument.

In conclusion, exploratory factor analysis (EFA) resulted in a 30-item scale organized into three dimensions: cognitive, metacognitive, and affective. The findings confirm that the hypothesized three-dimensional structure has been successfully established.

Confirmatory Factor Analysis

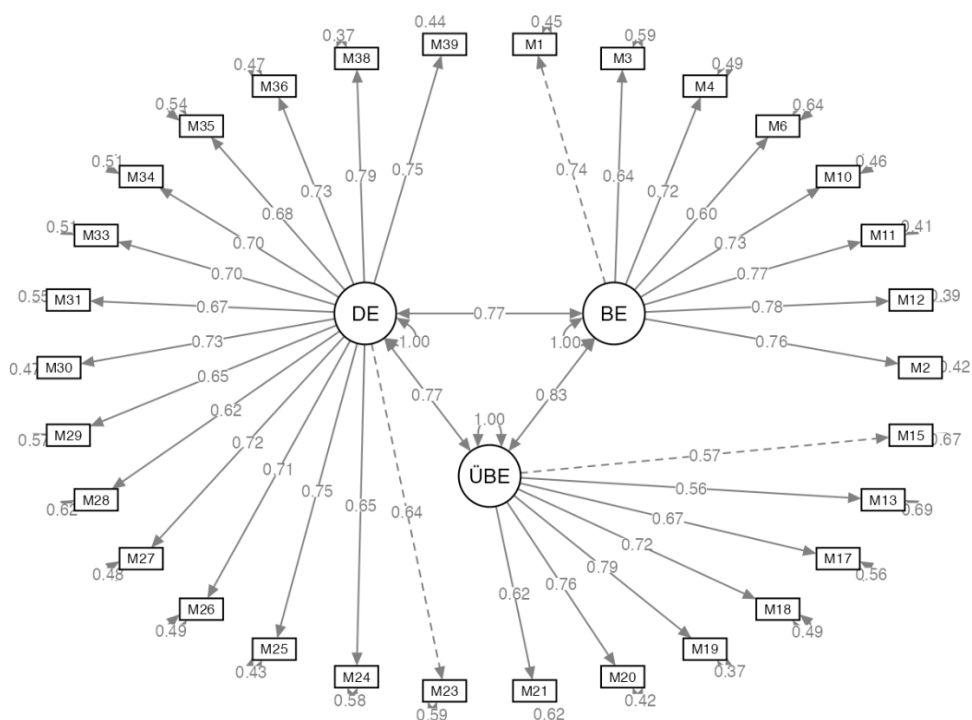
Following the completion of the scale development phase, the scale evaluation phase proceeded. CFA was conducted with a new sample of 328 participants, representing diverse grade levels and teaching programs, none of whom had participated in the earlier EFA. While the data were found to satisfy univariate normality, the Mardia test indicated a violation of multivariate normality. Therefore, Maximum Likelihood Robust (MLR), which is more robust to the effects of multivariate normality violations, was preferred as the extraction method in the analysis (Yuan & Bentler, 2000).

The fit indices of the MLR estimation method for the three-factor model, which successfully converged after 328 observations, 93 free parameters, and 45 iterations as shown in Table 7.

Table 7*Model Fit Evaluation of the Scale*

Fit Indices	Good Fit	Acceptable Fit	Value	Decision	References
χ^2/df	≤ 2	≤ 3	1.85	Good Fit	Schumacker & Lomax, 2004; Tabachnick & Fidell, 2007
RMSEA	$\leq .05$	.05–.08	0.05	Good Fit	MacCallum et al., 1996; Hu & Bentler, 1999
SRMR	$\leq .05$	$\leq .08$	0.05	Good Fit	Hu & Bentler, 1999
TLI /NNFI	$\geq .95$	.90–.95	0.91	Acceptable Fit	Hu & Bentler, 1999; Schumacker & Lomax, 2004
CFI /RNI	$\geq .95$	.90–.95	0.92	Acceptable Fit	Kline, 2016
GFI	$\geq .95$	$\geq .90$	0.95	Good Fit	Jöreskog & Sörbom, 1984
AGFI	$\geq .90$	$\geq .85$ –.90	0.94	Good Fit	Byrne, 1994
IFI	$\geq .95$	.90–.95	0.92	Acceptable Fit	Hu & Bentler, 1999

In reporting the fit indices, scaled values are reported, which are more robust to sample size and normality violations and provide more accurate fit results (Satorra & Bentler, 2001; Yuan & Bentler, 1998). According to the fit indices produced by CFA, the scale generally shows good fit values. The χ^2/df value of 1.85 falls within the good fit range ($0 \leq \chi^2/df \leq 2$). The RMSEA and SRMR values of 0.05 are within the good fit limits. While the NFI value of 0.84 indicates a poor fit, the NNFI (0.91) and TLI (0.91) values fall within the acceptable fit range. The CFI (0.92), IFI (0.92), and RNI (0.92) values are close to the good fit thresholds, while the GFI (0.95) and AGFI (0.94) values indicate a good fit.

Figure 3*Path Analysis for the Scale*

Upon examining the path diagram in Figure 3, it is evident that the standardized factor loadings are moderately to highly acceptable, all exceeding .50 (Tabachnick & Fidell, 2013). These loadings indicate adequate measurement model fit and support the intended factor structure. Additionally, the standardized error variances of the items ranged between .37 and .69. Analysis of the correlations between the latent variables revealed coefficients ranging from .77 to .83. While these values indicate a strong relationship between the latent variables, correlation values below 0.90 suggest that the factors are distinct from one another, thereby supporting discriminant validity (Kline, 2011). Finally, reliability coefficients and AVE (Average Variance Extracted) values related to the CFA solution were analyzed, as presented in Table 7.

Table 7*Reliability Coefficients for the Scale*

Factors	α	ω_1	AVE
Cognitive Effectiveness	0.89	0.89	0.51
Meta-cognitive Effectiveness	0.85	0.85	0.45
Affective Effectiveness	0.93	0.93	0.49

The Cronbach's Alpha values for the dimensions indicate that the scale exhibits high internal consistency (>.80), demonstrating strong reliability (Nunnally & Bernstein, 1994). Similarly, the Omega values suggest that the measurement tool possesses high internal consistency and can be considered reliable (Zinbarg et al., 2005). The Average Variance Extracted (AVE) value serves as a key indicator of the discriminant validity of the factors and their suitability for deriving a total score. AVE measures the extent to which a factor is explained by its associated observed variables, with values above 0.50 generally considered acceptable. However, researchers regard AVE values between 0.40 and 0.50 as acceptable when other reliability criteria are met (Fornell & Larcker, 1981; Hair et al., 2010). In cases where AVE values fall below 0.50, the Heterotrait-Monotrait Ratio (HTMT) test offers a more sensitive and robust alternative for assessing discriminant validity between factors (Henseler et al., 2015). According to this method, correlation values between factors below .85 provide evidence for discriminant validity. HTMT analysis demonstrated that the correlations between factors range between 0.77 and 0.84, which provides evidence for the discriminant validity of the scale.

A second-order confirmatory factor analysis was conducted to test whether a total score could be derived from the scale (Chen et al., 2006). The analysis revealed that the three subdimensions strongly loaded onto a single general effectiveness factor (cognitive effectiveness = .92, metacognitive effectiveness = .92, affective effectiveness = .84). All factor loadings exceeded both the .50 criterion recommended by Hair et al. (2010) and the .70 criterion for strong relationships specified by Kline (2011). The second-order model demonstrated acceptable fit indices (CFI = .915, TLI = .90, RMSEA = .058, SRMR = .049). The composite reliability values for the subdimensions met Hair et al.'s (2018) .70 criterion (cognitive effectiveness = .90, metacognitive effectiveness = .85, affective effectiveness = .93). These findings provide strong evidence for deriving a total score from the scale.

Conclusion, Discussion and Implications

The objective of this study was to construct a valid and reliable measurement tool for assessing the perceived effectiveness of feedback in terms of cognitive, metacognitive, and affective dimensions. The three-dimensional structure identified in this study provides empirical validation for the multifunctional nature of effective feedback extensively documented in the literature (Narciss & Huth, 2004; Hattie & Timperley, 2007; Narciss, 2008). Our findings demonstrate that the theoretical distinctions between cognitive, metacognitive, and affective feedback functions are not only conceptually meaningful but also empirically distinguishable by teacher candidates. The robust factor structure, with high factor loadings and acceptable model fit indices, confirms that learners can reliably differentiate between these dimensions when evaluating feedback effectiveness. Furthermore, the strong internal consistency coefficients indicate that each dimension represents a coherent construct, supporting the theoretical frameworks that emphasize feedback's multidimensional impact on learning (Brookhart, 2008; Shute, 2008). These psychometric properties provide practical validation for the theoretical models proposed in the literature, demonstrating that the conceptual distinctions correspond to measurable and reliable feedback perceptions among learners. This empirical evidence strengthens the foundation for designing and evaluating feedback interventions that systematically address all three dimensions of effectiveness.

The findings of the study demonstrated that the three-dimensional and 30-item structure was identified through EFA and subsequently validated by CFA, resulting in a measurement tool with strong internal consistency and validity. The fit indices suggest that the model exhibits a good overall fit, while the reliability indices confirm its consistency and dependability. Additionally, the reliability and model fit indices, along with the theoretical framework, provide robust evidence supporting the scale's suitability for obtaining a total score (Hair et al., 2010; Kline, 2011). Furthermore, the fit indices, factor loadings, and composite reliability scores obtained from secondary CFA results provided strong evidence for deriving a total score from the scale. The original Turkish version of the scale is presented in Appendix 2.

This scale provides a valuable instrument for the evaluation of educators' feedback practices and identification of their professional development needs. Institutions can utilize this scale for monitoring and enhancing the quality of feedback provided by their teaching staff. Furthermore, teacher training programs can employ this scale for the evaluation of feedback training effectiveness. The scale facilitates comparative analyses of feedback practices across various teaching levels and disciplines. In addition, it offers researchers the opportunity to examine the impact of the cognitive, metacognitive, and affective dimensions of feedback on learning outcomes.

The Perceived Effectiveness of Feedback Scale comprises 30 items and 3 factors, namely 'cognitive effectiveness' (8 items), 'metacognitive effectiveness' (8 items), and 'affective effectiveness' (14 items). The scale has a 5-point Likert-type rating system (1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always). There are no reverse-scored items in the scale. The total score and subscores are obtained by summing up the items in each dimension. The score ranges from 8 to 40 for cognitive and metacognitive effectiveness dimensions and from 14 to 70 for the affective effectiveness dimension. The total score ranges from 30 to 150. Higher scores indicate higher perceived effectiveness, while lower scores indicate lower perceived effectiveness regarding feedback practices.

Limitations and Future Directions

There are several limitations of the study that should be acknowledged by researchers and practitioners. Firstly, it is important to note that the scale was developed exclusively with pre-service teachers. Consequently, further validity and reliability studies should be conducted for its use with different sample groups. Secondly, the scale was developed using a cross-sectional data collection method, which does not reflect the change in feedback perceptions over time. Finally, it is important to note that the scale was developed within the Turkish higher education context, which necessitates further adaptation studies for its use in different cultural and educational contexts.

Several key areas warrant further investigation in future research. Firstly, an examination of the psychometric properties of the scale in different cultural contexts and in various sample groups (teachers, academics, and students at different educational levels) will contribute to a more comprehensive understanding of feedback effectiveness. These studies will facilitate the determination of the scale's cross-cultural validity and identify any potential adaptation requirements. Furthermore, the design of longitudinal studies is crucial to facilitate a comprehensive understanding of the shifts in feedback perceptions over time. Such longitudinal studies can illuminate the development of feedback effectiveness over time and its relationship with learning experiences. In addition, experimental studies can contribute to the determination of causal relationships and the development of effective feedback strategies.

Contribution Rate of the Researchers

The first author led the data collection, analysis, and manuscript writing process. The second and third authors provided significant contributions to item development and conceptual framework formulation and analysis check alongside their supervision and editorial oversight of the entire manuscript. All authors reviewed and approved the final version of the manuscript.

Statement of Conflict of Interest

The authors declare that no competing interests exist between researchers.

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Appendix

Appendix 1

Lawshe's (1975) CVR and CVI for the Scale

Perceived Effectiveness of Feedback Scale Content Validity Ratios and Index											
Item Number	Stayed	Not Stayed	Total	CVR	Decision ($\geq .59$)	Item Number	Stayed	Not Stayed	Total	CVR	Decision ($\geq .59$)
1	12	0	12	1	I*	21	12	0	12	1	I
2	12	0	12	1	I	22**	5	0	5	1	I
3	12	0	12	1	I	23	12	0	12	1	I
4	12	0	12	1	I	24	12	0	12	1	I
5	11	1	12	0.83	I	25	12	0	12	1	I
6	5	0	5	1	I	26	12	0	12	1	I
7	11	1	12	0.83	I	27	11	1	12	0.83	I
8	12	0	12	1	I	28	5	0	5	1	I
9	12	0	12	1	I	29	12	0	12	1	I
10	12	0	12	1	I	30	12	0	12	1	I
11	12	0	12	1	I	31	12	0	12	1	I
12	5	0	5	1	I	32**	5	0	5	1	I
13	12	0	12	1	I	33	12	0	12	1	I
14	5	0	0	1	I	34	5	0	5	1	I
15	11	1	12	0.83	I	35	12	0	12	1	I
16	10	2	12	0.66	I	36	12	0	12	1	I
17	11	1	12	0.83	I	37	12	0	12	1	I
18	12	0	12	1	I	38	12	0	12	1	I
19	12	0	12	1	I	39	11	1	12	0.83	I
20	12	0	12	1		CVI = 0.96					

*I: Included; ** Control Items

Appendix 2

The Original Version of the Scale

*Bu çalışma kapsamında geri bildirimler, yazılı ya da sözlü olarak gerçekleştirdiğiniz çalışmalarınız/performanslarınız kapsamında (sınavlar dahil) öğretim elemanları tarafından çalışmalarınıza/performanslarınıza ya da size yönelik yapılan yorum ve değerlendirmeleri ifade etmektedir. (Aşağıda yer alan maddeler tırnak içerisindeki cümlelerin devamı niteliğindedir.)			Hiçbir Zaman	Nadiren	Ara Sıra	Sıklıkla	Her zaman
"Eğitim fakültesi lisans dersleri kapsamında aldığım geri bildirimler; ...							
	No	Maddeler					
Bilişsel Etkililik	1	Konuya ilişkin bilgi düzeyimi artırır.					
	2	Konuya ilişkin anlama düzeyimi artırır.					
	3	Uygulamaya dönük becerilerimi güçlendirir.					
	4	Analiz becerilerimi geliştirir.					
	5	Daha özgün çalışmalar gerçekleştirmemi sağlar.					
	6	Öğrenme hızımı olumlu yönde destekler.					
	7	Akademik başarıyı olumlu yönde destekler.					
	8	Öğrenme hedeflerime ulaşmamı kolaylaştırır.					
Üstbilişsel Etkililik	9	Eleştirel bakış açımı güçlendirir.					
	10	Öğrenme stratejilerimi geliştirmeme yardımcı olur.					
	11	Öğrenme özelliklerimi anlamama yardımcı olur.					
	12	Öğrenme becerilerimi geliştirmek için stratejiler sunar.					
	13	Öğrenme sürecimi planlamama yardımcı olur.					
	14	Öğrenme sürecime ilişkin farkındalık kazanmamı sağlar.					
	15	Öğrenme sürecime ilişkin değerlendirme becerilerimi geliştirir.					
	16	Öğrenme sürecimi gözden geçirmemi sağlar.					
Duyuşsal Etkililik	17	Öğrenmekten aldığım hazzı artırır.					
	18	Konuya ilişkin öğrenme merakımı artırır.					
	19	Daha çok çaba göstermem konusunda cesaretlendirir.					
	20	Öğrenme amaçlarıma ulaşmak için motive eder.					
	21	Derse katılma isteğimi artırır.					
	22	Eksikliklerimi gidermek için motive eder.					
	23	Öğrenme sorumluluğu almama katkı sağlar.					
	24	Derinlemesine çalışmalar yapmak için teşvik eder.					
	25	Başarılı olma inancımı artırır.					
	26	Öğrenme sürecimde kendimi yeterli hissetmemi sağlar.					
	27	Öğrenme sürecimde karşılaştığım engellerle başa çıkmamı sağlar.					
	28	Dersi daha çok önemsememi sağlar.					
	29	Derse yönelik ilgimi artırır.					
	30	Derse ilişkin tutumlarımı olumlu yönde etkiler.					