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Development of the Perception Scale for Flipped Learning Model

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The main purpose of this research is to develop a measure to determine university students' perceptions of the flipped learning model. Exploratory and confirmatory factor analysis were conducted within the scope of the validity study of the scale, and its internal consistency was analyzed for its reliability. The data for exploratory factor analysis was collected from 360 pre-service teachers who experienced the flipped learning model in the 2019-2020 academic year. As a result of the exploratory factor analysis, a three-dimensional structure (learning readiness, learning support and motivational interaction) consisting of 22 items was obtained, and factor loadings were between .82 and .50. The total variance ratio explained by the factors of the scale was determined as 57.59. Moreover, the confirmatory factor analysis was carried out on the data obtained from 354 pre-service teachers who did not participate in the exploratory factor analysis study. The most important values for CFA were χ^2 =719.34; df=201; RMSEA = 0.08; SRMR =0.06; CFI = 0.97 and NNFI =0.97, which showed an acceptable level of fit confirming the three-factor structure. The findings show that the developed scale is a valid and reliable measure to determine the perceptions of university students regarding the flipped learning model.

Keywords: flipped learning, perception scale, university students, exploratory factor analysis, confirmatory factor analysis

INTRODUCTION

Active learning strategies are promoted in contemporary learning models, where students interact with the content, peers, and the instructor more instead of passively listening to the lectures. The pandemic we are in reminded us of the availability and plethora of learning resources in almost any field. Thus, the key in learning is not only having the resources, but also strengthening ourselves and our students about how to genuinely apply that knowledge.

In recent years, educators have been searching for more active learning strategies in various fields in higher education. Flipped learning model, which has gained popularity in recent years, is among the contemporary application models for active learning strategies in the classroom. Flipped classroom method offers a strong structure for active engagement of students in learning activities (Berrett, 2012; Day & Foley, 2006; Fisher et al., 2018). The transformation in the learning culture in the flipped classroom leads to a student-centered approach rather than teacher-centered (Hamdan et al., 2013; Muir & Chick, 2014). In flipped approach, students individually engage with content before the face-

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to-face sessions through the instructional videos and/or other instructional materials, and more active learning methods are applied in face-to-face sessions such as interactive engagement, just-in-time teaching and peer instruction (Bhagat et al., 2016; Berrett, 2012; Fisher et al., 2018).

Although the concept of "flipped classroom" and application of its components is not new in education, it has popularized by the work of two high school chemistry teachers, Jonathan Bergmann and Aaron Sams (2012), and later applied by many educators from different educational levels (Crouch & Mazur, 2001; McDonald & Smith, 2013; Shana & Alwaely, 2021). The flipped learning method is a personalized method by providing resources for different learning needs and transforming the face-to-face sessions into an environment where applications are made for the relevant subject, where learning is evaluated by process evaluation, and individual and group work is carried out when necessary. It is a learning approach that enables individual learning.

Although when it comes to the term "flipped classroom" it is new, many of the teaching approaches adopted by this model, such as active learning, research and inquiry, student-centered teaching, are successful teaching approaches used at different levels (Bergmann & Sams, 2012; Day & Foley, 2006). The original feature of the flipped learning model is the blending of these successful teaching strategies with video and audio recordings created using increasingly popular digital technologies. Thanks to this method, more time can be spared for practice-oriented teaching strategies, collaborative work activities and group discussions on concepts in face-to-face sessions (McDonald & Smith, 2013). According to McDonald and Smith (2013), flipped learning model enables learners with intensive programs to watch videos whenever it is suitable, eliminating time problems, and for those who have difficulty in comprehending the content, it offers the opportunity to stop and re-watch them wherever they want.

Hamdan et al. (2013) identified four pillars of flipped learning as: flexible learning environments, a shift in learning culture, intentional content, and professional educators. Time and location flexibility for watching video lectures, face-to-face sessions become more collaborative, active, and engaging (Awidi & Paynter, 2019; Bergmann & Sams, 2012; Chen Hsieh et al., 2017; Kong et al., 2020; McDonald & Smith, 2013). A shift in the learning culture, "where in-class time is meant for exploring topics in greater depth and creating richer learning opportunities" (Hamdan et al., 2013, p. 5), thus focusing more on student-centered instruction than teacher-centered. With the intentional content selected by the instructor, students can learn from the instructor and peers in face-to-face sessions after viewing the materials as many times as they needed before the face-to-face sessions (Bergmann & Sams, 2012; Connell et al., 2016; Halili et al., 2014; Lai & Hwang, 2016; Love et al., 2014; McDonald & Smith, 2013; Tucker, 2012). Professional educators are more demanding in flipped learning to make the critical decisions such as when to apply individual and group work and providing continuous feedback.

The flipped method applied in this study is a combination of different application strategies. Pre-service teachers watched videos related to the content prior to the face-to-face sessions, but videos were not recorded by the lecturers as mentioned in standard and demonstration-based flipped methods. Instead, the weekly videos were selected from the social networking site "YouTube." In the flipped classroom model, teachers may record themselves teaching or curate video lessons from internet sites (Hamdan et al., 2013; Muir & Chick, 2014). On the other hand, similar to the demonstration-based flipped method explained by Duffy et.al. (2020), in this study, pre-service teachers learned the activity steps at their own pace through the videos shared with them prior to the face-to-face sessions, and completed assignments repeating the steps. Similar to the faux flipped classroom, some pre-service teachers watched the tutorial videos in the face-to-face sessions because of some technology shortcomings or ingrained study habits. The teacher provided the individual assistance when they needed it, allowing them to review materials at self-paced. Although there were not permanent study

groups in this study, study groups emerged naturally as some of the pre-service teachers with higher level technology skills or pre-service teachers who prepared well prior to the face-to-face sessions volunteered to assist their peers on the assignments. The assignments were collected through the learning management system.

Literature Review

Flipped learning approach and its outcomes have been gaining popularity. Studies investigate the effectiveness or impact of the model and/or specific components or instructional elements of flipped applications (e.g. Awidi & Paynter, 2019; Halili et al., 2014; Jensen et al., 2015; Lai & Hwang, 2016; Love et al., 2014). Perception studies on flipped learning also have different focuses. Some of them are on student performance and engagement (Gómez-Carrasco et al., 2020; Gonza´lez-Go´mez et al., 2016; Lopes&Soares, 2018; McLaughlin et al., 2014); while some of them are specifically examine student perception of flipped model itself (Blair, Maharaj, & Primus, 2016; Musdi, Agustyani, & Tasman, 2019; Öncel & Kara, 2019; Unal & Unal, 2017). Studies also conducted on evaluation of application of flipped models in a particular content area or in combination with some other learning strategies (Fauzan & Ngabut, 2018; Shih & Tsai, 2017).

Awidi and Paynter (2019) argue that the baseline for the flipped learning approach is that students are learning experientially and constructing their knowledge actively. They suggest that *experiential learning* means construction of knowledge and its meaning could be extended to include learning through interaction with peers and the instructor. It also includes being able to transfer one's knowledge and skills to other contexts and deeper conceptualization of the content. In this sense, they suggest following scaffolds which would be the determining factors in flipped learning applications: access to the learning resources, support and motivation, active participation, collaboration and feedback. The authors argue that only focusing on the outcomes would not provide a healthy evaluation of the model without the investigation of the above-mentioned variables in a flipped learning application.

Several studies report positive gains from the flipped method such as improvements in student outcomes and attitudes, and greater student engagement and motivation (Awidi & Paynter, 2019; Bhagat et al., 2016; Day & Foley, 2006; Love et al., 2014; Tune et al., 2013). However, Jensen et al. (2015) lament that many factors change between treatments, like applying more active learning strategies, introducing additional technology to students, and higher interaction with peers. On the other hand, the authors value the supportive structure of flipped approach in terms of motivating using active learning strategies more. In this sense, even if it is not always possible to control all other potential causative variables, it is important to be able to identify which components and factors of a flipped model application contribute to the improvement regardless of the improvement which is related to achievement, affective or motivational.

Challenges to flipped learning were also reported by earlier studies. Some of the challenges were determined as being time consuming for the instructor, since she/he need to redesign the course, which requires completion of additional tasks such as recording videos and creating presentations for at home class preparation, developing meaningful in-class activities, etc. (Akçayır & Akçayır, 2018; Al Mulhim, 2021). At the same time, technical problems may be faced by the instructor or students, or the technology skills or the content could be insufficient (Al Mulhim, 2021, Pratiwi, et al., 2022). On the other hand, this student-centered model heavily relies on preparation of students before class. However, students may come to class with inadequate preparation (Akçayır & Akçayır, 2018). Poor preparation may reduce students' engagement and might prevent using in-class time effectively (Al Mulhim, 2021, Pratiwi, et al., 2022). Additionally, some students may not learn outside of the class through the materials, and/or may need more scaffolding (Akçayır & Akçayır, 2018; Shyr & Chen, 2018).

Most of prior literature on student perception, either apply qualitative methods and ask open-ended questions to the participants or used combination of Likert type scale items with open-ended questions. For example, González-Gómez, Jeong, & Rodríguez (2016) applied a questionnaire that consists of 8 four-point Likert-type scale questions and one open-ended question. The authors reported a general positive opinion about the flipped model. The majority of the students found useful the video lessons provided, not only for achieving the learning objectives but also engaging them more effectively in the course. They also highlighted that the flipped activities were more students' oriented than the traditional settings. Students agreed that the flipped instruction provided them the opportunities to work in their own place, and re-watching the multimedia to catch up on missed materials. Although the survey had Likert types questions, this study did not aim a scale development and only descriptive statistical results have been provided. In McLaughlin et al. (2014) study also Likert types questions on student perception of flipped method were included, due to the small sample size and use of short Likert scales, nonparametric tests were conducted to analyze the data and neither of exploratory or confirmatory factor analysis were applied. According to the study results, student class preparation time was longer and they spent more time for applied learning. Students also reported learning key concepts prior to the face-to-face sessions improved them in-class learning. Although several studies have been conducted on perception of flipped learning, none of them focus on scale development. Even if Colomo-Magaña et al. (2020) study evaluated the usefulness of the flipped classroom as a learning methodology with a validated scale, the authors urge that this instrument was not created specifically for that particular study and it has some limitations. Love et al. (2014) reported significant promise of the flipped model, while at the same time they argue that building the foundation of systematic research that explores nature, utility, and effectiveness of the flipped learning model is critical. In this regard, this study can contribute to the literature by providing a valid and reliable scale to measure student perception for future flipped learning studies.

METHOD

The aim of the current study is to develop a scale to measure the perceptions of university students regarding the flipped learning model**.** For this purpose, following questions were investigated.

- Is the flipped learning model perception scale a valid measurement tool?
- Is the flipped learning model perception scale a reliable measurement tool?

Sampling

This study was conducted with two different samples. The convenience sampling method was used in the selection of the participants. The first implementation was carried out in the 2019-2020 academic year and data were collected from 378 pre-service teachers, and the scales of 18 participants were not taken into consideration as a result of various analyzes (identified missing values and examined Z scores and box plots). Thus, 360 pre-service teachers constituted the working group of the first application, Exploratory Factor Analysis (EFA), which used in defining the sub-dimensions that make up the characteristic that is desired to be measured. It is stated as a general rule that at least 300 samples are appropriate in factor analysis (Çokluk et al., 2021). In addition, the sample number of 360 pre-service teachers meet the criterion (Kline, 2005) for the use of factor analysis technique, which states that the sample size is ten times the number of items.

The second application, Confirmatory Factor Analysis (CFA, which is used to confirm the structure revealed by Exploratory Factor Analysis, Çokluk et al., 2021), was carried out in the 2020-2021 academic year and data were collected from 363 pre-service teachers who did not participate in the exploratory factor analysis study. As a result of identify missing values and examine Z scores and box plots the scales of 9 participants were not included in the evaluation. Thus, 354 pre-service teachers formed the participant group of the second application. At this stage of the study in which the scale

was tested, the perception levels of the pre-service teachers regarding the flipped learning model according to some demographic variables were also examined. Demographic information about the study groups is given in Table 1.

Table1
Demographic Information on Working Groups

Sample I	f	%	Sample II	f	%
Gender					
Female	239	66.4	Female	269	76.0
Male	121	33.6	Male	85	24.0
Age					
18-19	262	72.8	18-19	262	74.0
20-21	91	25.3	20-21	74	20.9
22 and older	7	1.9	22 and older	18	5.1
Department					
Elementary Science Education	39	10.8	Elementary Science Education	72	20.3
English Language Education	59	16.4	English Language Education	18	5.1
Elementary Math. Education	56	15.6	Elementary Math. Education	52	14.7
Early Childhood Education	60	16.7	Early Childhood Education	48	13.6
Special Education	79	21.9	Special Education	61	17.2
Primary School Education	44	12.2	Primary School Education	65	18.4
Social Studies Education	23	6.4	Social Studies Education	38	10.7
Perceived IT Competence					
High competence	21	5.8	High competence	9	2.5
Good competence	106	29.4	Good competence	100	28.2
Moderate competence	177	49.2	Moderate competence	178	50.3
Low competence	47	13.1	Low competence	56	15.8
No competence	9	2.5	No competence	11	3.1
Total	360	100	Total	354	100

For the Sample I, most of participants were women and most of them were between the ages of 18-19. Participants mostly consider themselves to be moderately competent in using IT, some of them see their competence as being on a good level. In Sample II most of the participants were women, most of them were between the ages of 18-19. Participants mostly consider themselves to be moderately competent in using ICT, some of them see their competence as being on a good level. In both study groups, it is observed that pre-service teachers are generally self-confident in the use of ICT.

Item Generation

This scale, which was developed to measure the perceptions of university students towards the flipped learning model, is in the 5-point Likert type. In the process of developing a Likert-type scale, a series of steps must be taken gradually. These procedures are (1) determining the structure to be measured by scanning the literature, (2) determining the format of the measure, (3) creating an item pool, (4) evaluating the item pool by experts, (5) preparing the draft scale, (6) applying the scale, (7) validity

and reliability studies and (8) finalizing the scale (DeVellis, 2012; Tezbaşaran, 2008). The steps followed in the scale development process in this research are explained below.

During the preparation of the pilot form, related literature has been reviewed to identify the indicators pertinent to the flipped learning. Due to not a particular body of literature existing on practical tools for content development, several related topics on literature were scanned. The studies about the flipped learning model and the scale items developed for the flipped learning model were examined (Awidi & Paynter, 2019; Hamdan et al.,2013; Jensen et al., 2015; Long et al., 2016; McLaughlin et.al., 2014; Roach, 2014; Sletten, 2017; Wanner & Palmer, 2015; Zainuddin & Attaran, 2016). Five studies (Awidi & Paynter, 2019; Halili et al., 2014; Jensen et al., 2015; Lai & Hwang, 2016; Love et al., 2014) mostly shaped the generation of the item pool. Additional items were also written by the research team that consist of four experts from the fields of Computer and Instructional Technologies and Measurement and Evaluation. Then synchronous and asynchronous discussions were held to form the last version of the items. Through the literature review and contribution of the experts, a pool consisting of a 42-item draft form was prepared in line with the literature and expert opinions to assess pre-service teachers' perception of flipped learning. The levels of pre-service teachers' agreement to the items in the scale were classified as 1 "Strongly disagree", 2 "Disagree", 3 "Undecideds", 4 "Agree", 5 "Strongly Agree".

In order to ensure the content and face validity of the measure, the opinions of the experts were consulted. Experts were asked to examine the items in terms of theoretical structure, meaning and language. In line with the expert opinions, some items were removed, and some items were changed in terms of expression. Statements that contain more than one item have been divided. There was a total of 31 items in the final draft scale form. All of the items in the scale are positive. A personal information form, which includes five questions about gender, age, department and perceived ICT use competence, was also added to the scale form and made ready for application. The prepared trial form was applied to ten pre-service teachers studying at a state university and its comprehensibility was checked. No changes were needed on the trial form. The time required for filling the measure is determined as 10 minutes.

Data Collection Process

Within the scope of the first application, data were collected in the 2019-2020 academic year, and within the scope of the second application, data were collected from volunteer pre-service teachers in the 2020-2021 academic year. The scale was applied online. The scale was open for a week. Participants were informed verbally and / or in writing (in the instructions on the top of the scale) that the study was conducted for scientific purposes and that personal information would be kept completely confidential. During the research, participant information was kept confidential.

Data Analysis

Exploratory and confirmatory factor analysis techniques were used to generate evidence for the construct validity of the scale. In order to determine the reliability of the scale in terms of internal consistency, item total scores of each item and Cronbach-Alpha reliability coefficients were calculated to decide which items will remain in the scale. Exploratory factor analysis was performed using SPSS 22 package software, and confirmatory factor analysis was performed using LISREL 8.80 software.

Before analyzing the data in the study, the status of the data meeting the hypothetical criteria was examined. In order to control incorrect data entry and missing values in the data sets, a frequency table was created for all items, and any erroneous or missing data was not detected. Following this stage, normality distributions were examined. In determining the extreme values, the scores of the items were converted to the standard Z score, and it was examined whether the Z scores of items were between -3

and +3. The data whose Z score is out of this score range are considered extreme values (Çokluk et al., 2021). In determining the extreme values, box plots were also used. As a result of these processes, 18 participants from the first data set and 9 participants from the second data set were removed. Accordingly, exploratory factor analysis was carried out with 360 and confirmatory factor analysis with 354 participants. As another assumption to be examined on the data, the skewness (-.38) and kurtosis values (-.34) were calculated and it was determined that they were within acceptable limits for the assumption of normality. While evaluating the skewness and kurtosis coefficients, the range of +1.50 and -1.50 values was taken as the basis (Tabachnick & Fidell, 2015).

After examining the normality distributions, it was checked whether the data were suitable for factor analysis. Sample size was taken as the first condition. In factor analysis, it is suggested that in order for the sample size to be acceptable, the number of the participants should be at least 10 times of the number of items in the measure (Kline, 2005). Accordingly, the sample size can be considered to be sufficient for the draft scale form consisting of 31 items. Kaiser-Meyer-Olkin (KMO) test, which is another criterion to determine the suitability of the data for factor analysis in terms of sample size, was performed and the KMO value was calculated as .929. A KMO value higher than .50 means that factor analysis can be performed (Tabachnick & Fidell, 2015). In addition, Barlett's Sphericity test was used to examine whether the data came from a multivariate normal distribution. The fact that the chi-square test statistic obtained as a result of this test is significant indicates that the data come from a multivariate normal distribution (Cokluk et al., 2021). The result of the Barlett's Sphericity test ($\chi 2$ =5904.379; $p<0.001$) which shows that the data are suitable for factor analysis, were found to be significant and it was concluded that the data collected from the sample were suitable for factor analysis (Çokluk et al., 2021).

FINDINGS

In this part of the study, the findings obtained from the validity and reliability studies of the Flipped Learning Perception Scale are presented.

Exploratory Factor Analysis Results

In order to reveal the factor pattern of the scale, principal component analysis was used as the factoring method, and varimax vertical axis rotation was used as the rotation method. In determining the factor structure, the eigenvalue of each factor was at least 1, the item load values were at least .32, and the difference between the two factor loads of the same item was at least .10 (Çokluk et.al., 2021). In order to reveal the factor structure of the scale, unrotated principal components analysis was carried out with 31 items. As a result of the first analysis, a 6-factor structure with an eigenvalue above 1 emerged. Since the contribution of each factor to the total variance is expected to be 5% or more in the evaluation of the number of factors (Yaşlıoğlu, 2017), it was determined that the first three factors contributed 5% or more to the total variance, so it was decided to have a 3-factor structure. After determining the factor number of the scale, varimax technique, which is one of the vertical rotation techniques, was used for the distribution of the items to the factors. As a result of the analysis, items 11, 20, 21, 22, and 27, which had a high load value in more than one factor at the same time, and 13, 28, 29 and 30 items that did not fit the factor structure of the scale were removed from the scale. together with descriptive data on the substances After determining the factor number of the scale, varimax technique, which is one of the vertical rotation techniques, was used for the distribution of the items to the factors. As a result of the analysis, items 11, 20, 21, 22, and 27, which had a high load value in more than one factor at the same time, and 13, 28, 29 and 30 items that did not fit the factor structure of the scale were removed from the scale. Together with descriptive data on the substances factor loadings and item total correlations of 22 items belonging to the flipped learning model perception scale are presented in Table 2.

Table 2
Exploratory factor analysis results

Item (Pre EFA)	Item (Post EFA)	*Items*	*X*	*Sd*	*LR*	*LS*	*MI*	*Item-total Correlations*
In a flipped learning context,								
6	1	ready-made tutorial videos on the related topics make my study easier.	4.24	.93	.711			.671
5	2	pre-class watched tutorial videos help me to learn at the class session.	3.95	1.03	.822			.744
8	3	pre-shared tutorial videos motivate me to participate in the planned learning activities at the class.	3.81	1.09	.734			.728
9	4	pre-shared tutorial videos motivate me to read and research more about the related topics.	3.48	1.10	.602			.606
4	5	pre-shared handouts and tutorial videos allow me to be prepared for the class.	4.22	.92	.770			.669
In a flipped learning context,								
10	6	every activity is designed to have a purpose.	4.18	.83		.563		.619
3	7	necessary information (course structure, grading system, etc.) is given to complete the course successfully.	4.37	.77		.705		.549
2	8	necessary resources (presentation, document, video, etc.) are provided to complete the course successfully.	4.36	.75		.718		.595
24	9	a learner-centered environment is provided.	4.10	.91		.501		.615
7	10	in-class activities support the learning process.	4.31	.84		.615		.574
1	11	the general structure of the course facilitates learning.	3.83	.86		.513		.570
25	12	lecturer meets my learning needs.	4.40	.81		.655		.585
26	13	given feedback gives me direction on how to improve myself.	4.16	.81		.606		.632
23	14	my expectations from a university-level course are met.	3.97	.96		.540		.668
The flipped learning model,								
17	15	contributes to my creative thinking skills.	3.90	.98			.691	.688
18	16	makes me feel more confident.	3.68	1.09			.734	.720
12	17	provides a better learning experience than traditional courses.	3.92	1.06			.609	.668
16	18	makes me more active in class.	3.78	1.06			.734	.758
15	19	increases my interaction with the instructor.	3.77	1.06			.736	.736
14	20	increases my interaction with my friends.	3.74	1.09			.746	.744
19	21	makes the course more enjoyable.	3.76	1.07			.691	.516
31	22	encourages me to enroll in other flipped courses.	3.50	1.28			.570	.571
Variance Explained: 42.77% (Factor1), 8.05% (Factor2), 6.80% (Factor3) Total Variance Explained: 57.59%								

In Table 2, exploratory factor analysis studies revealed that the scale has a three-factor structure. The content of perception expressions in the factors were analyzed. The first factor was called learning readiness, the second factor was learning support, and the third factor was motivational interaction. The first factor of the scale explains 42.77 of the total variance with 5 items, the second factor explains 8.05 of the total variance with 9 items, and the third factor explains 6.80 of the total variance with 8 items. The factor loads of the items in the first factor ranged from .822 to .602; the loadings of the items belonging to the second factor are between .718 and .501; item loadings of the third factor ranged from .746 to .570. All factors explain 57.59% of the total variance. It is emphasized that the explained variance exceeds 50% of the total variance, which is an important criterion of factor analysis (Yaşlıoğlu, 2017). In order to determine the reliability of the scale, the Cronbach-Alpha internal consistency coefficient of the scale was examined. The Cronbach-Alpha reliability coefficients of the overall scale and for the factors are given in Table 3.

Table 3
Cronbach alpha reliability coefficients

Perception Scale for Flipped Learning Model	Cronbach-Alpha Internal Consistency Coefficients
Learning readiness	α =0.862
Learning support	α =0.868
Motivational interaction	α =0.893
Overall	α =0.934

As a result of the analysis, the internal consistency coefficient of the whole scale was found as .934, excellent, and the reliability coefficients of the first, second and third factors were found as .862, .868 and .893, respectively as seen Table 3. If the Cronbach-Alpha coefficient is above .70, it shows that the reliability level is sufficient (Kline, 2005). In this context, the reliability values obtained for the scale and scale factors show that the scale is a reliable data collection tool.

Confirmatory Factor Analysis

Confirmatory factor analysis was used to verify the 22-item final form of the Flipped Learning Perception Scale (Table 2). Scale items were realized through a standardized solution with the help of LISREL 8.80 software. In the following process, error variances, significance of t values and fit indices were discussed. In Figure 1, the path diagram regarding the latent variables underlying the single-factor structure of the scale revealed by the exploratory factor analysis is presented (Ki-kare: 1033.74; sd: 206; RMSEA: .11, before modification).

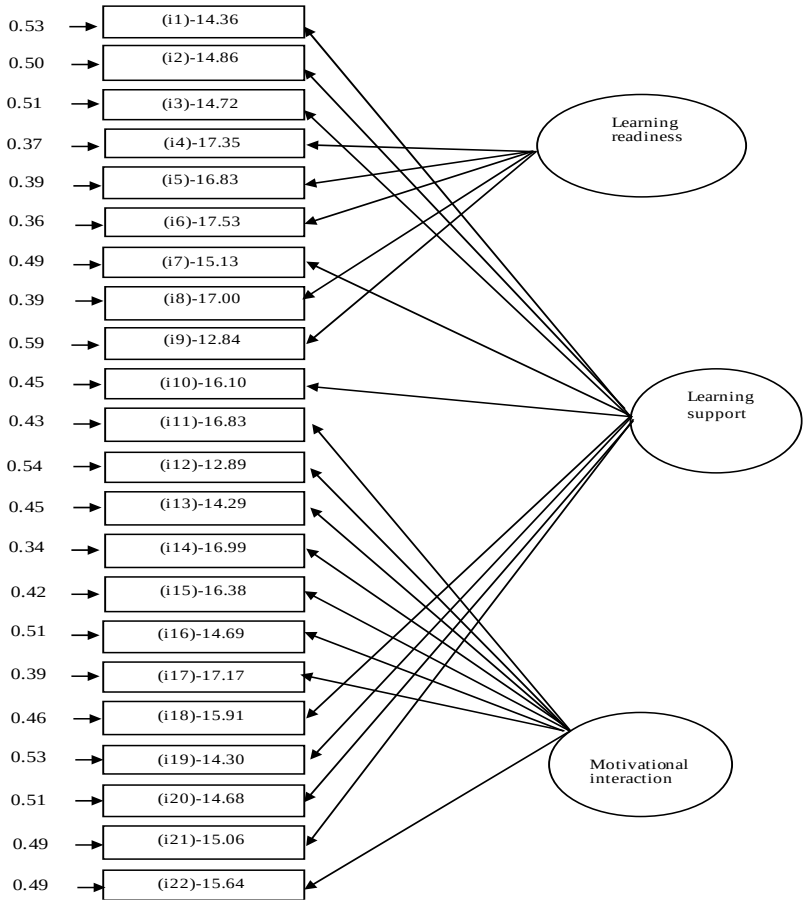

Figure1
Confirmatory factor analysis results

As seen in Figure 1, there is no high value worth extracting items in the context of error variances seen in the left part and since, all t values in the right part are above the critical value of 2.56, it is significant at .01 level. In order to reduce the $\chi 2$ value in line with the modification suggestions; in other words, by adding error variance through item associations, some items were associated within the framework of error variances in order for the scale to reach a desired level of structure. When the scale items were analyzed semantically in this direction, among the 35 modification suggestions proposed by the software, 6 modifications were selected that could be considered together with the findings in the relevant literature. Item associations were carried out as listed in the Table 4.

Table 4
Item associations and rationales from the literature

Items	Literature	Error covariance
i18-i19	The majority of students in both sections labeled the in-class activities as most beneficial to their learning. The most valid conclusion from this is that the presence of the instructor and/or peer interaction had greater influence on students' perceptions of learning than the activities themselves. (Jensen et al.2015)	+0.32
i7-i8	The main purpose of a motivational procedure is to ensure individuals to be reluctant, productive and active in a non-persistent manner. Individuals give effort as long as their essential needs are met, and thus their motivations will increase (Demirtas, 2005).	+0.13
i15-i18	The findings are that flipped and blended learning do positively influence perceptions of engagement, performance and satisfaction, but that flipped learning mediates the effects of blended learning, underscoring that blended learning pedagogies are delivery mechanisms that do not influence learning. (Fisher et al., 2018)	+0.18
i4-i3	Cornelius & Gordon (2008) found that student-centered learning was facilitated by flexibility in content delivery and study strategies, and individual student learning needs were accommodated.	+0.13
i22-i20	Among various learning modes, flipped classrooms are considered as an effective mode for engaging students in active learning as well as in meaningful peer-to-peer and peer-to-teacher interactions during the in-class learning process (Lai & Hwang, 2016)	+0.09
i17-i6	The main idea is sharing videos, recorded lectures, and other instructional items before class. Then, in- class time is spent for complex problem solving, deeper conceptual understanding, and peer interaction (Jensen et al., 2015)	+0.10

Following the modification process, the values of fit indices were discussed in the light of the literature. Please see Table 2-Post EFA column for the Post EFA items. Table 5 contains the values in the various sources that are applied for interpreting confirmatory factor analysis.

Table 5
Evaluation of confirmatory factor analysis

Index	Fit indices	Values	Resource
χ^2	$0 \leq \chi^2 \leq 2sd$	719.34>402	Yılmaz & Çelik (2009)
p değeri	$0.05 \leq p \leq 1.00$	<.05	Hoyle (1995)
χ^2 /sd	$0 \leq \chi^2 /sd \leq 2$	3.57	Tabachnick & Fidell (2015)
RMSEA	$0 \leq RMSEA \leq 0.05$	0.08	Raykov & Marcoulides (2006)
SRMR	$0 \leq SRMR \leq 0.05$	0.06	Sümer (2000)
NFI	$0.95 \leq NFI \leq 1.00$	0.96	Thompson (2008)
NNFI	$0.95 \leq NNFI \leq 1.00$	0.97	Raykov & Marcoulides (2006)
CFI	$0.95 \leq CFI \leq 1.00$	0.97	Thompson (2008)
GFI	$0.95 \leq GFI \leq 1.00$	0.84	Hu & Bentler (1999)
AGFI	$0.90 \leq AGFI \leq 1.00$	0.80	Yılmaz & Çelik (2009)
Chi-square: 719.34; SD: 201			

Jöreskog (1969) stated that a chi-square value close to zero and a chi-square significance value greater than 0.05 indicates that the difference between the expected covariance matrix and the observed covariance matrices is small and there is a good fit. However, he also drew attention to the fact that the chi-square test is a statistical test that is very sensitive to the sample size. For this reason, for model fit, not the p-value directly, but the alternative fit indices presented in the Table 5 were evaluated and the p-value was tolerated.

The first of the fit indices is $\chi 2$ value and this value is interpreted with the degree of freedom. As seen in the Table 5, it was found as $\chi 2 = 719.34$ and sd = 201. Therefore, the ratio of $\chi 2$ / df = 3.57, can be interpreted as a moderate model fit (Kline, 2005; Tabachnick & Fidel, 2015). Considering the RMSEA value, which is included in the path diagram as a result of the modification and determined as

.085, we can talk about the existence of an acceptable modeling at the limit value in terms of compliance, as suggested by Raykov and Marcoulides (2006).

It is seen that GFI, which is another value in the evaluation of fit indices, is .84 and AGFI is .80. When these values are evaluated together with the literature (Hu & Bentler, 1999; Yılmaz & Çelik, 2009), it is seen that the fit of the model is at a medium level. It is seen that the standardized RMR's fit index is .062. According to Sümer (2000), this value also shows that there is a medium level of fit. When the remaining NNFI and CFI indices are examined, it is seen that the NNFI is .97 and the CFI is .97. Thus, the values specified for this analysis also confirm that there is a medium level of fit. On the other hand, it is understood that it also shows a good fit according to the NFI (Normal Fit Index) value of .96. Hair et al. (2010) state that model fit can be determined by reviewing at least three different indexes.

In this context, when the significance value of p in Table 5; that RMSEA, CFI, NNFI and NFI values ensure the fit; and the fact that chi-square and associated statistics are sensitive to the sample size evaluated together with, it is understood that the model has been confirmed. Finally, the model has a structure open to development. Since it is a perception scale that can appeal to university students, it can be stated that this scale can provide more appropriate results in an experiment with a larger sample.

DISCUSSION AND FINDINGS

In this study, it was aimed to develop a scale that can be used to determine the perceptions of university students towards the flipped learning model. In the study, exploratory and confirmatory factor analysis were conducted for the construct validity of the scale. As a result of the exploratory factor analysis, it was seen that the scale consists of 22 items with three factors (learning readiness, learning support, motivational interaction). The three-factor structure of the scale explains 57.59% of the total variance. According to the confirmatory factor analysis, a moderate and acceptable model fit was found in general. Some modifications were made in order to tolerate the suggested model. Moreover, fitness indices showed a medium level of fit, confirming the RMSEA (.085) and $\chi 2$ / df ratio (3.57). Calculation of the internal consistency coefficient for the whole of the scale as .934 shows that the reliability of the scale is high.

Considering the relevant literature, the theoretical framework of the flipped learning model supports the dimensions (readiness to learn, learning support, motivational interaction) that form the structure of the flipped learning model scale. In addition, it coincides with the dimensions of the scale studies aimed at determining students' perceptions about the flipped learning model. In the definitions for the flipped learning model, attention is drawn to two basic components that make up the model: lesson preparation and classroom activities. Bishop and Verleger (2013) define the learning context of flipped classrooms in two stages: out-of-classroom computer-aided personal teaching and in-class interactive group learning activities. It can be said that especially the dimensions of *learning readiness* and *motivational interaction* of our scale reflect these two basic components. Zhai et al. (2017) state that the flipped learning model has three basic components: online videos, interactive platform and physical classes. The dimension of online videos is parallel to the *learning readiness* factor of our scale, interactive platform with the *learning support* factor, and physical classes with the *motivational interaction* factor.

In another scale study (Sletten, 2017), the perception of flipped learning was analyzed in two dimensions as flipped video phenomena (preference of video, value of video, viewing frequency) and active learning perceptions (learning enhancement, value of active learning) and five sub-dimensions. measure in size. The first dimension of that scale is parallel to *learning readiness* and the *learning support* factors of the scale developed in this study; and the value active learning dimension with the *motivational interaction* factor. Details of the factors of the scale developed in this study are explained below.

Learning readiness factor includes items relating to activities that support students for preparing themselves for the face-to-face sessions. Instructional videos were shared with students prior to the class, which is important to introduce new material to students (Day & Foley, 2006). Videos not only introduce the new content, also motivate students for further research on content and higher engagement in face-to-face sessions (Awidi & Paynter, 2019). *Learning readiness* coincides with the pre-classroom learning stage, which is one of the basic elements of the flipped learning model in the literature (Bergmann & Sams 2012; Bishop & Verleger 2013). In this process, instructive videos are frequently used as learning material (Davies et al. 2013). Videos shared before face-to-face sessions make it easier for students to understand the subject and learn individually (Long et al., 2016). In other words, it provides an environment where learners can adjust their learning pattern according to their learning pace, approach and interests. Thus, it removes the concerns of the students, whose learning process progresses differently, about the learning process. It also improves their psychological well-being with their peers and helps them feel more comfortable in the face-to-face sessions (Zhai et al., 2017).

Learning support factor refers to whole structure and also specific features of flipped design that promote student learning such as providing necessary resources and information (Awidi & Paynter, 2019), assuring a student-centered learning environment (Hamdan et al., 2013; Lai & Hwang, 2016), the flipped structure of the course facilitates learning (Jensen et.al.2015), and the instructor guidance and feedback support students to construct knowledge (Awidi & Paynter, 2019; Connell et al., 2016; Harris e al., 2016). Although the responsibility of learning in flipped learning belongs to the student, it is the responsibility of the teacher to create an attractive and encouraging, flexible learning environment for the development of students' skills such as critical thinking, group work, and communication (Wanner & Palmer, 2015). A well-designed lesson plan and structure is very important in the flipped learning model (Chen et al., 2014). In addition to structuring the lesson in detail, the instructors play the role of facilitators who are available to help students learn if they need it (Harris et al., 2016). In the flipped approach, the instructor guides the students to prepare for the lesson, to deliver the assignments on time, and to participate in the lesson by interacting with the content and their friends (Harris e al., 2016). Thus, it is ensured that students create a quality teaching experience in extracurricular time, make the most of face-to-face lessons and increase their motivation and commitment in these processes (Brewer & Movahedazarhouligh, 2018).

The motivational interaction factor, which offers information on student engagement, motivation, and overall satisfaction with items related to interaction with peers and the instructor (Abeysekera & Dawson, 2015; Awidi & Paynter, 2019; Connell et al., 2016; Love et al., 2014), creative thinking, self-confidence, self-esteem skills and active learning strategies (Halili et al., 2014; Lai & Hwang, 2016), and overall satisfaction with the course (Fisher et al., 2017). Motivational interaction parallels with classroom activities, which is another basic element of the flipped learning model in the literature (Bergmann & Sams 2012; Bishop & Verleger 2013). The flipped learning approach is designed to use classroom time efficiently to encourage students to become active participants (Abeysekera & Dawson, 2015). It usually takes the course content out of the classroom through short video lectures and quizzes, so the classroom structure is based on interactive participation through activities such as problem solving (Seerly, 2015). In-class activity and discussion can increase teacher and student as well as peer interaction. An active atmosphere can improve students' learning motivation and, through peer pressure, the learning effects would increase (Hwang et al., 2015).

CONCLUSION AND SUGGESTIONS

Considering the factor structure, reliability coefficients, and item-total correlations, developed scale is a valid and reliable measure to determine university students' perceptions of the flipped learning model. It can be used to measure participants' perceptions in studies aimed at determining the

variables which affect learners flipped perceptions in flipped learning environments. The validity and reliability studies of the scale were carried out with pre-service teachers. Studies on different study groups are considered to be valuable in terms of the validity and reliability of the scale for future studies.

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