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# Teachers' Self-Efficacy towards Gamification: A Scale Development Study

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## Abstract

In this study, a scale was created to measure the gamification ability levels of teachers. The rating system is a 5-point Likert scale. The scale has 36 items and 4 variables. The research's study group is made up of 526 instructors who are employed during the academic year 2022–2023 in kindergarten, primary schools, secondary schools, and high schools connected to the Ministry of National Education. By looking at the levels of exploratory and confirmatory component analysis, item discrimination levels, and meeting the goal, the validity of the scale was examined. Stability analyses and internal consistency coefficients were used to examine the scale's reliability. The investigation concluded that the scale is a viable and trustworthy measurement tool that may be used to assess teachers' degrees of self-efficacy with regard to gamification.

## Introduction

A game is an activity in which a player or players compete with one another to accomplish a target while following a set of rules and restrictions (Kendirli, 2019). The terms in the game can be expressed as system, players, rules, competition, interaction, feedback, progress and motivation (Yılmaz, 2015). Although there are many benefits of playing games, the first of these is that it has an educational value (Crawford, 1984). In addition to educational value, there are also games developed purely for educational purposes. Games developed for educational purposes are defined as educational games and researches on similar games are increasing, although they are quite new (Üçgül, 2006). Educational games are software that enable students to learn the curriculum or develop their problem-solving skills using the game format (Demirel, Seferoğlu & Yağcı, 2003). Games include features such as problem solving, developing alternative solutions, reaching unknown results, and features such as luck and competition (Bottino, Ferlino ve Travella, 2006; Ebner ve Holzinger, 2007). Games are recognized to contain a variety of motivators that, when used effectively, can aid in success (Laine & Lindberg, 2020). Motivation is important in game-based learning. As an internal condition that originates and sustains goal-directed behaviour, motivation is described as the student's desire to put up an effort to understand the content (Mayer, 2019). When the task specified in the game is completed, positive emotions arise in the players. In digital games, these positive emotions are fueled by a variety of rewards like points, badges or items. A low level of anxiety is expected if the player fails. A little anxiety is acceptable, but it is not desirable that it turns into fear. As a result, the order of the tasks should be modified to the player's skill level without going too low or high (Domínguez, Saenz-de-Navarrete, De-Marcos, Fernández-Sanz, Pagés and Martínez-Herráiz, 2013). Balanced mission difficulty will help players stick to the game. According to flow theory, in order for individuals to be connected to their environment, their task (maintaining the flow state) must be close to their capacity (Csikszentmihalyi, 1991).

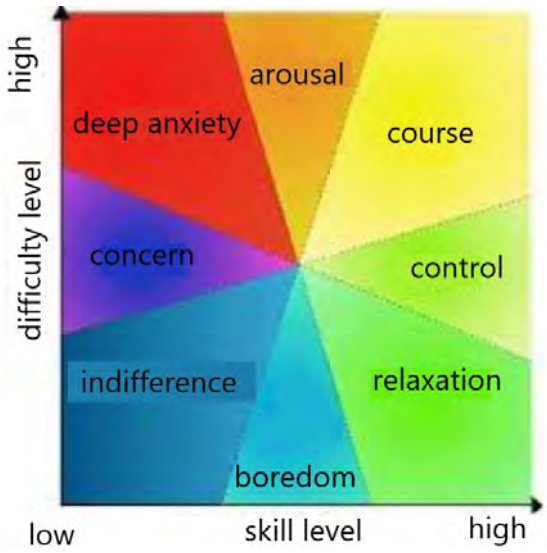


Figure 1. Flow Theory (Csikszentmihalyi, 1991)

Gifted individuals; they experience a sense of relief on less difficult tasks, but a desirable state of flow in tasks of equal difficulty with proficiency. Low-skilled individuals; They feel indifferent to low-difficulty tasks, but experience negative emotions that turn from fear to deep horror as the difficulty increases (Csikszentmihalyi, 1991). In the light of this information, learning steps should be designed according to the level of the student. The game industry and the serious audience that plays games are growing day by day. In this process, the concepts of "game designing" and "game thinking", that is, "game design" and "game-based thinking" gain importance. Game design is the process of bringing together game elements in a meaningful and holistic way, which are used in the creation of an entertaining activity defined as “game” with an interdisciplinary study (Yılmaz, 2015). Gamification is the term used to describe the usage of game design components in a context outside of games (Wilches, 2021). To better understand this fundamental difference between game and gamification, we need to define the term gamification.

Although gamification was first used by Nick Peeling in 2003 (Marczewski, 2018), the term "gamification", which was introduced to the literature by Gabe Zicherman & Christopher Cunningham (2011), from the 2010s, refers to "game thinking and game mechanics to attract the user's attention and solve problems." referred to as the “use process”. Gamification, as defined by Deterding (2011), is the application of game design principles outside of the setting of actual games. According to Kapp, gamification is the use of game mechanics, aesthetics, and game-based thinking to drive action, engage users, and solve issues (Kapp, 2012). Games foster the interaction required for any sort of learning process (Gogos, 2012). According to Arnold, gamification is the personalization of experiences such as buying bread, managing a handwriting recognition program, or learning mathematics using game-like items (Arnold, 2014). When we look at Werbach's pyramid gamification framework, it is seen that gamification has its own dynamics, mechanics and components (figure 2). Gains, achievements, collectibles, avatars, challenges, badges, battles, points, gifts, teams, etc. Like the game components, it also forms the basis of the game. The mechanics then incorporate the operational process into the game, revealing a simple action plan for the player. Game dynamics are very important. Game dynamics are very valuable in making the game interesting. Game dynamics are the last elements that cause changes in behaviour in order to maintain the

continuation of the game in the player.

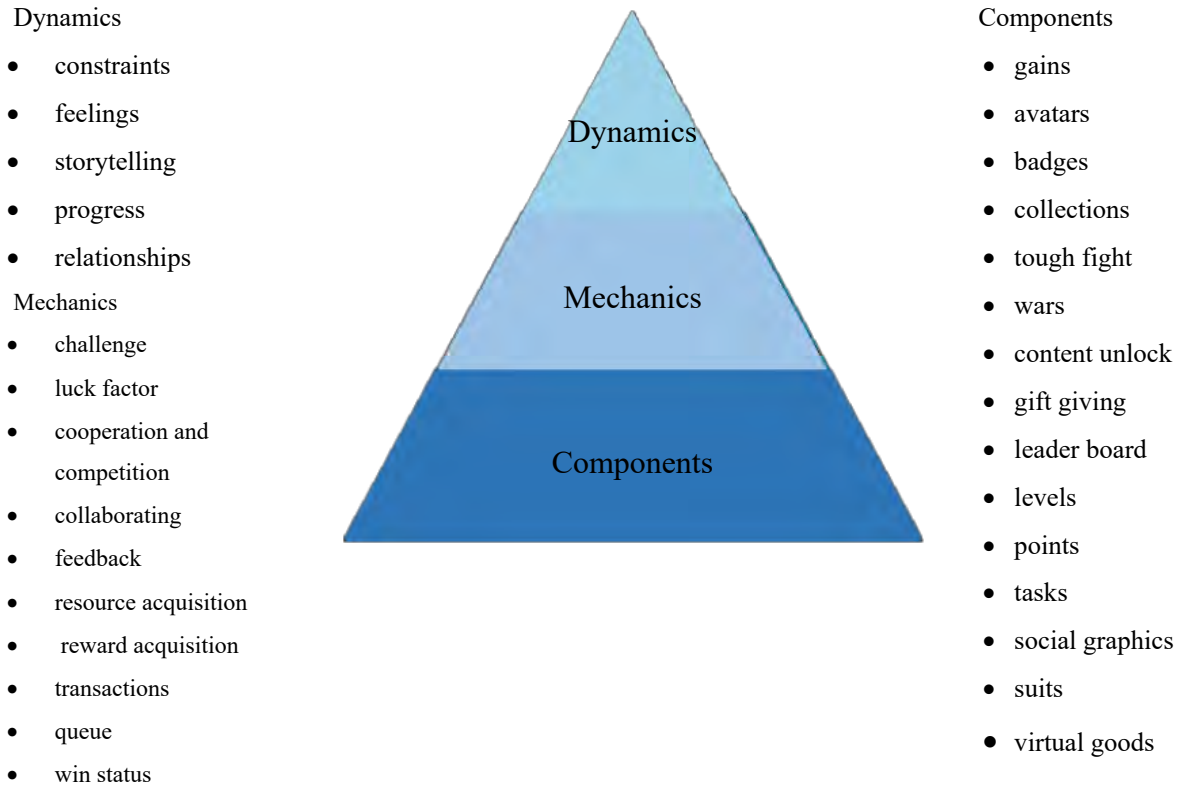


Figure 2. Werbach's Pyramid Gamification Framework

According to Yıldırım and Demir (2014), adapting game design in a way that motivates them in a fun way can positively affect the interests of digital native students. Increasing interest in the course also has a positive effect on the academic performance of the student. Due to its potential to enhance students' learning processes, gamification is receiving a lot of attention in the educational community (Hakak, Noor, Ayub, Affal, Hussin, ahmed, & Imran, 2019). Gamification is frequently applied while creating better educational systems with the goal of improving students' focus, motivation, engagement, and other pleasant experiences (Oliveira, Hamari, Shi, Toda, Rodrigues., Palomino, & Isotani, 2023). Gamification in education and learning is most commonly used for success and progress (Majuri, Koivisto, & Hamari, 2018). Considering the positive results of using gamification in learning environments, the inclusion of gamification elements in curriculum design can positively change learner motivation (Güler & Güler, 2015). Today's students are growing up with digital tools. Students require diverse learning philosophies, fresh perspectives on the educational process, and higher standards for both teaching and learning (Kiryakova, Angelova, & Yordanova, 2014). Teachers face new challenges and need to solve the critical problem of adapting learning. Teachers should use a variety of teaching methods to meet their students' needs and preferences. Developed modern teaching paradigms and teaching trends regarding the use of technology create conditions for the use of new approaches and techniques to drive active learning. Gamification used in education is one of these trends (Kiryakova, Angelova, & Yordanova, 2014). Teachers make an attempt to grab students' interest and guarantee that they are actively participating in the classroom (Kara & Sevim, 2013). It is seen that gamification plays a key role in solving many problems (De-Marcos, Domínguez, Saenz-de-

Navarrete, & Pages, 2014). Additionally, it is believed that the difficulty of taking into account individual differences in learning is one of the reasons for employing gamification (Hanus & Fox, 2015). In schools where traditional teaching methods and practices are prevalent, gamification aids in improving the performance of both students and teachers. Gamification may have an effect on students' academic achievement, engagement, and motivation (Manzano-León, Camacho-Lazarraga, Guerrero, Guerrero-Puerta, Aguilar-Parra, Trigueros, and Alias. 2021). Increasing student success is one of the primary responsibilities of teachers. This can be done with fun tutorials using player-type scales. By including gaming aspects in the lesson and curriculum, students may find subjects that are potentially uninteresting for them to learn far more motivating. The choice of the gamification approach and the creation of a gamified lesson plan using some game planning models are related to instructors' self-efficacy for those who employ innovative learning-teaching techniques. In fact, teachers' self-efficacy towards gamification affects their tendencies in this direction. Gamification in education has been around for a long time. A learning task becomes more enjoyable, interesting, and engaging for pupils of all ages when a game component is added. It is very simple to gamify the learning process to make the lesson more fun for both the student and the teacher. Scoring is as simple as adding a competitive element or educational technology. To properly reap all the benefits that gamification brings to education, it must be done in a way that has proven effective. There are many options to consider, from collection promotion to point-based rewards and participation in competitions. Choosing the best among these many options, designing educational gamification applications, creating gamified lesson plans are directly related to teacher self-efficacy.

One of the fundamental ideas first stressed in Bandura's Social Learning Theory is self-efficacy (Bandura, 1977). Bandura; It describes self-efficacy as a trait that influences how behaviors are formed as well as how well an individual can plan and carry out the tasks necessary to succeed at a given level (Zimmermann, 1995). Depending on the behaviors preferred by individuals, there are behaviors to complete tasks that represent situations related to the individual's self-efficacy. In this case, two dimensions of behavior emerge. These 2 dimensions are outcome expectations and self-efficacy expectations. Self-efficacy beliefs, which are very important for individual behaviors, come from 4 sources. 1) mutual experience of similar behaviors, 2) observing similar behaviors in others, 3) persuading with empty talk, and 4) one's own physiology, physical and emotional perception situations (Bandura, 1995). The teacher's sense of self-efficacy is among the most crucial elements of the notion. Teachers' perceptions of self-efficacy are one of the most crucial aspects of self-efficacy study. The ability to affect student performance or to exhibit the behaviors required to successfully accomplish tasks is described as teachers' judgments of their own self-efficacy (Aston, 1984; Atici, 2000). In this study, two criteria were taken into consideration, namely the gamification process and the teacher competencies to be possessed in gamification. Self-efficacy is examined in relation to seven different dimensions, including the cognitive process dimension, psychological dimension, psychomotor development dimension, social dimension, design dimension, motivation dimension, and creativity dimension.

In order for educational gamification to be used and developed effectively, studies to determine and increase teachers' self-efficacy are important. The use of gamification, which is an innovative teaching method, is increasing day by day in educational environments to help students learn through games, motivate them, integrate what they have learned and provide various permanent learning with complementary features. In gamification

trainings for teachers, it is aimed to increase gamification skills and self-efficacy. Finding out teachers' gamification self-efficacy levels is crucial in this situation. However, when the literature was scanned, gamification self-efficacy scale for teachers was not found. “Gamification Attitude Scale” (İnesi, Gökalp and Sezer, 2022), “Digital Educational Game Development Self-Efficacy Scale” (Kelleci and Kulaksız, 2020), “Modified Gamification User Types Scale” (Çakmak and Taşkın, 2020), “User for Gamification” Types Scale” (Topal and Akgün, 2018), “Gamification Process Scale” (Çiçek and Baydaş, 2019). However, all these scales do not specifically measure teachers' gamification self-efficacy levels. With these demands in mind, the primary objective of this study is to create a Teachers' Gamification Self-Efficacy Scale (SSPS) that is both valid and reliable.

## Method

This study is a scale study that was carried out using the cross-sectional descriptive survey model.

### Participants

526 teachers who worked in schools and organizations connected to the Ministry of National Education during the 2022–2023 academic year are included among the study's participants. Participants in the study were determined by convenient sampling method. Teachers were reached through social media platforms and volunteer participants filled out the form on a voluntary basis.

Table 1. Distribution of Teachers by Seniority and Gender

| Seniority | Gender | | |
|---|---|---|---|
| | Male | Female | Total |
| 1-5 | 5 | 21 | 26 |
| 6-10 | 21 | 47 | 68 |
| 11-15 | 34 | 64 | 98 |
| 16-20 | 31 | 58 | 89 |
| 21-25 | 64 | 50 | 114 |
| 26 and older | 83 | 48 | 131 |
| Total | 238 | 288 | 526 |

### Development Process of the Scale

"Teachers' Self-Efficacy Scale for Gamification" was developed in accordance with Bandura's Social Learning Theory. Analyzing the literature and compiling an item pool were the first steps in the scale development process. In the first step, scales designed to measure comparable traits were analyzed by scanning the literature, and items appropriate for the goal of the scale to be built based on these scales were written (e.g. Gülle & Bolat, 2022; İnesi, Gökalp & Sezer 2022). In the item pool of Teachers' Self-Efficacy Scale for Gamification; There are 7 items for the cognitive process dimension, 6 items for the psychological dimension, 6 items for the psychomotor

development dimension, 5 items for the social dimension, 11 items for the design dimension, 6 items for the creativity dimension, and 7 items for the motivation dimension. The entire item pool consists of 48 items. Finally, the scale research was distributed to three faculty members who are gamification specialists, and necessary arrangements were made by taking their opinions both in terms of items and factors. Then, by working with a Turkish Language and Literature teacher, the expressions that are difficult to understand or the errors of expression in the items were checked and necessary arrangements were made.The participants were asked to rate the scale on a 5-point Likert scale using the following responses: "Totally Agree" (5), "Agree" (4), "Undecided" (3), "Disagree" (2), and "Strongly Disagree" (1). After these steps, validity and reliability study was started.

### Data Analysis

KMO and Bartlett tests were analyzed primarily within the context of statistical analysis. The analyses of the "KMO" and "Bartlett" tests, which were carried out to ascertain the construct validity of the scale, were used to ascertain whether factor analysis could be undertaken.With the information gathered from the scale, exploratory and confirmatory factor analyses were carried out. To ascertain the scale's factor distribution, principal component analysis was used. The "Varimax" vertical rotation approach was used to determine and analyze the factor loadings of the scale. An independent sample t-test was performed following the factor analysis to assess the discriminatory potential of the scale's remaining 36 items. By using the "Pearson's r" test to analyze the item-total correlations, the validity of the scale was ascertained. Internal consistency coefficient and stability tests were used to evaluate the scale's dependability.

## Results

### Findings Regarding the Validity of the Scale

The validity of the Teachers' Self-Efficacy Scale for Gamification was studied in terms of construct validity, item-total correlations, adjusted correlations, and item discrimination. Following are the conclusions:

### Construct Validity

Exploratory factor analysis results include the following First, "Kaiser-Meyer-Oklin (KMO)" and "Bartlett" tests were run on the study's data in order to check the construct validity of the Teachers' Self-Efficacy Scale for Gamification. The results of the "Bartlett" test were "2"= 19512,987 and "sd"=1128 (p=0.000) with "KMO"= 0.959. It was determined from the results that a 48-item scale may be used for factor analysis.

“Principal Components Analysis" was done in the first stage. The scale was examined using "principal component analysis" to see if it was one-dimensional or not. According to the preliminary findings, the "Varimax vertical rotation technique" was preferred for the following step. Since the item load was less than 0.40 and the load was distributed across different components, it was removed from the scale at the conclusion of the studies, which were performed in numerous stages, using 12 items. The remaining 36 items were subjected to factor analysis. Items of Teachers' Self-Efficacy Scale for Gamification; It was collected in 4 factors such as Cognitive Process

Dimension, Psychological Dimension, Design Dimension, Motivation. Two educational technologists and two guidance and psychological counseling professionals reexamined the 36-item item pool to guarantee that the content validity was not affected by the eliminated items. Other analyses were conducted when the subject matter experts concluded that the remaining items were enough to assess the necessary competencies.

It was discovered that the remaining 36 scale components were grouped into 4 factors at the conclusion of the operations. The "KMO" value of the scale, whose final version is 36 items, is 0.953; "Bartlett" values are $\chi 2$=14853,26; sd=630; It was determined as $p<0.001$. The factor loads of the remaining 36 items on the scale ranged from 0.484 to 0.781 without rotation; however, factor loads with the "varimax vertical rotation" technique were determined to be between.521 and.860. In addition, it was discovered that the scale's 36 items and 4 factors accounted for 64.01% of the overall variation. The items' contents in the factors were looked at in the following phase, and the factor names were given. While creating the item pool, since the skill levels used to define the teachers' self-efficacy for gamification in the Teachers' Self-Efficacy Scale for Gamification were taken into account, when identifying the factors, this condition was also taken into consideration. The resulting factors largely overlap with the sub-skills that were determined when creating the item pool at the beginning. In this framework, 6 items were collected in the factor named "Cognitive Process Dimension", 12 items were collected in the factor named "Psychological Dimension", 11 items were collected in the factor named "Design Dimension" and 7 items were collected in the last factor named "Motivation".When Graph 1 is analysed, it is seen that it followed a horizontal course after the first 4 factors. Accordingly, it shows that the first 4 factors contributed significantly to the variance. In other items, the decrease continues in a horizontal state. In this case, we can say that the contributions of the other items to the variance are close to each other. In other words, the scree plot graph confirms that the scale is 4 dimensional.

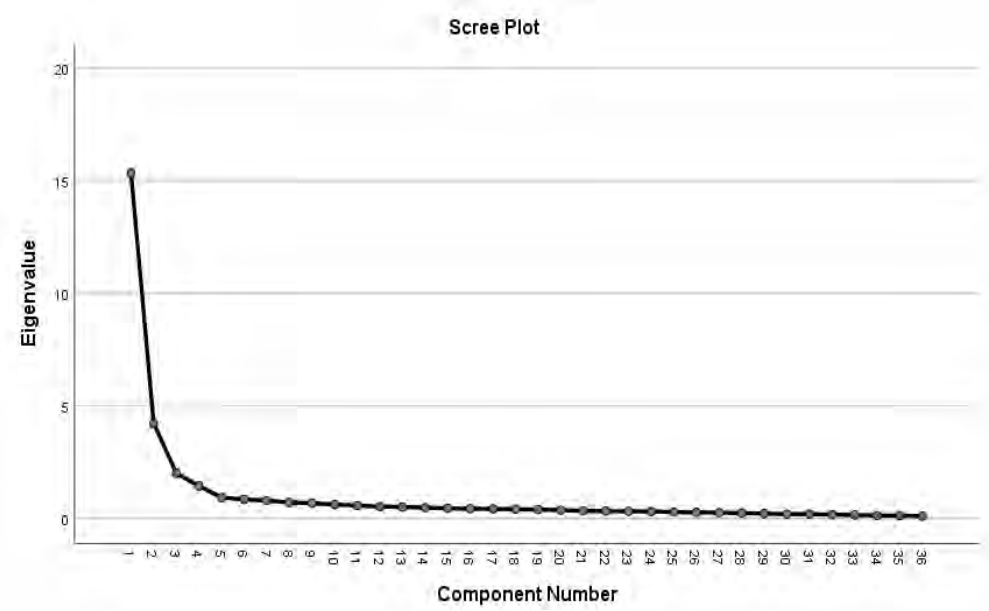


Figure 3. Screen Plot Graphic (Eigenvalues according to the Factors).

Table 2 displays the results for the item loadings, factor eigenvalues, and variance explanation percentages of a total of 36 items in the scale's final iteration.

Table 2. Factor Analysis Results of the Scale as per Factors

| Items | | | Com. Factor | F1 | F2 | F3 | F4 |
|---|---|---|---|---|---|---|---|
| Cognitive Process Dimension | I1 | Gamification allows me to easily explain educational topics to students. | .591 | .715 | | | |
| | I2 | I can improve students' decision-making skills through gamification. | .648 | .763 | | | |
| | I3 | I can improve students' problem-solving skills through gamification. | .656 | .649 | | | |
| | I4 | I can develop students' scientific thinking skills through gamification. | .609 | .628 | | | |
| | I5 | I can improve students' focusing skills through gamification. | .618 | .652 | | | |
| | I6 | I can improve students' reasoning and reasoning skills with gamification. | .636 | .676 | | | |
| Psychological Dimension | I11 | I can develop students' empathy skills through gamification. | .677 | | .557 | | |
| | I12 | I can reduce students' anxiety with gamification. | .606 | | .640 | | |
| | I13 | I can increase students' self-confidence through gamification. | .655 | | .716 | | |
| | I14 | I can develop students' gross motor skills through gamification. | .634 | | .716 | | |
| | I15 | I can develop students' fine motor skills through gamification. | .660 | | .746 | | |
| | I16 | I can increase students' sense of balance through gamification. | .684 | | .757 | | |
| | I17 | I can increase the attention span of students with gamification. | .701 | | .569 | | |
| | I18 | I can increase the reaction speed of students with gamification. | .685 | | .577 | | |
| | I19 | Gamification makes it easier for me to use different tools. | .654 | | .559 | | |
| | I22 | I can improve students' social skills through gamification. | .658 | | .573 | | |
| | I23 | Gamification I can improve students' communication skills. | .641 | | .521 | | |
| | I24 | With gamification. I can improve students' ability to cope with stress situations. | .659 | | .675 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Design Dimension | I25 | I can identify students' needs in order to design gamification. | .683 | | | .746 | |
| | I26 | In order to design gamification. I can determine new acquisitions in line with the needs of the students. | .712 | | | .733 | |
| | I27 | I can benefit from different design models while developing gamification. | .656 | | | .773 | |
| | I28 | I can use gamification elements in accordance with the learning outcomes in the curriculum. | .630 | | | .724 | |
| | I29 | I can test the usefulness of the designed gamifications according to appropriate criteria. | .603 | | | .771 | |
| | I30 | I can select appropriate game elements when designing gamification. | .643 | | | .848 | |
| | I31 | I know the tools that can be used to design gamification. | .598 | | | .860 | |
| | I32 | I can choose appropriate tools to design gamification. | .641 | | | .848 | |
| | I33 | I can use at least one tool to design gamification. | .582 | | | .731 | |
| | I34 | I can turn an enhanced script into a gamification. | .671 | | | .752 | |
| | I35 | I can design gamification. | .620 | | | .824 | |
| Motivation | I42 | I can attract students' attention to the lesson with gamification. | .625 | | | | .741 |
| | I43 | I can encourage students to participate in the lesson through gamification. | .632 | | | | .813 |
| | I44 | With gamification. I can ensure that students maintain their interest in the lesson. | .665 | | | | .820 |
| | I45 | With gamification. I can help students discover knowledge themselves. | .716 | | | | .707 |
| | I46 | With gamification. I can enable the use of teaching strategies suitable for students' motivation profiles. | .735 | | | | .686 |
| | I47 | With gamification. I can increase students' intrinsic motivation for the lesson. | .725 | | | | .736 |
| | I48 | With gamification. I can increase students' external motivation for the lesson. | .656 | | | | .667 |
| | | Eigenvalue | | 1.453 | 4.232 | 15.344 | 2.016 |
| | | Explained variance | | 4.037 | 11.755 | 42.621 | 5.601 |

Table 2 reveals that the "Cognitive Process Dimension" factor of the scale has six items, and its load ranges from 0.628 to 0.763. The entire scale's "eigenvalue" for the Cognitive Process Dimension factor was 1.45, and its contribution to overall variance was 4.03%. There are 12 entries in the "Psychological Dimension" factor. Twelve products have factor loads ranging from 0.521 to 0.757. The psychological dimension factor's "eigenvalue" on the total scale was 4.23; it contributed 11.75% of the overall variation. There are 11 things total in the "Design Dimension" factor. Eleven products have factor loads ranging from 0.724 to 0.860. The Design Dimension factor's "eigenvalue" in the overall scale is 15.34, and its contribution to the overall variance is 42.62%. There are seven items in the "Motivation" factor. The motivation factor items have factor loads ranging from 0.667 to 0.820. The motivation factor's "eigenvalue" in the overall scale was 2.01; it contributed 5.6% of the overall variance.

Findings from CFA: Data from 526 teachers, the sample from whom the data for EFA were gathered, were utilized in CFA to verify the building of the scale's factors, which were found to consist of 4 factors at the conclusion of EFA. The "maximum likelihood" method was used to run DFA without any restrictions. Table 3 displays the CFA-derived estimates for each of the 36 elements.

Table 3. Standardized Regression Weights

| I. No. | | Estimate. | I. No. | | Estimate. |
|---|---|---|---|---|---|
| m1. | <---- | 1.000 | m25 | <---- | 1.000 |
| m2. | <---- | 1.145 | m26 | <---- | 0.982 |
| m3. | <---- | 1.142 | m27 | <---- | 1.013 |
| m4. | <---- | 1.249 | m28 | <---- | 0.929 |
| m5. | <---- | 1.043 | m29 | <---- | 1.026 |
| m6. | <---- | 1.027 | m30 | <---- | 1.094 |
| m11. | <---- | 0.953 | m31 | <---- | 1.122 |
| m12. | <---- | 0.901 | m32 | <---- | 1.083 |
| m13. | <---- | 0.869 | m33 | <--- | 0.899 |
| m14. | <---- | 0.885 | m34 | <--- | 1.047 |
| m15. | <---- | 0.993 | m35 | <--- | 1.143 |
| m16. | <---- | 1.04 | m42 | <--- | 0.789 |
| m17. | <---- | 0.904 | m43 | <--- | 0.894 |
| m18. | <---- | 0.866 | m44 | <--- | 0.921 |
| m19. | <---- | 0.84 | m45 | <--- | 1.097 |
| m22. | <---- | 0.757 | m46 | <--- | 1.068 |
| m23. | <---- | 0.704 | m47 | <--- | 1.020 |
| m24. | <---- | 1.000 | m48 | <--- | 1.000 |

The estimated values in Table 3 are larger than 0.70, as can be seen. The items' estimated values were discovered to range between 0.757 and 1.145. The scale goodness of fit values were 2(sd=582, N=526)= 1892,827, p.001, CMIN/DF=3,252, "RMSEA"=0.065, "CFI"=0.908, "TLI"=0, 901 and "IFI"=0.909, according to the CFA results.

According to the goodness of fit values, the fit values observed demonstrate a satisfactory fit (Kline, 2005; Şimsek, 2007). In this situation, the emerging model demonstrates that the elements are supported by the data. Figure 2 depicts the scale's factor-based model and the values that relate each factor to each item.

Table 4. Statistical Values Regarding the Fit of Structural Equation Model and Fit Scores of the Scale

| Measurement (Compliance Statistics) | Good Compliance | Acceptable Compliance | Teachers' Self-Efficacy Scale for Gamification Compliance Scores | Compliance Status |
|---|---|---|---|---|
| $X^2$ | not meaningful | - | not meaningful | |
| $X^2$/sd | ≤3 | ≤4-5 | 3.252 | Acceptable Compliance |
| NFI | ≥0.95 | 0.94-0.90 | 0.873 | - |
| TLI | ≥0.95 | 0.94-0.90 | 0.901 | Acceptable Compliance |
| IFI | ≥0.95 | 0.94-0.90 | 0.901 | Acceptable Compliance |
| CFI | ≥0.97 | ≥0.90 | 0.908 | Acceptable Compliance |
| RMSEA | ≤0.05 | 0.06-0.08 | 0.065 | Acceptable Compliance |
| RMR | ≤0.05 | 0.06-0.08 | 0.025 | Good Compliance |

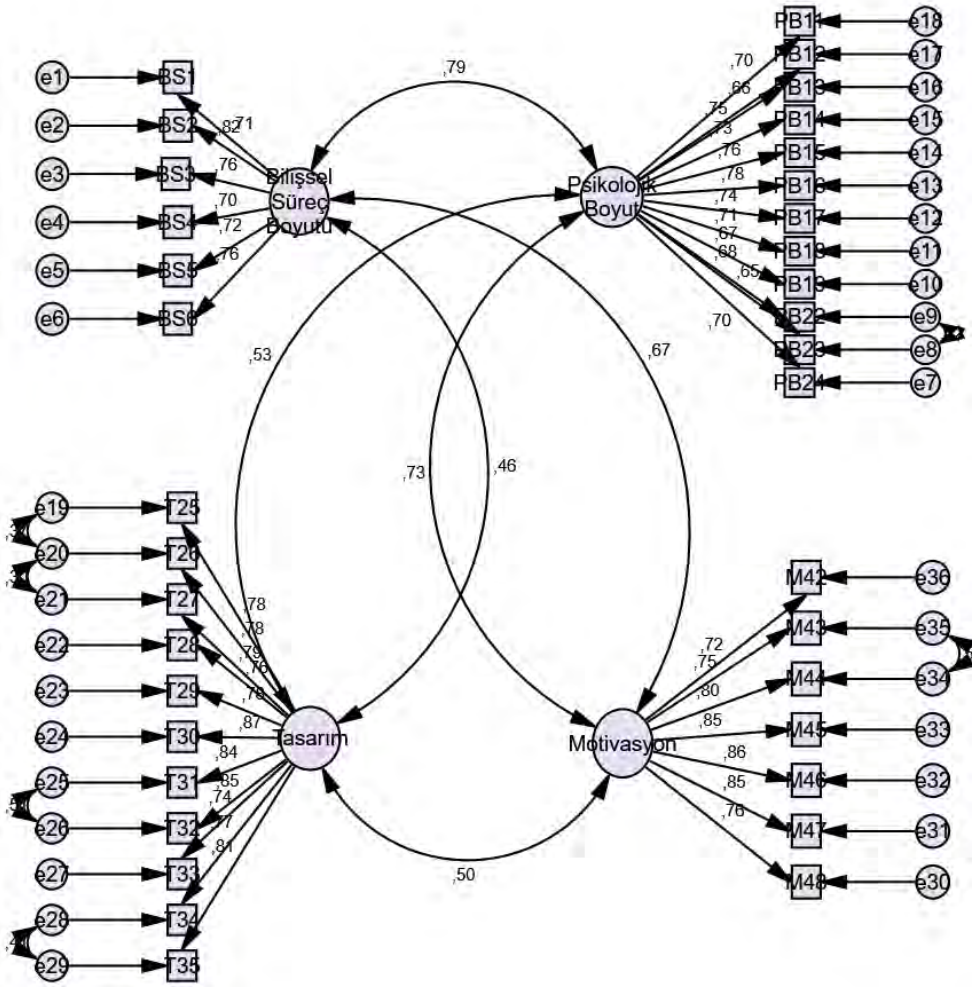


Figure 4. Confirmatory Factor Analysis Diagram of the Scale

The Chi-Square Fit test result in Table 4 was found to have an acceptable fit. The fit indices TLI, IFI, CFI, and RMSEA were found to be in acceptable compliance, while the fit index RMR is an excellent fit. No adjustment was necessary because the NFI value is extremely close to the permitted fit value.

Researchers have various ideas regarding which fit indices should be included in CFA outcomes. Although giving the results of the chi-square fit test is generally accepted (Meydan & Esen, 2011; Lhan & Etin, 2014), it can be useful to provide one or two of the other indices. Figure 4 shows the model that was created after the generated scale's corrections as well as the relationships between the factors.

**Item Factor Total and Adjusted Correlations**

The "item-total correlation" and "adjusted item correlation" approaches were used to calculate the correlation between the scores of each item under the four categories and the scores of the four factors. Table 5 lists the "item-factor correlation" values discovered for each of the scale's 36 items, whereas Table 6 lists the corrected correlation values.

Table 5. Item-Factor Scores Correlation Analysis

| F1 Cognitive Process Dimension | | F2 Psychological Dimension | | F3 Designs Dimension | | F4 Motivation | |
|---|---|---|---|---|---|---|---|
| I | r | I | r | I | r | I | r |
| I1 | .770** | I11 | .725** | I25 | .814** | I42 | .786** |
| I2 | .842** | I12 | .706** | I26 | .818** | I43 | .838** |
| I3 | .794** | I13 | .775** | I27 | .824** | I44 | .862** |
| I4 | .780** | I14 | .750** | I28 | .774** | I45 | .854** |
| I5 | .770** | I15 | .778** | I29 | .799** | I46 | .853** |
| I6 | .794** | I16 | .800** | I30 | .866** | I47 | .865** |
| | | I17 | .750** | I31 | .859** | I48 | .796** |
| | | I18 | .727** | I32 | .865** | | |
| | | I19 | .701** | I33 | .761** | | |
| | | I22 | .728** | I34 | .814** | | |
| | | I23 | .699** | I35 | .846** | | |
| | | I24 | .744** | | | | |

N=526; **=p<.001

Table 5 shows that the "item-test correlation coefficients" ranged from 0.770 to 0.842 for the first component, from 0.699 to 0.800 for the second factor, from.761 to.866 for the third factor, and from.786 to.865 for the final factor. A significant and favourable link exists between each of the 36 scale elements and the entire factor (p 0.000). In this situation, it may be claimed that each of the 36 components makes a contribution to the scale's factor and overall objective.

Table 6. Item Factor Scores Corrected Correlation Analysis

| F1 Cognitive Process Dimension | | F2 Psychological Dimension | | F3 Designs Dimension | | F4 Motivation | |
|---|---|---|---|---|---|---|---|
| I | r | I | r | I | r | I | r |
| I1 | .666** | I11 | .659** | I25 | .772** | I42 | .715** |
| I2 | .766** | I12 | .636** | I26 | .777** | I43 | .776** |
| I3 | .690** | I13 | .728** | I27 | .783** | I44 | .809** |
| I4 | .644** | I14 | .696** | I28 | .727** | I45 | .791** |
| I5 | .662** | I15 | .724** | I29 | .752** | I46 | .793** |
| I6 | .704** | I16 | .750** | I30 | .835** | I47 | .811** |
| | | I17 | .696** | I31 | .824** | I48 | .711** |
| | | I18 | .669** | I32 | .833** | | |
| | | I19 | .636** | I33 | .711** | | |
| | | I22 | .676** | I34 | .769** | | |
| | | I23 | .644** | I35 | .806** | | |
| | | I24 | .677** | | | | |

N=526

The "corrected correlation coefficients" between each of the 36 scale items and the factor to which it is associated can be found in Table 6. They are as follows:.644 to.766 for the first factor;.636 to.750 for the second factor;.711 to.835 for the third factor; and between.711 and.811 for the last factor. It can be claimed that these findings confirm the earlier findings and demonstrate the importance of each of the 36 components in achieving the scale's overall goals.

**Item Discrimination**

Each of the 36 items on the scale had its discrimination power measured. First, from greatest to smallest, the raw scores for each of the 36 elements on the scale were arranged. The lower 27% and upper 27% groups were formed by selecting 142 people from the total of 526 participants as the lower and upper groups, respectively. According to the groups' combined scores, independent groups t-test results were discovered.

Table 7 displays the t values for the discrimination power of the 36 items on the scale and the results of the significant levels. Table 7 shows that the "independent sample t-test" values of the 36 items, 4 components, and the scale's overall score range from 12,939 to 21,790. The total scale's t value is 49,320.

Each difference that has been found is statistically significant (p 0.001). In this situation, it is possible to say that both the entire scale and each of the 36 items have high levels of discrimination. However, it is also clear that the Cognitive Process Dimension factor has a lesser level of discrimination than the other components.

Table 7. Item Discrimination Powers

| F1 Cognitive Process Dimension | | F2 Psychological Dimension | | F3 Designs Dimension | | F4 Motivation | |
|---|---|---|---|---|---|---|---|
| I | t | I | t | I | t | I | t |
| I1 | 14.123 | I11 | 19.689 | I25 | 18.637 | I42 | 15.122 |
| I2 | 17.123 | I12 | 17.196 | I26 | 20.452 | I43 | 14.536 |
| I3 | 18.329 | I13 | 18.074 | I27 | 16.989 | I44 | 18.244 |
| I4 | 16.960 | I14 | 15.022 | I28 | 18.378 | I45 | 20.038 |
| I5 | 15.598 | I15 | 17.189 | I29 | 15.638 | I46 | 21.790 |
| I6 | 20.468 | I16 | 19.193 | I30 | 16.383 | I47 | 21.037 |
| | | I17 | 21.390 | I31 | 15.712 | I48 | 15.585 |
| | | I18 | 18.080 | I32 | 17.060 | | |
| | | I19 | 16.138 | I33 | 12.939 | | |
| | | I22 | 15.327 | I34 | 18.366 | | |
| | | I23 | 16.334 | I35 | 17.335 | | |
| | | I24 | 15.752 | | | | |
| F1 | 25.377 | F2 | 30.438 | F3 | 23.237 | F4 | 23.887 |

*df: 282; p<.001

**Findings Regarding the Reliability of the Scale**

In order to determine the reliability of the scale, "internal consistency" and "stability" assessments were performed on the data. The analyses and results are displayed below:

**Internal Consistency Level**

Using the correlation value between two equal halves, the Spearman-Brown formula, and the Guttmann split-half reliability formula, "Cronbach's Alpha reliability coefficient" was produced for the scale's reliability analysis based on the factors and the scale as a whole. Table 7 displays the findings of the reliability analysis for the scale's four individual variables as well as the scale as a whole.

Table 8. Reliability Analysis Results Considering the Whole of the Scale and Its Factors

| Factor. | Number of items | Two congruent halves correlation | Spearman Brown | Guttmann Split-Half | Cronbach's Alpha |
|---|---|---|---|---|---|
| Cognitive Process Dimension | 6 | .763 | .865 | .865 | .877 |
| Psychological Dimension | 12 | .800 | .889 | ..887 | .924 |
| Designs Dimension | 11 | .828 | .906 | .903 | .952 |
| Motivation | 7 | .790 | .883 | .872 | .928 |
| Total | 36 | .667 | .800 | .796 | .961 |

The scale, which has four variables and a total of 36 items, has "two-part correlations" of,667; a "Spearman Brown reliability coefficient" of,800; a "Guttmann Split-Half value" of,796; and a "Cronbach's Alpha reliability coefficient" of,961. Additionally, "Spearman Brown" values range from 800 to 906; "Guttmann Split-Half" values range from 796 to 903; and "Cronbach's Alpha" values range from 0.877 to 0.961. The "peer-half correlations" of the four components were also between 667 and 828. It is capable of taking accurate measurements of the full scale as well as each of the 4 elements in this situation.

**Stability Level**

The stability level of the scale was ascertained using the "test-retest" method. Twenty teachers, to whom the initial application was made, were given another chance to complete the scale's 36 final items. Both the association between the scores obtained as a consequence of the two applications and the relationship between the scale's 36 individual components were analyzed. As a result, both the stability of the measurements made by each of the 36 scale's elements as well as the scale as a whole were examined. Table 9 displays the outcomes of the analysis.

Table 9 Test-Retest Results of the Items of the Scale

| F1 Cognitive Process Dimension | | F2 Psychological Dimension | | F3 Designs Dimension | | F4 Motivation | |
|---|---|---|---|---|---|---|---|
| I | r | I | r | I | r | I | r |
| I1 | .612** | I11 | .611** | I25 | .616** | I42 | .523** |
| I2 | .569** | I12 | .461** | I26 | .656** | I43 | .542** |
| I3 | .517** | I13 | .668** | I27 | .631** | I44 | .655** |
| I4 | .437* | I14 | .681** | I28 | .517* | I45 | .609** |
| I5 | .495* | I15 | .694** | I29 | .493* | I46 | .800** |
| I6 | .524* | I16 | .685** | I30 | .582** | I47 | .620** |
| | | I17 | .510* | I31 | .715** | I48 | .800** |
| | | I18 | .553* | I32 | .579** | | |
| | | I19 | .442* | I33 | .497** | | |
| | | I22 | .561* | I34 | .572** | | |
| | | I23 | .757** | I35 | .633** | | |
| | | I24 | .487* | | | | |
| F1 | .609** | F2 | .818** | F3 | .694** | F4 | .707** |

N: 20; *=p<0.05.: **=p<0.001.

The correlation coefficients for each of the 36 items of the scale determined using the "test-retest" method are shown in Table 9 and range between 0.437 to 0.800. Each of the 36 items' association was discovered to be significant and favorable. The "test-retest" method revealed that the four components that make up the scale have correlation coefficients that range from.609 to.818. The total score's correlation was found to be.835. Each factor's relationship with the others was determined to be substantial and favorable on the basis of the factors. According

to the data collected, it can be concluded that the scale can produce accurate readings.

## Discussion

In this study, a scale was created to evaluate the gamification proficiency of teachers. The scale, which has four components and 36 items, was developed using a 5-point Likert type. It can be concluded that the scale supports construct validity when factor loads, eigenvalues, and explained variance rates of the scale's items are reviewed. The scale, which was shown to have 4 components at the conclusion of EFA, underwent CFA to confirm its factor structures. It demonstrates that the model created using the DFA data is accurate.

To establish how well each of the 36 items in the scale measures the properties that are intended to be measured with the factor it is included in, item-total correlations and adjusted correlations were calculated using the data acquired. The data discovered led to the conclusion that each of the 36 scale items and each of the 4 criteria significantly contributed to the objective of measuring the levels to be measured by the entire scale.

A four-factor structure instead of the seven that Bandura's Social Learning Theory predicted should be produced as a result of the construct validity investigation. A major portion of the items relating to the Psychomotor Development Dimension and the Social Dimension are distributed under the psychological dimension factor, it can be noticed when the items collected under the factors are reviewed. Since the items in these dimensions are intended to measure psychometric properties and because these items act as a single construct, it was deemed appropriate to be called the psychological dimension. Since the psychological dimension factor supports the skills mentioned above, it was decided that this situation was acceptable and the four-factor structure was preserved. An application with gamification elements can increase the creativity of users. However, since the developed scale is intended for teachers, it is expected that teachers will use gamification elements not as a user but as a person who designs the teaching material. Since they did not use a material containing direct gamification elements, material preparation did not contribute to their creativity, so creativity was not included as a separate dimension in this scale developed for teachers. Additionally, the creative factor was eliminated from the scale and the 4-factor structure was maintained because the item loads of the items falling under the creativity factor were lower than 0.40. Self-efficacy was discussed along four axes: the cognitive process axis, the psychological axis, the psychomotor axis, and the design axis. The following is a brief explanation of the other four components.

Cognitive Process Dimension: Albert Bandura's Social Learning Theory, which is frequently referred to as a bridge between cognitive theory and behaviorism (conventional learning theory). The focus of behaviorism is a certain understanding of learning. It is a modification of outward behavior brought about by repetition and reinforcement of rote learning-related behaviors. According to the cognitive learning theory, many learning processes can be understood by examining mental processes (Rumjaun and Narod, 2020).

The technique described by Bandura to explain human modeling and observing behavior is as follows:

(1) The individual first understands the modeling behavior and actions connected to a specific activity,

(2) what is then observed is specifically designed by the model through various cognitive processes,

(3) then the audience tries to translate their concepts into actions and
(4) In the end, if the person gets credit for his actions, he becomes even more motivated.
On the one hand, this procedure boosts the achiever's confidence in himself or herself. On the other hand, individuals with high levels of self-efficacy frequently outperform others in their field (Bandura, 1977).

The psychological dimension: According to Bandura (2009), some of the most ambitious large-scale applications of social cognition theory address the rising international dangers to preserving a sustainable natural future. Three essential elements are necessary to bring about community-wide reforms. A theoretical model makes up the first part. It details the factors that influence psychosocial change as well as the methods by which these factors have an impact. The translation and implementation model is the second element. creates novel operational models by transforming theoretical ideas. It details the nature of the transformation, its tactics, and how they are put into practice (Bandura, 2019).

Design Dimension: Finding innovative solutions to challenging issues is becoming an increasingly crucial skill. There is a need for designers who can update the instructional materials to meet the demands of the 21st century (Meyer and Norman, 2020). The teacher actively participates in the development of educational games as a co-creator. In order to accomplish academic learning objectives, pupils must be creative, imaginative, and capable of making difficult decisions (Weitze, 2021).

Motivation: In this scale development study, Bandura's Social Cognitive Theory was used to discuss motivation. Processes that promote and maintain meaningful activities are referred to as motivating factors. Personal and internal factors called "motivational processes" are what cause actions like "choice," "effort," "perseverance," "accomplishment," and "environmental regulation." An essential component of social cognitive theory has been motivation. Goals and self-evaluations of progress, self-efficacy, social comparisons, values, result expectations, characteristics, and self-regulation are the main intrinsic motivational processes (Schunk & DiBenedetto 2020).As a result, it can be concluded from the data that the instructors' Self-Efficacy Scale for Gamification is a valid and reliable scale that can be used to assess instructors' levels of self-efficacy toward gamification. This scale can significantly contribute to the literature because there isn't a robust and reliable scale that measures instructors' overall levels of self-efficacy with regard to gamification.

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