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Full Length Research Paper

Study of the validity and reliability of a self-efficacy scale of teaching material utilization

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The main purpose of this study is to develop a scale in order to detect the level of pre-service teachers' utilization from teaching materials based on their perception of self-efficacy. The sample group is composed of 439 students for the first application and 215 students for the second. In order to detect the validity of the scale, exploratory and confirmatory factor analyses and item discriminations were conducted. To assess the reliability of the scale, level of internal consistency and the consistency level were calculated. As a result, it can be said that this scale is a valid and reliable scale that can be used in the measurement of self-efficacy perception levels of pre-service teachers' utilization of teaching materials.

Key words: Teaching materials, developing scale, validity, reliability.

INTRODUCTION

Due to their various important contributions, such as structuring the teaching process in a way to address all senses, meeting the individual needs of the students, attracting attention, facilitating recollection, saving time, objectifying abstract concepts, making learning permanent and providing reliable observation (Heinich et al., 2002; Halis, 2002; Isman, 2003; Yalin, 2003), teaching materials are acknowledged among the important components of the learning-teaching environments.

Whether or not teaching materials can provide the expected contributions to the effectiveness of learning-teaching processes naturally depends on the appropriate design of teaching materials (Heinich et al., 2002; Yalin, 2003). It is frequently emphasized that the utilization of visuals in presenting information is very important for easy and effective recollection of the information (Alessi and Trollip, 2001; Chi et al., 1989; Morrison et al., 2001). It is stated that the main purpose of preparing a visual is to establish an environment of communication where information can be easily comprehended, in order to attract the viewers' attention and enable them to recall the messages (Szabo and Kanuka, 1998). In this context, many empirical works have been carried out pertaining to how writing, colours and graphics are to be used within the design (Aspillaga, 1991; Livingston, 1991; Szabo and Kanuka, 1998). In these studies many design elements such as font boldness, font size, lines, margins, columns, positioning of the messages, colour selection, utilization of graphics and visuals have been dealt with. In other words, when designing a visual, besides the basic design principles such as integrity, focal point, balance, message type, background and hierarchy, also basic design elements such as colour, font type, spacing, size and lines are focused on (Demirel et al., 2002; Halis, 2002; Heinich et al., 2002; Isman, 2003; Kaya, 2006; Yalin, 2003). These design principles and elements constitute the main criteria pertaining to the suitability of teaching materials when designing, adapting or selecting a teaching material.

On the other hand, it can be asserted that just by designing teaching materials as per the basic principles and elements is not enough for providing a contribution to teaching-learning environments. Besides the design suitability of teaching materials, it is also an important matter to use them correspondingly to the learning-teaching environment (Ornstein and Lasley, 2000). In other words, the contribution of teaching materials to the learning-teaching processes is largely related to the material designing and utilization capabilities of teachers

(Heinich et al., 2002). Ultimately, it is a natural requirement for the teachers to have a command of the effective use of design principles, design elements and teaching materials in order to benefit from teaching materials (Hizal, 1992). Due to this reason, there are many studies in the literature considering the teachers' or teacher candidates' levels of utilization of teaching materials (Fidan, 2008; Karamustafaoglu, 2006; Sonmez et al., 2006; Ulusoy and Gulum, 2009). In these studies, the data pertaining to the teaching material utilization levels of study groups are mostly collected through structured or semi structured interviews or questionnaires. No study focusing on developing a scale, the validity and reliability works of which has been completed, intended for determining the levels of utilization of teaching materials could be found in the literature. For this reason, it is considered that developing a scale with this purpose will prove to be highly important in terms of the contribution it will make to the literature.

The 'teaching materials' utilization self efficacy scale' (TMUSES) developed in this research intends to measure teacher candidates' utilization levels of teaching materials in terms of their own self-efficacy perceptions. Self-efficacy is defined as the confidence in the accomplishment of a given task. It is stated that this confidence affects whether the behaviour pertaining to the task is to be tried or not, the continuity of this behaviour, the motivation concerning the behaviour, and eventually the performance (Kotaman, 2008). On the other hand, it is also emphasized that self-efficacy plays an important role in gaining a new skill or experiencing new learning, and then putting this new skill or learning into practice (Kotaman, 2008). When people with high levels of self-efficacy run into difficulties regarding a given task, they tend to show more persistence for accomplishing the task. It is asserted that the robust self confidence of an individual in what they can accomplish increases persistence and endeavour (Bouffard-Bouchard, 1990). In this context, it is possible to state that the self-efficacy perceptions of teacher candidates in utilizing teaching materials will provide sufficient evidence regarding the matter.

Thus, this study is considered important from the aspect that it intends to develop a measuring tool that will determine to what level teacher candidates can utilize teaching materials. In the context of the obtained data, it will be possible to determine teacher candidates' shortcomings on utilizing teaching materials and to make plans concerning the types of development activities to be implemented within faculties of education, in order to rectify these shortcomings.

METHOD

The study group of this research consists of 439 students on the teaching technologies and material design course and in the 3rd grade of different departments of the Faculty of Education of the Ahi Evran University for the first implementation, and 215 students in the 4th grade for the second implementation. Since there were no 4th grade students in the departments of Computer and Instructional Technologies, Elementary Mathematics Education and Early Childhood Education, these departments were excluded from the second implementation. Only confirmatory factor analyses were carried out on the data collected with the second implementation. The distribution of the study groups in terms of departments and genders is summarized in Table 1.

Development process of the scale

In the development process of the scale, first a literature review was conducted (Coklar and Odabasi, 2009; Demirel et al., 2002; Guven, 2006; Halis, 2002; Isman, 2003; Kaya, 2006; MEB, 2005; Varank and Ergun, 2008; Yalin, 2003). In this context, a list of the design principles and elements of the teaching materials of the general criteria regarding the selection of the materials, and of the main principles on the use of the materials within courses was established. This list then was examined with the assistance of five experts in the field of educational technology and some of the items were combined with others, in order to ensure that the scale will have a reasonable extent. The items peculiar to each material type were removed, and the items oriented on selection, design and utilization were selected. For instance, items highly peculiar to a single type of material such as "not to be shuffled from hand to hand" for models and "not to exceed 50 slides" for slides were removed or generalized by being combined with other items.

By combining the information obtained from the literature and the contribution of the experts, a pool of 32 items was established. Across each item, five step choices have been given in order to determine teacher candidates' self-efficacy levels expressed for the items. The choices were arranged as: (1) never, (2) rarely, (3) sometimes, (4) usually and (5) always.

The items prepared as drafts were reviewed by a linguistics expert, eight educational technology experts and a psychological counselling and guidance expert in terms of context, wording, expression, spelling and punctuation. After making the necessary amendments following the inputs of the experts, the 32 item draft scale was established.

The draft scale was applied with the assistance of the instructors attending the courses in line with the faculty course schedule within one course hour. Collected data was loaded into the SPSS 15.00 and Lisrel 8.7 programs in order to carry out the validity and reliability analyses of the scale through statistical means.

Data analysis

As part of the statistical analyses, KMO and Bartlett test analyses were implemented on the data gathered with the scale in order to determine the structural validity of the scale and to determine whether or not factor analysis will be conducted. Based on the obtained values, exploratory and confirmatory factor analyses were conducted on the data, the allocation to factors was analysed with the principal components analysis, and factor loads were examined by utilizing the Varimax orthogonal rotation technique. Factor analysis is used to discover whether the items in a scale are divided into a lesser number of factors (Balci, 2009). On the other hand, as a consequence of the principal components analysis used in factor analysis, the items with factor loads lower than 0.30 and those that do not have at least 0.100 difference between their loads on two factors, or in other words the items with loads separated into two factors, are supposed to be removed (Buyukozturk, 2002). As a matter of fact, a scale that has items with factor loads higher than

Table 1. Distribution of the study group in terms of departments and genders.

Department	I. Implementation			II. Implementation		
	M	F	Total	M	F	Total
Computer and Instructional Technologies	15	18	33	-	-	-
Primary Science Education	25	27	52	20	23	43
Primary Mathematics Education	15	10	25	-	-	-
Early Childhood Education	28	3	31	-	-	-
Psychological Counseling and Guidance	25	14	39	18	6	24
Primary School Teaching	66	37	103	46	14	60
Primary Social Science Education	43	41	84	33	28	61
Turkish Language Teaching	34	20	54	18	9	27
Unknown			18		-	-

0.30 and at least 40% of the total variance explained is considered to be satisfactory in terms of behavioural sciences (Kline, 1994; Scherer et al., 1988). The main criterion in evaluating factor analysis results is the factor loads (Balcı, 2009; Gorsuch, 1983). High factor loads are deemed to be an indicator that the variable can be included under the given factor (Buyukozturk, 2002). In addition to this, it is stated that the calculation of common factor variance is important, particularly in terms of multiple-factor patterns, and it is defined as the common variance the factors cause on each variable as a consequence of the factor analysis (Çokluk et al., 2010). There are opinions which state that in case an item has a common factor lower than 0.20 it should be removed from the scale (Cokluk et al., 2010, cited in Sencan, 2005).

By means of implementing the scale obtained from the exploratory factor analysis to a second study group, other than the group to which the first implementation was done, a confirmatory factor analysis was carried out on the obtained data. Confirmatory factor analysis is based on the principle of regarding each correlation between the observed and unobservable variables as a hypothesis and testing them as one (Pohlmann, 2004). The maximum likelihood technique was used in the confirmatory factor analysis. In the scale model obtained as a consequence of the confirmatory factor analysis, having the observed values between the ranges of $\chi^{22}/d<3$, $0<RMSEA<0.05$, $0\leq S\text{-}RMR\leq 0.05$, $0.97\leq NNFI\leq 1$, $0.97\leq CFI\leq 1$, $0.95\leq GFI\leq 1$, $0.95\leq AGFI\leq 1$ and $0.95\leq IFI\leq 1$ indicates a perfect fit, while having them between the ranges of $\chi^{22}/d<5$, $0.06\leq RMSEA<0.08$, $0.06\leq S\text{-}RMR\leq 0.08$, $0.90\leq NNFI\leq 0.96$, $0.90\leq CFI\leq 0.96$, $0.90\leq GFI\leq 0.96$, $0.90\leq AGFI\leq 0.96$ and $0.90\leq IFI\leq 0.96$ indicates an acceptable fit (Kline, 2005; Sumer, 2000; Simsek, 2007).

The validity of the scale has been determined by testing the item discrimination power item-total correlations of the 23 items left after the factor analysis, with Pearson's r test. The availability of a correlation between the score obtained from each item and the point scored from the factor to which the item belongs is used as a criterion in order to understand the level of each item of the scale on serving the general purpose of the factor (Balci, 2009). As for determining the reliability of the scale, stability tests were conducted with the internal consistency coefficients. For determining the internal consistency level, Cronbach's alpha reliability coefficient, the correlation value between two congruent halves, the Sperman-Brown formula and Guttmann split-half reliability formula were used; a reliability coefficient higher than 0.70 was acknowledged as an indication of the reliability of a given scale (Buyukozturk, 2002; Gorsuch, 1983). On the other hand, the stability level of the scale was calculated in terms of determining the correlation between the results of the two implementations, the second implementation of which followed the first one five weeks after. It increases as the reliability coefficient indicating the consistency level approaches 1.00 and decreases as it approaches 0.00 (Gorsuch, 1983). As it is known, generally a correlation coefficient between the values of 0.00 and 0.30 indicates a low correlation, while the same between the values of 0.70 and 1.00 implies a high level of correlation (Buyukozturk, 2002).

FINDINGS

The actions taken and the findings obtained within the scope of the validity and reliability analysis of the scale are presented as follows:

Findings regarding the validity of the scale

As part of the validity of the teaching materials' utilization self efficacy scale (TMUSES), its structural validity and item-total correlation were examined and the related findings are presented herein:

Structural validity

Findings relating to exploratory factor analysis

In order to test the structural validity of the TMUSES, the data was first subjected to Kaiser-Meyer-Oklin (KMO) and Bartlett test analyses and their results were determined as KMO= 0.924 and χ^2= 3476,80; sd=496 (p=0.000) for the Bartlett test. In line with these values, it was understood that factor analysis can be conducted on the 32 item scale.

In order to do so, at first principal components analysis was carried out in order to determine whether the scale is one-dimensional or not, because principal components analysis is a technique very frequently employed as a factor extraction technique (Buyukozturk, 2002). Then, the

Varimax orthogonal rotation technique was used as per the principal components. In line with this, after removing the total 9 items as 8 items with less than 0.30 item load and 1 item, the load of which was distributed into different factors, the remaining items were once again subjected to factor analysis.

In order to ensure that the scope validity was not disrupted because of the removed items, the pool of items was once again submitted to the review of two educational technology experts. Other analyses were conducted after receiving the experts' opinions, stating that the removal of the 9 items did not affect the scope validity.

After all these, it was seen that the remaining 23 items in the scale were gathered under three factors. In its 23 item final state, the scale's KMO value was found as 0.932, and the Bartlett test values were found as χ^2=2901.946, sd=253, p<0.001. The un-rotated factor loads of the remaining 23 items were found to be between the values of 0.400 and 0.632, and the rotated loads after the Varimax orthogonal rotation were found to be between 0.485 and 0.742. On the other hand, it was determined that the items and factors included in the scale explain 46.879% of the total variance. As it is know, having factor loads not lower than 0.30 and in terms of behavioural sciences having at least 40% of the variance explained is deemed sufficient (Buyukozturk, 2002; Eroglu, 2008). After examining the contexts of the items in the factors, their factor names were determined. While a total of 10 items were gathered under the factor called 'message design', another six were gathered under 'usage' and the remaining seven under the factor 'visual design'.

This can also be seen from the screen plot graphic (Figure 1) plotted according to the eigen values. The high velocity drops in the first three factors in Graphic 1 indicate that these three factors have a significant contribution to the variance, and the drops in other factors gradually becoming horizontal meaning that their contributions to the variance are close to each other (Buyukozturk, 2002; Eroglu, 2008).

Factor based loads and factor eigenvalues of the remaining 23 items and the findings concerning variance explanation percentage are given in Table 2.

As shown in Table 2, the 'message design' factor covers 10 items and the factor loads vary between the values of 0.512 and 0.742. The eigen value of this factor within the general scale is 4.592, while its contribution to the total variance is 19.966%. The factor 'Usage' incorporates six items. Factor loads of the items vary between the values of 0.545 and 0.724. The eigen value of this factor within the general scale is 3.096, while its contribution to the total variance is 13.462%. The factor 'visual design' covers seven items. Factor loads of the items vary between the values of 0.485 and 0.704. The eigen value of this factor within the general scale is 3.094, while its contribution to the total variance is 13.451%. In addition, there are no items with common factor variance less than 0.20.

Findings relating to confirmative factor analysis

In order to verify the factor structures, which were determined to consist of three factors as a consequence of the exploratory factor analysis, first and second level confirmatory factor analyses were carried out on 215 students, other than those included in the sample group, from which the data used for the exploratory factor analysis was obtained.

As a consequence of the confirmatory factor analysis carried out with no restrictions, with the use of the maximum likelihood technique, the goodness of fit values were determined to be [×2 (sd=227, N=215)= 374.51, p<.001, RMSEA= 0.055, S-RMR= 0.057, GFI= 0.91, AGFI= 0.89, CFI= 0.97, NNFI= 0.96, IFI= 0.97]. According to these values, the observed values of the scale other than GFI and AGFI show a perfect fit of data. In other words, this model shows that the factors are verified by the data. The t values in relation with the factorial model and factor-item relation of the scale are given in Figure 2.

In order to prove that the message design, usage and visual design dimensions of the scale, which were obtained by means of a first level confirmatory factor analysis, come together and represent the variable of self-efficacy perception on utilizing teaching materials as a super-concept, a second level confirmatory factor analysis was carried out. The relations between the latent variables, obtained with the first level confirmatory factor analysis, were taken as a basis for this examined model. With the analysis, also the variances that the high-level (second level) self-efficacy perception variable explains on the first level variables are determined. By adding the second level self-efficacy latent variable to the first level confirmatory structure tested with three latent and 23 indicative variables, the second level factor model was tested. The correlation diagram and t values of the second level confirmatory factor analysis of the scale are given in Figure 2.

The factor loads (Lambda x, λx), t values, and measuring errors (delta δ) between the first level latent variables in the model (message design, usage, visual design) and the self-efficacy perception as the high-level (second level) variable, and the rates of the second level variable explain the first level variables (R^2) shown in Table 3.

By examining the t values and path coefficients between the second level 'self-efficacy perception' latent variable and the first level latent variables, it was determined that the highest correlation was between self-efficacy perception and message design, and also that

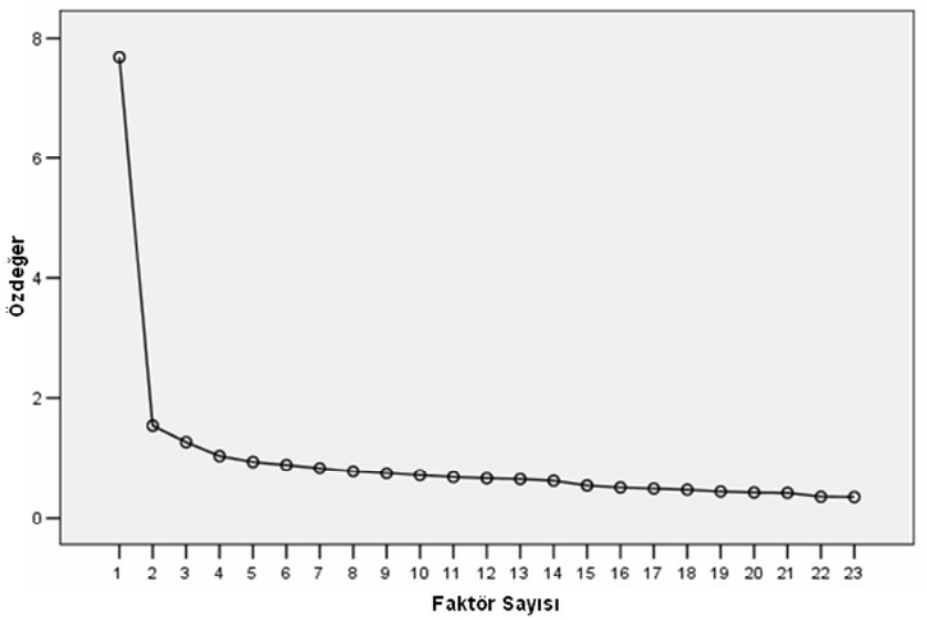

Figure 1. Screen plot graphic (eigenvalues according to the factors).

Table 2. Factor analysis results of the scale as per factors.

Items			Common factor variances	F1	F2	F3
Message design	I1	I can design teaching materials that properly reflect the context	0.632	0.742		
	I2	I can use figure-background color contrast in order to increase the understandability of the message in a teaching material.	0.521	0.663		
	I3	I can use the sizes of the visuals in order to create a sense of distance/closeness in a teaching material.	0.513	0.661		
	I4	When preparing a teaching material, I can use texture in order to create a sense of realism of the visual.	0.472	0.603		
	I5	I can choose teaching materials conforming with the teaching principles such as arranging the content from concrete to abstract, from basic to complex.	0.489	0.596		
	I6	When designing a teaching material, I can utilize sufficiently concrete visuals.	0.483	0.588		
	I7	I can select the teaching materials suitable to the teaching methods I use.	0.433	0.566		
	I8	When designing a teaching material, I can make use of spaces in order to place emphasize on the message.	0.437	0.545		

Table 2. Contd.

	I9	I can design teaching materials suitable to the type of context (cognitive, affective, psychomotor, etc.).	0.400	0.542		
	I10	I can select the teaching materials that express the message to be given in the most explicit and short way possible.	0.402	0.512		
Usage	I11	I can use the information sources on the internet as teaching materials.	0.550		0.724	
	I12	I can sufficiently utilize teaching materials for evaluating students.	0.507		0.677	
	I13	When planning educational statuses, I can decide on which phase of the course I will use the material.	0.482		0.634	
	I14	I can sufficiently utilize teaching materials for motivating students.	0.482		0.586	
	I15	I can rearrange and use an already available teaching material.	0.423		0.568	
	I16	I can sufficiently utilize teaching materials in order to attract and maintain the attentions of the students.	0.417		0.545	
Visual design	I17	I can select the teaching materials in which the visuals are designed in a more orderly and easily understandable way (where integrity is established).	0.573			0.704
	I18	I can select the teaching materials in which the amount of the information presented is suitable.	0.453			0.662
	I19	When designing a teaching material, I can properly utilize colors.	0.403			0.564
	I20	I can design up-to-date teaching materials in terms of context and visuals.	0.454			0.555
	I21	I can select the teaching materials with up-to-date context and visuals.	0.412			0.513
	I22	I can select the teaching materials suitable in terms of design elements such as texture, form-background, emphasize, line, size and space.	0.439			0.495
	I23	I can select the visuals in conformity with the type of context.	0.406			0.485
Eigenvalue				4.592	3.096	3.094
Explained variance				19.966	13.462	13.451

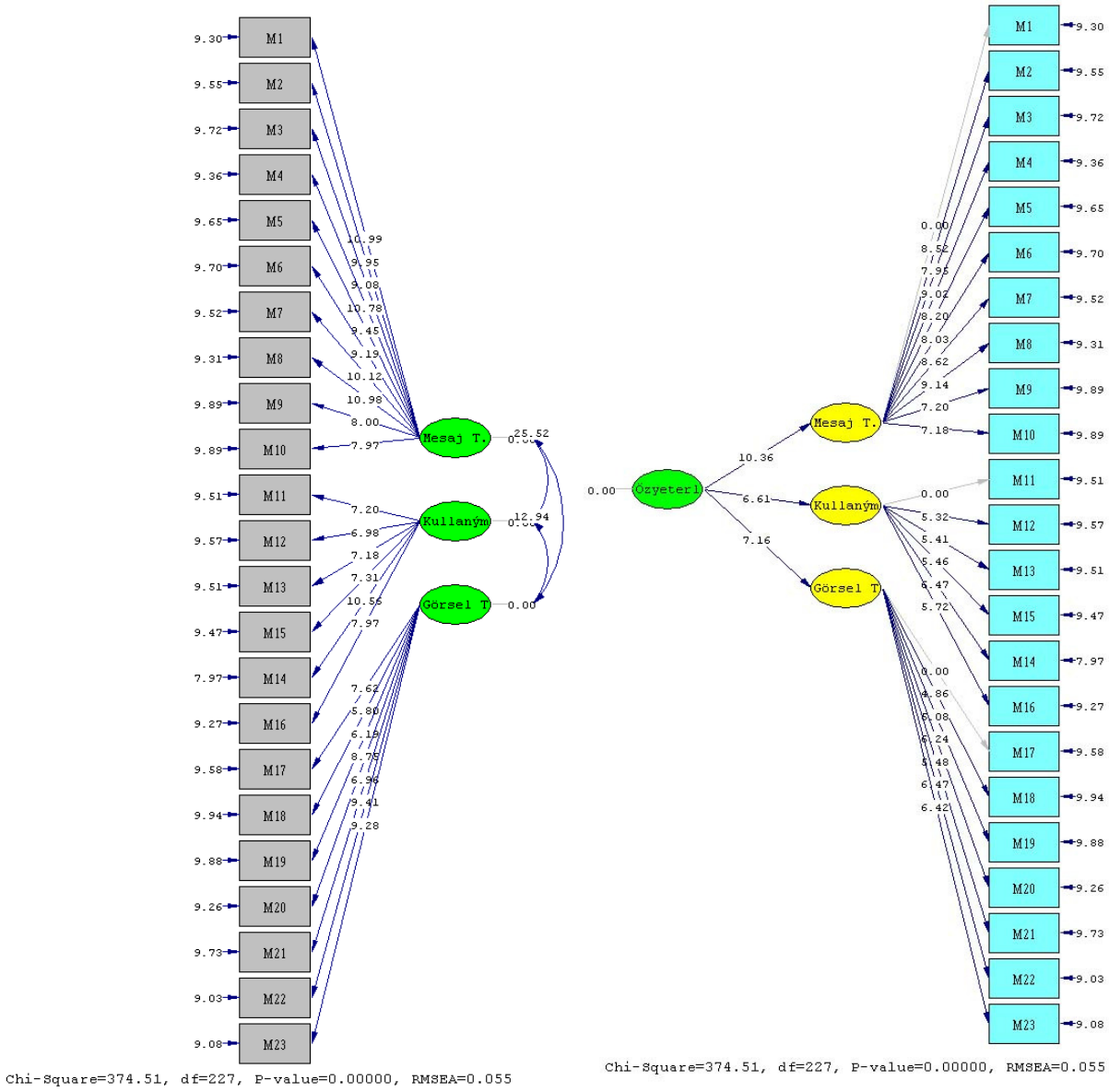

Figure 2. First and second level confirmatory factor analysis correlation diagram of the scale (t values)

Table 3. λx , δ, t and R^2 values of the second level confirmatory factor analysis on super concept - sub concept relation.

Second level variable	First level variable	λx	δ	t	R^2
Self-efficacy	Message design	1.00	0.0086	10.36	0.99
	Usage	0.83	0.314	6.61	0.69
	Visual design	0.90	0.20	7.16	0.80

the relations between the three dimensions concerned with this factor are statistically significant and positive ($p<0.05$). When the variances explained by the self-efficacy perception second level variable on the first level

variables are examined, most variability was explained in the message design (R^2 =0.99) variable, while it was followed by the Usage (R^2 =0.80) variable and Visual Design (R^2 =0.80) variable.

Item discrimination

Here, item discrimination levels, or in other words the level of each item to serve the general purpose, were determined by means of calculating the correlations between the scores obtained from each item in the factors and the scores obtained from the factors, as per the total correlation method.

The item-factor correlation values obtained for each item are given in Table 4.

As seen in Table 4, item test correlation coefficients vary between the values of 0.577 and 0.715 for the first factor, between 0.432 and 0.729 for the second factor, and between 0.545 and 0.611 for the third factor. Each item is in a positive and significant relationship with the factor in general ($p<0.000$). These coefficients are the validity coefficients of each item and indicate consistency with the whole of the scale, or in other words each item's level of serving the general purpose of the scale (Carminesi and Zeller, 1982; Yuksel, 2009, cited in Parasuraman et al., 1988). With the same purpose, also the corrected correlations between the total score of the factor and each item, calculated by subtracting the items' score, were calculated and are presented in Table 5.

As seen from Table 5, the corrected correlation coefficients of each item in the scale were found to be between the values of 0.452 and 0.621 for the first factor, between 0.304 and 0.432 for the second factor, and between 0.330 and 0.444 for the third factor. As it is known, corrected correlation coefficients higher than 0.20 indicate that the item serves the purpose of the related factor in a significant way (Tavsancil, 2010).

Findings considering the reliability of the scale

In order to calculate the reliability of the scale, the data was subjected to internal consistency and stability analysis. The actions taken and the findings obtained are therefore submitted:

Internal consistency level

The scale's factor based and whole reliability analysis was carried out by using Cronbach's alpha reliability coefficient, the correlation value between two congruent halves, the Sperman-Brown formula and Guttmann split-half reliability formula. Reliability analysis values considering each individual factor and the scale as a whole are summarized in Table 6.

As can be seen from Table 6, the two congruent halves' correlations of the scale consisting of three sub-factors and 23 total items is 0.667, while its Sperman-Brown reliability coefficient is 0.801, the Guttmann Split-Half value is 0.800 and Cronbach's alpha reliability coefficient is 0.822.

On the other hand, in terms of factors it is observed that congruent halves correlations are between 0.481 and 0.710. Sperman-Brown values are between 0.650 and 0.831, Guttmann Split-Half values are between 0.621 and 0.830, and Cronbach's alpha values are between 0.0620 and 0.835.

Stability level

The stability level of the scale was determined by using the test-retest method. As known, a reliable measuring tool has to be capable of making stable measurements (Balci, 2009). The final 23 items of the scale were resubmitted to the 65 students, to whom the scale was originally applied, after five weeks. The relationship between the points scored from the two separate implementations was examined in terms of both individual items and the whole of the scale. By this way, the capability of each individual item and the scale itself to make stable measurements was tested. The findings are summarized in Table 7.

From Table 7 it can be seen that the correlation coefficients of each item obtained from test-retest method vary between the values of 0.253 and 0.670, and that each relationship is positive and significant ($p<0.001$). As for the correlation coefficients of the factors constituting the scale, obtained through the test-retest method, they vary between the values of 0.761 and 0.885, and each of them are statistically significant and positive ($P<0.000$). As it is know, reliability is related with the consistency, stability and sensitivity of the scale. Due to this reason, these values determined as the stability coefficient are considered to show that the scale has reliability (Hovardaoglu, 2000). According to this, it is possible to state that the scale is capable of making stable measurements.

DISCUSSION

In this study, a scale intended to measure the self-efficacy perceptions of teacher candidates on utilizing teaching materials. TMUSES is a five point Likert-type scale and consists of 23 items gathered under three factors. Each item under the factors is scaled with the choices of: never (1), rarely (2), sometimes (3), usually (4) and always (5). The validity of the scale was examined

Table 4. Item-factor scores correlation analysis.

F1 (Message design)		F2 (usage)		F3 (Visual design)	
I. Nu	R	I. Nu	r	I. Nu	R
I1	0.715(**)	I11	0.432(**)	I17	0.563(**)
I2	0.640(**)	I12	0.500(**)	I18	0.545(**)
I3	0.652(**)	I13	0.486(**)	I19	0.584(**)
I4	0.638(**)	I14	0.560(**)	I20	0.584(**)
I5	0.635(**)	I15	0.729(**)	I21	0.562(**)
I6	0.625(**)	I16	0.511(**)	I22	0.611(**)
I7	0.647(**)			I23	0.563(**)
I8	0.638(**)				
I9	0.585(**)				
I10	0.577(**)				

N=439; **=p<0.001.

Table 5. Item-factor scores corrected correlation analysis.

F1 (Message design)		F2 (Usage)		F3 (Visual design)	
I. Nu	R	I. Nu	I. Nu	R	I. Nu
I1	0.621	I11	0.432	I17	0.330
I2	0.542	I12	0.328	I18	0.399
I3	0.539	I13	0.316	I19	0.420
I4	0.536	I14	0.392	I20	0.330
I5	0.523	I15	0.304	I21	0.389
I6	0.513	I16	0.330	I22	0.444
I7	0.543			I23	0.378
I8	0.529				
I9	0.463				
I10	0.452				

N=439.

Table 6. Reliability analysis results considering the whole of the scale and its factors.

Factor	Number of items	Two congruent halves correlation	Sperman-Brown	Guttmann split-half	Cronbach alpha
Message design	10	0.710	0.831	0.830	0.835
Usage	6	0.483	0.651	0.649	0.685
Visual design	7	0.481	0.650	0.621	0.620
Total	23	0.667	0.801	0.800	0.822

with two different methods. These are: (1) factor analysis and (2) determination of validity through discrimination characteristics.

According to the results of the exploratory factor analysis, the scale consists of three factors. Considering the factor loads, factor eigenvalues and rates of explained variances of the items under the factors, it is possible to state that the scale has structural validity.

In order to verify the factor structures of the scale, determined to consist of three factors as a consequence of exploratory factor analysis, first and second level confirmatory factor analysis was conducted. As a consequence of the confirmatory factor analysis conducted, according to both primary and secondary

Table 7. Test-retest results of the items of the scale.

I. Nu	*r*	I. Nu	*r*	I. Nu	*R*
I 1	0.670(**)	I 9	0.302(*)	I 17	0.419(**)
I 2	0.629(**)	I 10	0.526(**)	I 18	0.464(**)
I 3	0.558(**)	I 11	0.253(*)	I 19	0.525(**)
I 4	0.591(**)	I 12	0.532(**)	I 20	0.570(**)
I 5	0.613(**)	I 13	0.378(**)	I 21	0.442(**)
I 6	0.598(**)	I 14	0.559(**)	I 22	0.525(**)
I 7	0.668(**)	I 15	0.576(**)	I 23	0.416(**)
I 8	0.637(**)	I 16	0.655(**)	F1	0.852(**)
F2	0.761(**)	F3	0.768(**)	Total	0.885(**)

N: 65; *=p<0.001: **=p<0.000.

confirmatory factor analysis results, the observed values of the scale model prove that the data shows compliance, or in other words, that this model is verified by the data.

In order to determine that the level of each of the items included in the scale is capable of measuring the attributes measured by the respective factors, item-factor correlations were calculated for the data. According to the values obtained, it was observed that each item and each factor included in the scale significantly serves the purpose of the whole scale, and each item is satisfactorily discriminative.

In order to determine the criterion validity (similar scales or already) of the scale, related literature was reviewed; yet, since no similar scale was found in terms of context and purpose, similar scales' validity could not be calculated.

The internal consistency coefficients of the scale were calculated by using two congruent halves' correlations, Cronbach's alpha, the Sperman-Brown formula and Guttmann split-half reliability formula. In line with these values, it is possible to assert that the scale is capable of making reliable measurements.

In order to determine the time based invariance level of the scale, the test-retest method was used by utilizing the data collected in two implementations made with an interval of five weeks. The test-retest method has been calculated for the sub factors of the scale and for each separate item. According to the calculated correlation coefficients, 22 of the items of the scale have a medium correlation, while one has a low correlation. On the other hand, all three of the factors were found to have a high level of correlation. According to this, all items and all factors included in the scale are capable of making stable measurements in terms of time based invariance.

Conclusion

It is possible to state that the TMUSES is a valid and reliable scale that can be used to determine teacher candidates' self-efficacy perceptions in utilizing teaching materials.

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