Developing a scale of self-efficacy perceptions in flipped learning model

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Abstract. This study aims to develop a valid and reliable scale of self-efficacy perception in order to identify pre-service teachers' perceptions of self-efficacy in flipped learning model. The study group was composed of 496 pre-service teachers who attended a university. First, the factor intended to be measured was determined while developing the scale. Then, the relevant literature was reviewed, the pool of items was formed and the way of measurement was evaluated. The scale items were created in 5-pointed Likert type. They were graded as 1: "I absolutely disagree", 2: "I disagree", 3: "I am indecisive", 4: "I agree" and 5: "I absolutely agree". The scale was decided to have two factors and 19 items according to the Exploratory factor analysis done to determine the construct validity of the scale. Confirmatory factor analysis was done so as to confirm the accuracy of the decided construct, and according to the analysis, the fit indices were found as X2/df=2.775; RMSEA=.060; CFI=.943; GFI= .917 and NFI=.914. The Cronbach's Alpha reliability coefficient was found as .927. It can be said on the basis of the findings obtained here that the scale of self-efficacy perceptions in flipped learning which was developed for pre-service teachers was valid and reliable for use as an instrument of measurement.

1 Introduction

The requirements of the era in the world of 21st century, which constantly develops and changes, keep changing. Today's generation needs to have such skills as learning and innovativeness skills (creative thinking, critical thinking, problem-solving, communication, collaboration), information, media and technology skills (information literacy, information and communication technologies literacy, media literacy), and survival and career skills (flexibility and adaptation, self-management, social skills, prolificacy and accountability, leadership)- which are described as 21st century skills [1]. Those skills aim to transform individuals into people who are active, who are prolific and who have made technology a part of their life. It is possible to raise such people only through technology- oriented and student-centred approaches of education. Teaching approaches used today should be the

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practices which benefit from the advantages of information technologies, which consider individual differences important and in which learned knowledge can be adapted into daily life.

Covid-19 pandemic- from which people all over the world had suffered since 2020- put an end to the discussions in the differentiation needed in teaching approaches, strengthened the place hybrid learning models occupied in educational systems and thus increased their importance. It is inevitable to use the hybrid learning models even when the epidemic has come to an end in the whole world. One of those models which is used the most commonly is flipped learning model.

Flipped learning is "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" [2]. Teachers make online learning resources such as presentation videos accessible to their students prior to lessons so as to have more class time in flipped learning [3, 4]. Sending students presentation videos prior to lessons enables them to learn at the level of knowledge and comprehension at their own pace at home. Passive learning in the classroom is replaced by enriched activities in which upper order thinking skills are available in this learning model [5, 6, 7]. Teachers shoulder great responsibilities in planning, preparing, managing the learning process and in introducing students to the model and motivating them [8]. Teachers' levels of technological literacy should be high. In this way, the model provides wide support of materials usable in effective and retained learning [9].

According to Bandura [10], the task of creating learning environments which contribute to the development of students' cognitive skills largely depends on teachers' capabilities and self-efficacies because teachers with high sense of efficacy in their teaching ability can motivate their students and can increase their cognitive development. Self-efficacy is individuals' levels of confidence in their ability to fulfil a certain task and their belief in integrating the task and actualising it [11]. Vaughan [12, 13] argues that flipped learning is very important in teacher training and that pre-service teachers attain the course objectives by using active learning strategies, collaborative learning and technology during the implementation of the model. Besides, Vaughan [12] also found that pre-service teachers who use the model could apply their knowledge more easily and that they were more creative. Hao and Lee [14], in a study which investigated pre-service teachers' concerns about flipped learning, found that the participants' thoughts on how to teach to their students when they start the teaching profession and the exercises they prepared were associated with their own teaching methods, classroom management and students' participation.

It cannot be said that the number of existing scales concerning perceptions of self-efficacy in flipped learning model is sufficient. Therefore, the need is felt for a valid and reliable scale which measures perceptions of self-efficacy in the model.

2 Method

This is a study of scale development. It aims to develop a scale of self-efficacy perceptions in flipped learning so as to identify pre-service teachers' self-efficacy in using the model.

2.1 Study group

The study group was composed of 496 pre-service teachers who were undergraduate students in German language teaching, Physical Education and Sports, Biology teaching,

computer education and instructional technologies (CEIT), Science teaching, Physics teaching, French language teaching, elementary mathematics teaching, English language teaching, Chemistry teaching and mathematics teaching departments of an established university. The participants were the individuals who had theoretical knowledge of flipped learning model and who had experience in implementing the model in courses they had taken before. Descriptive statistics on the participants are shown in Table 1 below.

Table 1. Descriptive statistics concerning the participants.

		Frequencies	%
Gender	Female	368	%74,2
	Male	128	%25,8
Programmes	German language teaching	11	%2,2
	Physical education and sports	21	%4,2
	Biology	6	%1,2
	CEIT	12	%2,4
	Science teaching	66	%13,3
	Physics teaching	4	%0,8
	French language teaching	12	%2,4
	Elementary mathematics	48	%9,7
	English language teaching	33	%6,7
	Chemistry teaching	29	%5,8
	Mathematics teaching	20	%4
	Pre-school teaching	76	%15,3
	Special education	22	%4,4
	Psychological counselling and guidance	13	%2,6
	Elementary school teaching	68	%13,7
	Turkish language teaching	55	%11,1

2.2 The stages of scale development

The stages recommended by DeVellis [15] were taken into consideration in developing the scale of self-efficacy perceptions in flipped learning model (SSEPFL).

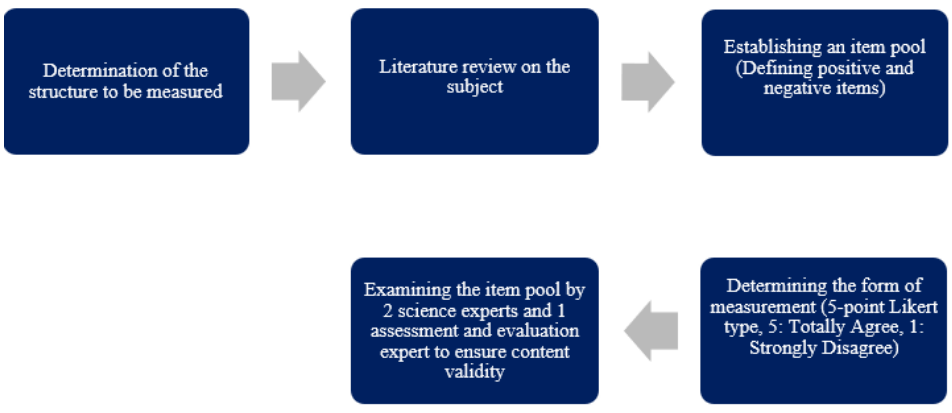

Fig.1. The stages of developing the SSEPFL

Following the stages, the 30-item draft for the scale was created. Having applied the items to the scale development sample, the validity and reliability analyses were done and the evaluation was made. The SPSS v.26 package programme was used for exploratory factor analysis and for Cronbach's Alpha analysis while the AMOS v.23 package programme was used for confirmatory factor analysis.

3 Findings

This part presents the exploratory and confirmatory factor analysis results in the context of validity and the findings obtained from the reliability analyses.

3.1 Exploratory factor analysis

The stages recommended by Pallant [16] were taken in doing the exploratory factor analysis. In this context, primarily the fit of the data for EFA was checked. Kaiser-Meyer-Olking (KMO) and Bartlett's Sphericity test were used in determining the fit between the sample and the EFA. According to Bryman and Cramer [17], the KMO value of 0.60 is considered medium, the value of 0.70 is considered good, the value of 0.80 is considered very good and the value of 0.90 is considered perfect. Bartlett's test should be significant ($p<.05$) in order for factor analysis to be considered to be fit. Table 2 shows the KMO and Bartlett's Sphericity test results.

Table 2. The KMO and Bartlett's sphericity test results for the SSEPFL

Kaiser-Meyer Olkin measure of sampling adequacy	Approx. $\chi 2$	df	Sig.
.944	4380.613	171	.000

Having the KMO value of .94 and Bartlett's Sphericity test value of ($p<0.05$) indicated that the data fitted EFA analysis.

Having determined that the data fitted the factor analysis, Catell' scree plot and Horn's [18] parallel analysis techniques were used and the decision that the scale would have a 2-factor construct was made. The scree plot drawn as additional evidence for the 2-fator structure of the scale- which was supported with Horn's [18] parallel analysis- is shown in Figure 2.

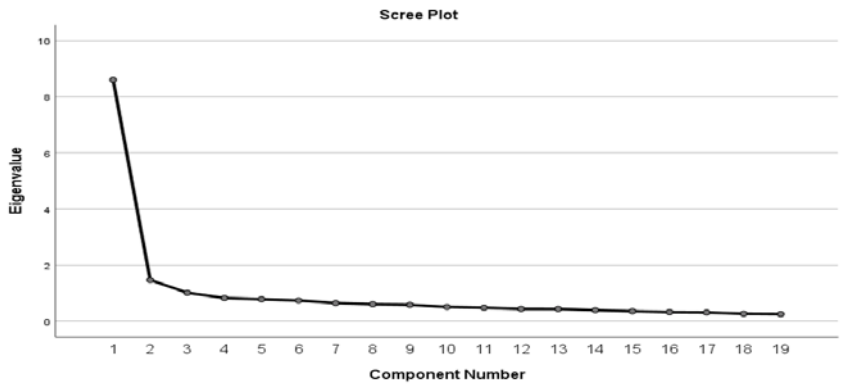

Fig. 2. Scree plot

An examination of the scree plot makes it apparent that the scale has a two-factor structure. Thus, it was concluded that it would be appropriate to group the items in the scale

in two factors considering the fact that the results of the scree plot and of the parallel analysis were mutually supportive. 11 items which were seen to have the lowest item load value and to overlap on repeating the analysis with two factors were excluded from the scale, and thus, the factor analysis was completed. The analysis was repeated for the remaining 19 items in the scale. The factors included in the factors in the scale were put to varimax rotation- a technique of rotation. After the rotation, the factor loads were found to range between .758 and .560 for factor one and to range between .673 and .615 for factor two. The results obtained following the EFA are shown in Table 3.

Table 3. Information on Exploratory Factor Analysis for the SSEPFL.

Items	Factor 1	Factor 2
M3	.758	
M4	.750	
M11	.741	
M7	.741	
M8	.710	
M2	.703	
M14	.676	
M26	.666	
M20	.650	
M18	.648	
M19	.607	
M30	.599	
M21	.560	
M25		.673
M28		.653
M27		.639
M9		.630
M22		.628
M12		.615
19 items	13 items	6 items

It is clear from Table 3 that the 19 items available in the scale are included in the two factors labelled as Technology and Pedagogy. Accordingly, factor one labelled as “Technology” contains 13 items while factor two labelled as “Pedagogy” contains 6 items. The total variance explained by the two factors was found as 53.077%.

Considering the fact that having the total variance explained by multi-factor structures in the 40%-60% range is considered adequate, the value found in the current study is quite good [19].

3.2 Confirmatory factor analysis

The structure of the scale determined by EFA was tested with confirmatory factor analysis done with another study group. Goodness of fit values were presented and they were evaluated on the basis of the criteria accepted by the literature. The links recommended by modification indices were analysed in confirmatory factor analysis- which was done for the two-factor structure. Table 4 shows the fit indices found as a result of the modification theoretically.

Table 4. Model – data fit values for the data concerning the SSEPFL.

X^2/df	RMSEA	CFI	GFI	NFI
2.775	.060	.943	.917	.914

On examining the values found, it may be stated that the χ2/sd value is significant (p<.01) and that it has acceptable goodness of fit due to the fact that it was calculated as χ2/sd=2.77. Having Normed Fit Index (NFI) (.914), Comparative Fit Index (CFI) (.943), Goodness of Fit Index (GFI) (.943) bigger than 0.90 indicated that the measurement model had good fit. Moreover, having root mean square error of approximation (RMSEA) (0.060) smaller than 0.10 was also an acceptable result [20]. The CFA results concerning the model are shown in Figure 3.

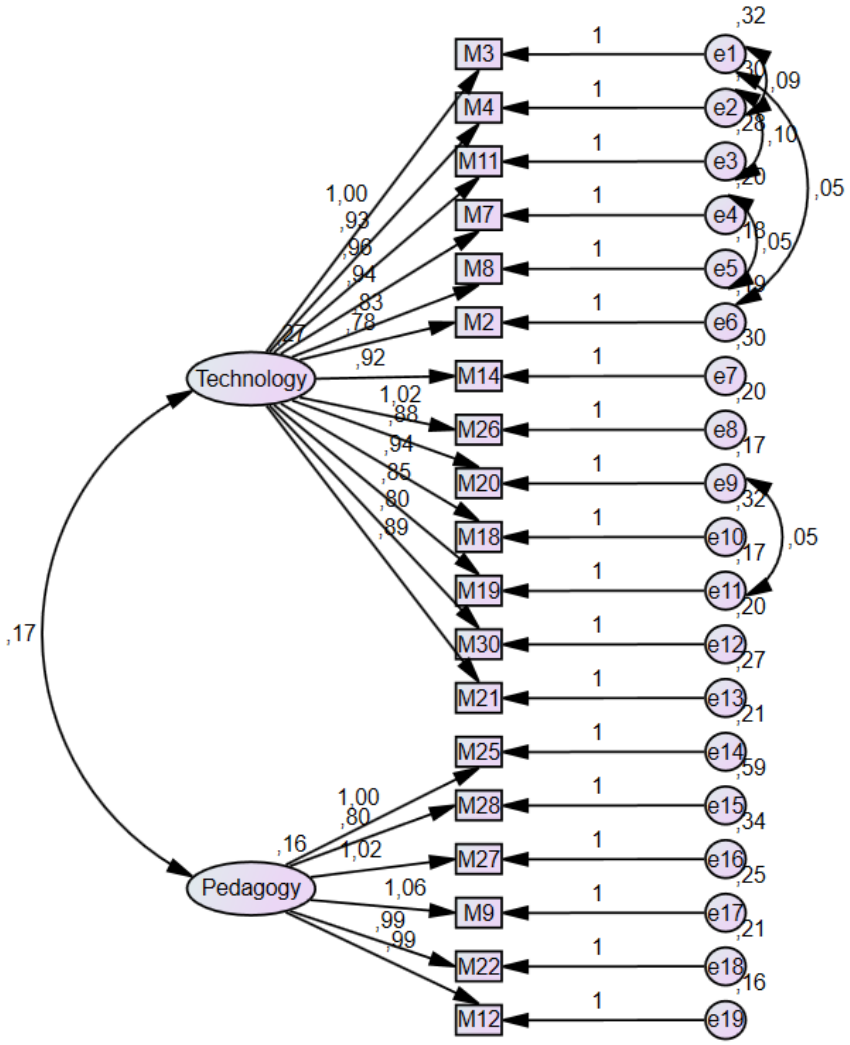

Fig. 3. Information on Confirmatory Factor Analysis for the SSEPFL

Evaluation of CFA and the fit of the data to CFA were done according to modification indices.

3.3 Reliability analysis

The scale was given its final shape as having 2 factors and 19 items after the EFA and CFA.

Cronbach's Alpha internal consistency coefficient- one of the reliability coefficients most commonly used in education and psychology- was checked in determining the reliability of the scale developed. Following the reliability analyses conducted with the sample used in the CFA, the value was found as .927 for the whole scale. As to the factors, the Cronbach's Alpha was found as .925 for factor 1 and as .773 for factor 2. Cronbach's Alpha commonly used in determining reliability in the sense of internal consistency is expected to be above 0.700 [15].

Table 5. Cronbach's alpha reliability analysis results of SSEPFL.

The scale and the sub-factors	Items	Cronbach's Alpha reliability coefficients
Technology	M3, M4, M1, M7, M8, M2, M14, M26 M20, M18, M19, M30, M21	.925
Pedagogy	M25, M28, M27, M9, M22, M12	.773
SSEPFL	All the items	.927

The scale items were created in 5-pointed Likert type. They were graded as 1: "I absolutely disagree", 2: "I disagree", 3: "I am indecisive", 4: "I agree" and 5: "I absolutely agree". There is not any inverse items in the scale.

4 Conclusion and Discussion

This study aimed to develop a "scale of self-efficacy perceptions in flipped learning model" usable with pre-service teachers. The trial form of the scale contained 30 items prior to the application. The 11 items which failed to meet the criteria set were excluded from the scale after the analyses and thus, the decision was made to have a scale of 19 items. Exploratory factor analysis (EFA) was done by using the SPSS v.26. in testing the construct validity of the scale. It was concluded after the EFA by considering the scree plot, item loads and Horn's [18] parallel analysis that the scale would have a 2-factor, 19-item structure. Factor one was labelled as "Technology" and contained 13 items. Factor two, on the other hand, was labelled as "Pedagogy" and contained 6 items. The structure of the scale which was determined with exploratory factor analysis was tested with the AMOS v.23 programme. It became apparent that the fit indices calculated as a result of the CFA were acceptable.

Reliability test for the SSEPFL was done by calculating the Cronbach's Alpha coefficient. The Cronbach's Alpha for the confirmed structure of the scale was found as .927. On the basis of the factors, the value was found as .925 for the factor of Technology and as .773 for the factor of Pedagogy.

It was concluded on the basis of all the findings that the scale of self-efficacy perceptions in flipped learning model was a scientifically and psychometrically valid and reliable measurement instrument. The scale is expected to reveal pre-service teachers' self-efficacy scores in flipped learning model in a valid and reliable manner.

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