International Journal of Assessment Tools in Education
2025, Vol. 12, No. 3, 727–747
https://doi.org/10.21449/ijate.1575320
journal homepage: https://dergipark.org.tr/en/pub/ijate *Research Article*

Financial literacy scale: Development and investigation of psychometric properties

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ARTICLE HISTORY

Received: Oct. 28, 2024

Accepted: May 7, 2025

Keywords:
Financial literacy,
Financial literacy scale,
Scale development.

Abstract: This study aims to develop a financial literacy scale that can be used to assess the level of financial literacy among university students and the relevant age group. This study employs quantitative research methods and is a scale development study. The study group consists of 580 students enrolled at a state university during the 2023-2024 academic year. Participants were selected through convenience sampling and participated in the research voluntarily. In the scale development process, exploratory and confirmatory factor analyses and discrimination analyses were conducted as validity analyses. The Cronbach's alpha coefficient was calculated for the whole scale and sub-dimensions for reliability analysis. After the analyses, the final scale was validated with two dimensions and 18 items. The Cronbach's alpha coefficient of internal consistency for the whole scale was 0.90. At the same time, the sub-dimension of "Financial Planning" achieved a coefficient of 0.90, and the sub-dimension of "Investment and Market Knowledge" attained a coefficient of 0.89. Also, strict invariance was provided according to gender in measurement invariance. As a consequence of the study, a valid and reliable scale has been developed to measure financial literacy levels of university students.

1. INTRODUCTION

Throughout human history, the economy has played a central role in the lives of people and societies. Financial structures at the micro and macro levels have been among the main factors affecting the behaviour of individuals, societies, and countries. In this context, economic structures have evolved from simple barter systems to commodities, such as gold and silver, from printed currency and money to complex financial instruments, including digital/virtual/cryptocurrencies and digital finance (Baidoo *et al*., 2018). This process has had an impact on economic growth and wealth distribution in all countries around the world (Barradas, 2015). Therefore, understanding financial concepts and the capacity to make informed decisions on spending, saving, and investment are essential for individuals to manage their economic welfare (Huston, 2010). Especially in times of economic uncertainty and the

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e-ISSN: 2148-7456

widespread use of financial products and services, the importance of financial literacy in making healthy economic decisions is emphasized (Baidoo *et al*., 2018).

Financial literacy means that individuals are informed about financial instruments, services, and concepts and can use them effectively (Salman & Esmeray, 2020). It can be said that financial literacy includes basic issues and concepts for individuals to be knowledgeable about financial and economic issues, to understand financial concepts, to make financial plans, to provide budget management and to act accordingly, to balance consumption/savings, to invest, to borrow and manage their debts, to trade in financial markets, to make the right decisions about engaging in risky financial behaviours, and to make and implement financial decisions at individual, family or institutional level (Durak *et al*., 2020). Thus, it can be said that developing financial literacy helps people manage their finances and ensure their future financial well-being. The acquisition of these skills at an early age is essential for ensuring financial well-being in later life. Therefore, the development of financial literacy and related skills is of great importance for individuals to manage their finances effectively, to make informed decisions about spending, saving, and investment, to be aware of economic developments, and to understand the basic concepts of finance and economics. This skill contributes to individual financial awareness and the development of financial literacy in society and the country.

High financial literacy, especially among young individuals, may bring more positive results in terms of the economy and sustainable development (Limbu & Sato, 2019). As with every layer of society, university students need to adopt the right financial behaviours. In particular, the fact that they are in young adulthood, that they will soon have to directly face the realities of life after university, and that they will face the financial context in many aspects, such as starting a profession, starting a business, developing career, starting a family, earning and sustaining salary/money, and dealing with financial decisions for family or business life, reveal the importance of financial literacy for them. In addition, the increasing availability and accessibility of financial products and services confront university students with complex financial decisions. Therefore, they need to understand concepts, such as budgeting, savings, investment, consumption, and debt management correctly and realistically, and they need to be able to realise their financial actions on this basis. In this respect, the fact that university students are developing their financial habits increases the importance of financial literacy (Aydın & Akben-Selçuk, 2019; Nawi *et al*., 2020). Studies in this field show that university students generally lack knowledge and skills in financial matters (Bağcı, 2020). These deficiencies carry the risk of making the wrong financial decisions and causing financial problems (Xue, 2022). At this point, raising awareness about financial literacy from an early age is important.

In formal or informal education processes, supporting content, such as courses, seminars, conferences, programmes, training, and visual and written information sources should be included to improve students' financial literacy levels starting from childhood. In this context, Arıman (2020) emphasises that students must make financial decisions consciously and increase their financial welfare. In support of this, Sönmez and Kılıç (2020) and Güneş (2022) see financial literacy as a basic skill that will enable university students to cope with the financial difficulties they may face in the future.

1.1. Problem Statement

Research shows that financial literacy skills help individuals improve their financial decision-making and manage risks (Aydın & Akben-Selçuk, 2019; Uyar & Atalay, 2021). In this respect, with regard to university students, determining their financial literacy levels constitutes the first step of the studies to be carried out (Alkan *et al*., 2020; Salman & Esmeray, 2020). Determining the financial literacy levels of students is important for ensuring younger generation to have a strong financial foundation, solving personal financial problems, increasing financial well-being, encouraging them to make informed financial decisions, helping them cope with future financial challenges (Jorgensen & Savla, 2010; Kuntze *et al*., 2019; Mudzingiri *et al*., 2018;

Świecka *et al*., 2020), and developing financial literacy skills. Given what has been said, determining the need in terms of financial literacy, developing and measuring various measurement tools, and making plans, such as which areas to focus on and what kind of training and awareness activities need to be developed to support and raise awareness constitute the first step (Kıran & Çetinkaya Bozkurt, 2020; Lusardi *et al*., 2010; Yılmaz & Aslan, 2020). Considering that university students, who are at a critical point in their lives, need significant support in terms of making short, medium, and long-term financial decisions (Uyar & Atalay, 2021). It is important to start the process by determining their financial literacy levels to evaluate their financial knowledge levels and develop policy recommendations for financial literacy education (Adalar & Ata, 2021; Reiter & Ford, 2019).

In the national literature, various measurement tools are developed for the financial literacy levels of university students. Accordingly, some scales about the financial literacy attitudes and behaviours of primary school students (Çelikten & Doğan, 2020; Yılmaz *et al*., 2022); the financial literacy levels of high school students (Güvenç, 2016); the relationship between digitalisation and financial behaviours of university students (Uraz Kaya & Kılıç, 2021) were developed. At the same time, there are also some studies using data collection tools prepared as "questionnaires" consisting of various questions for which validity and reliability analyses were not conducted (Durmuşkaya & Kavas, 2018; Kakilli Acaravcı & Bediroğlu, 2019). In addition, it is observed that data collection tools were prepared in which some questions or items in different scales and questionnaires were selected and blended according to research purposes (Akın & Kayacı, 2021; Kılıç *et al*., 2015; Öngen & Öngen, 2018). For university students, financial literacy scales were developed by Sarıgül (2015) and Gerek and Kurt (2011). Also, some postgraduate theses aimed directly to develop a financial literacy scale for university students (Albayrak, 2023; Albulut, 2020).

In this context, it is evident that there is a limited number of financial literacy scales available developed for university students. Similarly, research on pre-university education levels appears to be limited. The scarcity of scale development studies on financial literacy in Türkiye has resulted in a lack of thorough examination of financial literacy behaviours from the past across the country. Therefore, increasing the number of measurement tools capable of assessing individuals' financial literacy levels is believed to enhance the relevant literature significantly, allowing for a deeper understanding of individuals' behaviours regarding financial literacy. Beyond simply increasing the quantity of studies related to financial literacy levels, it is also believed to have a rise in parallel studies examining the diverse qualifications of individuals. This study aims to develop suitable measurement tools tailored to the educational levels of target groups, particularly university students and those in the relevant age group, highlighting an important gap.

Moreover, it is considered that the measurement tools developed in the financial literacy literature need to be updated, or new tools need to be developed. Many new financial and economic developments occur daily, both locally and globally. The most obvious example is the widespread use of credit cards and their impact on individuals' consumption patterns and payment habits. Another example is the emergence of new economic concepts, transactions, functions, and understandings, such as cryptocurrencies, which are still not clearly understood by many people worldwide and for which there is no clear picture of their real-world equivalents, functions, or areas of use. Therefore, the developed financial literacy scales must include on-time innovations, attitudes, behaviours, and concepts in this context.

It should also be emphasized that most studies were conducted using questionnaires consisting of questions prepared under various titles and dimensions (Öztürk & Yalçın, 2019). In this regard, there is a need for more standardized measurement tools with psychometric properties to measure financial literacy levels. This is because, although survey questions are designed to target a specific group for a particular purpose and behaviour, the responses and research outcomes can be more localised. However, it's worth noting that more standardized

measurement tools with defined psychometric properties can potentially deliver more valid and reliable results regarding "generalisability."

At the same time, some scale development studies exhibited deficiencies in their psychometric properties. It was noted that some studies (Gerek & Kurt, 2011; Sarıgül, 2015) conducted exploratory factor analyses to determine the items and factors. However, the factor structure was revealed based on reliability studies without verifying the factor structure through confirmatory factor analysis in a different sample. This situation appears to be an important issue in terms of construct validity (Akyüz, 2018). Therefore, the fact that it is not checked whether the factor structure revealed by EFA measures the relevant behaviour and/or behaviour pattern in the relevant sample indicates that the relevant factor structure, and thus the construct validity of the measurement tool, is not verified. In this respect, accuracy, validity, and reliability of the studies, as well as the results obtained based on such measurement tools, are negatively affected. Therefore, scales with strong measurements are needed.

In addition, it should be stressed that none of the measurement tools mentioned in the national literature have measurement invariance to any variable. Measurement invariance provides more consistent and realistic results in the context of different variables. Reasons, such as the lack of psychometric studies, non-standardised and survey-type scales in the literature, threaten the consistency of the results obtained in the context of different variables. Therefore, it can be said that conducting measurement invariance studies as much as possible on variables that have the potential to influence financial literacy will lead to more consistent, realistic, and robust results in the relevant literature and will help to understand the sensitivity of financial literacy according to individual and social variables.

In conclusion, it can be said that there is a need for scales with various psychometric properties in the cultural context, covering current financial issues, validity and reliability analyses, and factor analyses, and even scales suitable for more inclusive use, such as measurement invariance in subsequent processes. From this point of view, when the related literature is analysed, it can be said that there is a need to develop a financial literacy scale to determine the financial literacy levels of university students. The developed scale provides an important instrument for measuring and improving financial literacy among university students. This study aims to develop a scale to determine the financial literacy levels of university students.

2. METHOD

In this section, the research model and method used in the study, participant information, data collection tools and process, data analysis process, validity, reliability, and ethical considerations are presented. This study was conducted using a correlational research design, a quantitative method that examines relationships between two or more variables without researcher intervention (Fraenkel *et al*., 2018). This design was considered suitable for analyzing the interrelationships among scale items, underlying factors, and the complete instrument during the Financial Literacy Scale construction.

2.1. Study Group

Following the completion of the validity and reliability studies of the Financial Literacy Scale, it was planned to apply it to university students. The study employed convenience sampling to recruit participants from readily accessible populations, a pragmatic approach given the research constraints related to time, funding, and human resources (Büyüköztürk *et al*., 2012). In this study, a total of 580 students studying at various faculties of Uşak University during the 2023-2024 academic year constituted the study group since the researchers were present in the relevant faculties and could easily reach the participants.

In determining the study's group size, the 'number of items X response scale' formula suggested by Tabachnick and Fidell (2013) was taken as a basis. Since this scale is a five-point Likert scale, for exploratory factor analysis a group of "57 x 5 = 285" and for confirmatory factor

analysis "18 x 5 = 90" was calculated. In this study, the 580 participants were divided into two halves: 290 for EFA and 290 for CFA as stated by Wegener and Fabrigar (2000) for scale development studies. By this way, time was saved without needing to collect data from a different group for CFA and for the reliability analyses. In this context, the minimum sample size was achieved by collecting data from 290 students for both analyses. Therefore, a total of 580 students took part in this study voluntarily for validity and reliability analyses. The demographic characteristics of the EFA and CFA groups are explained in Table 1.

Table 1. *Characteristics of the study group.*

		EFA Group		CFA Group		Total	
		f	*%*	*f*	*%*	*f*	*%*
Gender	Woman	199	68.62	208	71,72	417	70.4
	Man	91	31.37	82	28.27	175	29.6
Total		290	100	290	100	580	100
Faculty of	Economics and Administrative Sciences	68	49.27	70	50.72	138	23.8
	Education	60	51.28	57	48.71	117	20.2
	Humanities and Social Sciences	52	50.48	51	49.51	103	17.8
	Communication	47	49.47	48	50.52	95	16.4
	Engineering and Natural Sciences	63	49.60	64	50.39	127	21.9
Total		290	100	290	100	580	100

2.2. Data Collection Process and Data Analysis

For data collection within the research scope, Ethics Committee Permission was obtained within the framework of Uşak University "Social and Human Sciences Scientific Research and Publication Ethics Board's decision dated 17.05.2023 and numbered 2023-121".

In order to develop Financial Literacy Scale for university students, semi structured interviews were conducted and for item writing six students, three females and three males, were selected from different faculties (two students from the Faculty of Economics and Administrative Sciences; one student from the Faculty of Education; one student from the Faculty of Humanities and Social Sciences, one student from Faculty of Communication, one student from Faculty of Engineering and Natural Sciences). The interview questions were prepared within the framework of the topics (from the literature review; budget, money management, consumer behaviours, investment, financial knowledge, following financial news, trading on different financial instruments, etc.). The data obtained from student interviews was analysed using content analysis. Then, within the scope of construct validity studies, data were collected from 580 students: 290 students for exploratory factor analysis, and 290 for confirmatory factor analysis. All the validity and reliability analyses of the scale were carried out using R Studio 4.1.2 (R Core Team, 2022) and the Jamovi 2.4.14.0 program (The Jamovi Project, 2023).

Following these analyses, implemented 57-item scale was piloted with 290 students, and then AFC and CFA analyses were conducted. Firstly, to determine the suitability of the data for factor analysis, the strength of the relationships between items, Bartlett's test, and Kaiser-Meyer-Olkin (KMO) sampling adequacy measurement were considered. Then, exploratory factor analysis was conducted to evaluate the factor structure of the financial literacy scale consisting of 57 items. The principal axis factoring method was used as a factor extraction method. "Promax," one of the oblique rotation methods, was used as the rotation method because a relationship was expected between the dimensions. As a result of the EFA analysis,

it was revealed that the scale had a two-factor structure and CFA analysis was started to confirm this structure.

Secondly, confirmatory factor analysis was performed on the other group of 290 students. To determine the parameter estimation method in confirmatory factor analysis, descriptive statistics of all items of all scales were analysed. Then, the DWLS method was preferred as the parameter estimation method in the scale. The goodness of fit values for the confirmatory factor analysis results of the scale were determined and the results were found to be satisfactory. According to the results, most goodness of fit values show good fit.

After EFA and CFA, measurement invariance of the scale was performed across gender variables. In MG-CFA, a four-stage hierarchical approach to invariance testing (configural, metric, scalar, and strict invariance) was applied. In invariance testing, the initial focus was on the goodness-of-fit values for each level. Then, difference tests for $\Delta\chi^2$, ΔCFI, ΔTLI, ΔRMSEA, and ΔSRMR were conducted between the current model and the less restrictive models. For the measurement invariance of the scale, Multi-Group Confirmatory Factor Analysis (MG-CFA) was performed, whether the Financial Literacy model, previously confirmed through CFA, exhibited measurement invariance across genders.

Besides, the discrimination of the scale was tested. For this, the financial literacy scores of 290 participants were first ranked from higher to lower for discrimination in the lower and upper 27% groups. Then, the mean financial literacy scores of the two groups were compared with independent samples t-test. As the prerequisite of the independent samples t-test, normal distribution was determined by examining the Skewness and Kurtosis coefficients, and the homogeneity of variances concluded with Levene's Test was examined. Lastly, the scale's reliability was analysed. For this purpose, Cronbach's Alpha, Ordinal Alpha, McDonald's Omega, and AVE (Average Variance Extracted) were calculated as internal consistency values.

3. FINDINGS

The steps offered by Erkuş (2012) were followed in the scale development process.

3.1. Literature Review and Student Interviews to Create an Item Pool

To create an item pool, firstly, a literature review was conducted (Albayrak, 2023; Albulut, 2020; Çelikten & Doğan, 2020; Gerek & Kurt, 2011; Güvenç, 2016; Huston, 2010; Lusardi, 2015; OECD, 2013; Sarıgül, 2015; Uraz Kaya & Kılıç, 2021; Yılmaz *et al*., 2022). Related studies on the concept, content, and dimensions of financial literacy and previously developed scales and surveys were analysed. In this context, it can be said that the dimensions and titles, such as personal finance management, planning, budget, savings, consumption behaviours, spending, debt management, investment, following economic developments, financial attitude, knowledge and awareness, financial education, trading in markets, decision making and risk management come to the fore. Then, semi-structured interviews were conducted with six university students, three females and three males, from five different faculties. The interview questions were prepared within the framework of the topics from the literature review (budget, money management, consumer behaviours, investment, financial knowledge, following financial news, trading on different financial instruments, etc.): (i) What do you think financial literacy is? What should be the characteristics of a financially literate person? (ii) How would you rate your own level of financial literacy? How do you improve it (read books, follow news, follow expert opinions on news sites and/or social media, take training, etc.)? (iii) What do you pay attention to when you spend money? What factors encourage you to spend the most? (iv) Do you do any price or market research before purchasing? What do you look for? (v) Have you ever invested? Which investment instruments did you prefer and why? (vi) How do you make investment decisions? (vii) How do you follow financial news and market developments? What sources do you use?

The data collected from student interviews were content analysed. After the content analysis, six categories were established: General Financial Knowledge and Attitudes, Budget and Money Management, Consumer Behaviour, Investment and Financial Instruments, Following Financial News, and Using Information. Subsequently, several items were developed for the scale pool. Some sample items include (translated into English): (i) I invest in different financial instruments to invest my money properly. (ii) It is wiser to invest in low-risk options. (iii) I lack the patience for long-term investments. (iv) I closely follow national economic developments. (v) I strive to keep up with current developments in finance and economics. (vi) I shop by comparing prices to stay within my budget. (vii) I spend the money I receive. A pool of 67 items was created after the literature review and interviews. The related items were categorized under various dimensions based on the theoretical framework.

3.2. Expert Opinions, Pre-Test Application, and Preparation for Pilot Study

To determine whether the items in the item pool were clear and comprehensible in terms of language and grammar, whether there were any scientific errors, whether they were suitable for the group to be applied, and whether they were capable of measuring the behaviour in accordance with the purpose, the opinions of four experts—one expert in Turkish education, one expert in measurement and evaluation, and two experts in finance—were taken.

The expert in Turkish education made some suggestions regarding comprehensibility, grammar, and expression disorder for some items. For example, he stated that the statement ‘I learnt the habit of saving from my family’ had an indirect and complex meaning and suggested that the sentence should be corrected to ‘I learnt to manage my money from my family’ in terms of comprehensibility. The expert in the field of measurement and evaluation made suggestions that some items overlapped that the same item measured different things. For example, for the item ‘I follow national and international economic developments’, it was suggested that it should be written as two items as ‘I follow national economic developments’ and ‘I follow international economic developments’. In addition, he suggested that the item ‘I should invest my savings in the least risky/low-risk investments’ could not measure the relevant behaviour accurately, and instead, the item should be corrected as ‘It is wiser to invest money in low-risk investments’. Additionally, two experts in the field of finance made suggestions about whether some items measured knowledge, behaviour, and attitudes towards financial literacy. For example, for the item ‘I keep my savings in Turkish Lira and foreign currency.’, they stated that it is not known whether the individual has savings or not, or if he/she has savings, he/she may have invested in different financial instruments instead of Turkish Lira or foreign currency and suggested removing the item from the scale. At the same time, they suggested that the item ‘I think that crypto assets do not carry an economic value’ needed to be removed from the scale because it was not clear what it measured in the context of financial literacy. They also stated that some items, such as ‘I can make conscious choices among investment options’ and ‘I prefer to use credit cards for shopping’ should be added.

As a result, a total of 15 items were suggested to be removed from the scale, and five items were suggested to be added, in accordance with the suggestions of all experts. The researchers made the necessary arrangements and corrections on the scale. Thus, the scale's item pool was finalised at 57 items. To assess the readability and comprehensibility of the scale items for the target group, the items were read aloud to three students. They were asked to express what they understood from the items, and the points that were not understood or misunderstood were identified and corrected. Finally, the scale's explanations and instructions were written, and the scale was ready for pilot application.

3.3. Pilot Implementation

The 57-item scale was applied to 290 university students. Tabachnick and Fidell (2013) state that the sample size should be at least 150; they also suggest the formula "number of items x response scale" for the minimum number of applicable samples used in scale development

studies. According to the formula of Tabachnick and Fidell (2013), it was calculated as "57 x 5 = 285," and therefore it was decided that 290 participants were sufficient for this study's validity and reliability analyses. The students evaluated the scale on a five-point Likert scale (*Strongly Disagree* [1], *Disagree* [2], *Undecided* [3], *Agree* [4], and *Strongly Agree* [5]).

3.4. Validity Analyses

Exploratory factor analysis was performed for the construct validity of the scale. A two-dimensional structure with 18 items was revealed. Then, in a different group, this structure was confirmed by confirmatory factor analysis. The results of the related analyses are presented under this heading.

3.4.1. *Exploratory factor analysis*

The scale, which was prepared to measure financial literacy and consisted of 57 items, was examined for the suitability of the data for factor analysis to reveal the factor structure of 57 items in a group of 290 students. In this context, sample group size, the strength of the relationships between items, Bartlett's test, and Kaiser-Meyer-Olkin (KMO) sampling adequacy measurement were considered. In this context, the strength of the relationships between the items was determined by pairwise correlation coefficients. Within the scope of this research, it was determined that there were quite a number of correlation coefficients of .30 and above in the pairwise correlation values calculated between the items. For the data to be accepted as suitable for factor analysis, Bartlett's test must be significant ($p < .05$), and the KMO value must be 0.60 and above (Tabachnick & Fidell, 2013). Within the scope of this research, it was determined that Bartlett's test result was significant ($p < .05$), and the KMO value was 0.886.

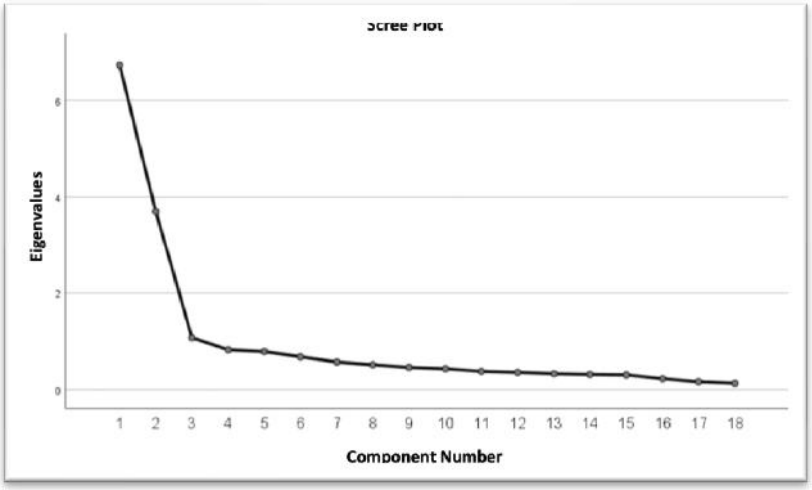
After determining the suitability of the data for factor analysis, exploratory factor analysis was conducted to evaluate the factor structure of the financial literacy scale consisting of 57 items. The principal axis factoring method was used as a factor extraction method. The rotation method was not used in the first stage. When the factor loadings of the items were analysed, it was seen that the items with a loading of 0.60 and above were collected in two dimensions. Although values of 0.30 and above are generally accepted (Tabachnick & Fidell, 2013), 0.60 was determined as the limit value to factorize the scale items better and to make more valid and stronger measurements. Thus, it was determined that the structure consisting of 57 items could consist of two dimensions. Since a relationship was expected between the dimensions, "Promax," one of the oblique rotation methods, was used as the rotation method. Tabachnick and Fidell (2013) state that to use orthogonal rotation methods, factors should be independent or unrelated, and to use oblique rotation methods, factors should be correlated.

Table 2. *Factor correlation matrix.*

Factor	1	2
Financial planning (FP)	1.000	.309
Investment and Market Knowledge (IMK)	.309	1.000

Then, the exploratory factor analysis was repeated by forcing two factors and using the Promax rotation method. As a result, the final scale consisting of two dimensions and 18 items was obtained (Table 2) (Appendix 1). It was determined that the Bartlett's test result for the final version of the scale, consisting of 18 items, was significant ($p < .05$), and the KMO value was 0.894. Cattell's Scree Test plot for the scale structure consisting of 18 items and two dimensions is shown in Figure 1.

Figure 1. *Cattell's scree plot of the financial literacy scale.*



According to Cattell's Scree Test, the point where the shape of the curve in the plot changes direction or becomes horizontal is determined, and the points on the break are accepted as a factor (Tabachnick & Fidell, 2013). According to Figure 1, it is seen that the curve changes direction and becomes horizontal after the third component. Since there are two components above the break, it can be said that the scale has a two-factor structure. Based on the exploratory factor analysis results, the first factor explains 34.83% of the variance, and the second factor explains 18.03% of the variance. The total variance explained by the two-factor structure is 52.86%. Table 3 shows the pattern and structure coefficients of the factor loadings of each item in the scale after rotation. When Table 3 was analysed, it was determined that the scale's item factor loadings were quite high, and there were no overlapping items.

Table 3. *Pattern and structure coefficients for the two-factor solution of the scale items (m).*

Item	Pattern Coefficients		Structure Coefficients	
	Component 1	Component 2	Component 1	Component 2
m27	**.804**	-.061	**.785**	.187
m2	**.775**	-.070	**.767**	.275
m1	**.754**	.042	**.753**	.169
m28	**.754**	-.072	**.742**	.213
m47	**.747**	-.017	**.732**	.160
m4	**.726**	-.038	**.714**	.186
m7	**.683**	.089	**.710**	.300
m26	**.681**	-.086	**.662**	.284
m52	**.635**	.087	**.655**	.124
m51	**.615**	.097	**.645**	.287
m38	.020	**.834**	.277	**.840**
m40	-.090	**.771**	.404	**.808**
m39	-.115	**.757**	.329	**.747**
m31	.171	**.755**	.148	**.744**
m19	-.044	**.730**	.118	**.722**
m37	.109	**.713**	.181	**.716**
m12	.085	**.620**	.276	**.646**
m46	-.124	**.602**	.061	**.563**

Note: Loadings of 0.60 and above for each item are indicated in bold.

3.4.2. *Confirmatory factor analysis*

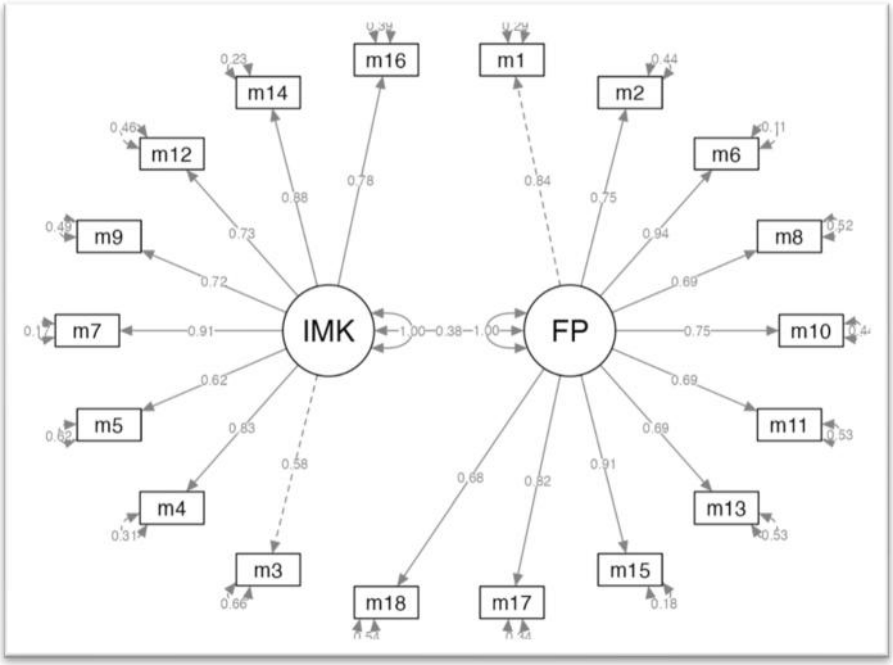
To confirm the structure of the financial literacy scale, consisting of two sub-dimensions and 18 items, the scale was reapplied to another group of 290 participants. Confirmatory factor analysis was performed using the collected data. To determine the parameter estimation method in confirmatory factor analysis, descriptive statistics of all items of all scales were analysed. Accordingly, it was determined that there were deviations from the normal distribution in the items related to the financial literacy scale, and some items showed skewed distribution. It is recommended to use the DWLS method when the multivariate normality requirement cannot be met in items in Likert-type ranked scales at the ranking level (Kline, 2015; Mindrila, 2010; Schumacker & Beyerlein, 2000). For this reason, the DWLS method was preferred as the parameter estimation method in the scale. The goodness of fit values for the confirmatory factor analysis results of the scale are shown in Table 4.

Table 4. *Goodness of fit values related to confirmatory factor analysis results of the scale.*

Goodness of fit values	Coefficients	Decision
χ^2	752 (p<.05)	Not acceptable
χ^2/df^*	5.61	Not acceptable
CFI	0.97	Good fit
TLI	0.97	Good fit
GFI	0.98	Good fit
NFI	0.97	Good fit
RFI	0.96	Good fit
IFI	0.97	Good fit
AGFI	0.96	Good fit
RMSEA	0.12	Not acceptable
SRMR	0.09	Acceptable

* *df*: Degrees of freedom

Figure 2. *Standardized factor loadings of the scale items.*



When the goodness of fit values in Table 4 is evaluated according to the acceptable criteria proposed by Kline (2015) and Tabachnick and Fidell (2013), it can be said that the two-dimensional and 18-item structure of the Financial Literacy Scale is confirmed that most of the goodness of fit values show good fit. The standardized factor loadings of this validated structure are shown in Figure 2.

When Figure 2 is examined, it is observed that the standardized factor loadings for the two sub-dimensions and 18 items of the financial literacy scale have values between 0.58 and 0.94. Tabachnick and Fidell (2013) state that the standardized factor loadings should be at least 0.32. Therefore, it can be said that the standardized factor loadings of the items are quite good.

3.4.3. *Measurement invariance*

In MG-CFA, a four-stage hierarchical approach to invariance testing (configural, metric, scalar, and strict invariance) was applied. Because of the hierarchical structure, if one stage does not meet the required evidence, subsequent models with additional parameter constraints are unnecessary (Vandenberg & Lance, 2000; Wu *et al*., 2007). During invariance testing, the initial focus was on the goodness-of-fit values for each level. Then, difference tests for $\Delta\chi^2$, ΔCFI, ΔTLI, ΔRMSEA, and ΔSRMR were conducted between the current model and the less restrictive models. An insignificant $\Delta\chi^2$, ΔCFI, and ΔTLI between -0.01 and +0.01, and ΔRMSEA and ΔSRMR between -0.015 and +0.015 were anticipated criteria. Furthermore, for ΔSRMR, a difference of 0.030 was deemed acceptable at the metric invariance stage only (Chen, 2007; French & Finch, 2006).

For the scale's measurement invariance, a Multi-Group Confirmatory Factor Analysis (MG-CFA) was performed using R Studio to evaluate whether the Financial Literacy model, previously confirmed through CFA, exhibited measurement invariance across genders. The MG-CFA results suggested that the Financial Literacy model achieved strict invariance across genders. Although certain goodness-of-fit indices and difference test values marginally exceeded the specified thresholds, these deviations were minimal. Since most of the difference tests are in the appropriate range, it can be said that strict invariance is provided according to gender.

Table 5. *MG-CFA results.*

Variables	Fit Indices	Configural Invariance	Metric Invariance	Scalar Invariance	Strict Invariance
Gender	χ^2	893.991 (*df*= 268, *p*<0.05)	1037.092 (*df*= 284, *p*<0.05)	985.015 (*df*= 336, *p*<0.05)	985.385 (*df*= 336, *p*<0.05)
	χ^2/df	3.336	3.651	2.932	2.932
	CFI	0.976	0.971	0.975	0.975
	TLI	0.973	0.969	0.977	0.977
	GFI	0.971	0.967	0.969	0.969
	AGFI	0.952	0.948	0.958	0.958
	NFI	0.97	0.96	**NA	**NA
	RFI	0.96	0.96	**NA	**NA
	IFI	0.98	0.97	0.98	0.98
	RMSEA	0.127 (*p*<0.05) *(0.118, 0.137)	0.136 (*p*<0.05) *(0.127, 0.145)	0.116 (*p*<0.05) *(0.107, 0.124)	0.116 (*p*<0.05) *(0.107, 0.124)
	SRMR	0.116	0.121	0.116	0.116
	ΔCFI	-	-0.005	0.004	0.000
	ΔTLI	-	-0.004	0.008	0.000
	ΔRMSEA	-	0.008	-0.020	0.000
	ΔSRMR	-	0.005	-0.005	0.000
	$\Delta\chi^2$	-	$p < 0.05$	$p > 0.05$	$p < 0.05$

Note. Those written in bold are values within the unacceptable goodness-of-fit range. *Lower and upper 90% confidence interval for RMSEA. **Non-applicable.

3.4.4. *Distinctiveness*

To determine the discrimination of the scale, the financial literacy scores of the 290 participants were first ranked from higher to lower for discrimination in the lower and upper 27% groups. Then, 78 participants were assigned to the lower and upper groups. It was decided to compare the mean financial literacy scores of the two groups with independent samples t-test. Among

the prerequisites of the independent samples t-test, normal distribution and homogeneity of variances were examined for lower and upper groups. In normal distribution, Skewness and Kurtosis coefficients of -1.5 and +1.5 were considered (Tabachnick & Fidell, 2013). Accordingly, it was determined that the Skewness and Kurtosis coefficients were within the desired range. Levene's Test determined the homogeneity of variances. Accordingly, it was determined that the variances were not homogeneous ($p < .05$).

It was determined that the mean financial literacy score of the upper group was 76.78 and 46.13 for the lower group. According to the test result, it was determined that the difference of 30.65 points was statistically significant ($t(101.199) = 22.246$, $p < .05$). The effect size was calculated as "η^2 =0.76". When this effect size is evaluated according to Cohen's (1988) criteria, it corresponds to a large effect. It can be said that the financial literacy scale is valid in distinguishing the lower and upper groups. This result provides support for construct validity.

3.5. Reliability Analyses

Internal consistency values were calculated for the scale's reliability (Table 6). Internal consistency values include Cronbach's Alpha, Ordinal Alpha, McDonald's Omega, and AVE (Average Variance Extracted). An internal consistency value of .70 and above indicates good internal consistency (Hair *et al*., 2014). AVE values of 0.50 and above are preferred (Yaşlıoğlu, 2017). While the AVE values for the subdimensions exceed 0.50, the whole scale is very close to 0.50. According to Table 5, the internal consistency coefficients are quite high. Therefore, it can be concluded that the two-factor financial literacy scale is reliable.

Table 6. *Reliability indices of the scale.*

Variable	α	Ordinal α	ω_1	ω_2	ω_3	AVE
FL	0.90	0.92	0.92	0.92	1.10	0.48
FP	0.91	0.92	0.92	0.92	1.00	0.61
IMK	0.89	0.91	0.90	0.90	0.92	0.59

The item-total correlations of the items in the "Financial Planning" sub-dimension vary between 0.62 and 0.73. The item-total correlations of the items in the "Investment and Market Knowledge" sub-dimension vary between 0.47 and 0.75. Item total correlations for the whole financial literacy scale vary between 0.39 and 0.66. Item total correlations are expected to be 0.30 and above (Büyüköztürk, 2009). Accordingly, it can be said that the item total correlation values are quite good.

As a result, after the validity and reliability studies, it can be said that the Financial Literacy Scale, consisting of 18 items and two dimensions, has a very high validity and reliability. The contents of the sub-dimensions of this scale can be expressed as follows:

Financial Planning: Budget and expenditure management (saving, investment, spending plan), consumption and spending behaviour, debt management, financial security, etc.

Investment and Market Knowledge: Finance and market knowledge, awareness and consciousness, following current developments and information at micro and macro levels, making financial investments and transactions, taking financial risks, etc.

4. DISCUSSION AND CONCLUSION

The current study discussed the development of the Financial Literacy Scale based on a group of 580 university students. The scale development process followed the steps outlined by Erkuş (2012). Specifically, the process involved creating an item pool, conducting a literature review, seeking expert opinions, performing pre-test and pilot applications, and carrying out exploratory and confirmatory factor analyses for validity, measurement invariance, discrimination, and reliability analyses.

In the scale development process, first, a 67-item item pool was created after the literature review and interviews. To determine whether the items in the item pool were clear and comprehensible in terms of language and grammar, whether there were any scientific errors, whether they were suitable for the group to be applied, and whether they were capable of measuring the behaviour in accordance with the purpose, the opinions of four experts—one expert in Turkish education, one expert in measurement and evaluation, and two experts in finance—were taken.

Experts offered some corrections and suggestions regarding their field. In this context, some suggestions about comprehensibility, grammar, complexity, and expression disorder for some items; some suggestions about item overlap and the same item measuring different things for some items were made. Also, some suggestions regarding some items whether they accurately measure knowledge, behaviour, and attitudes towards financial literacy were made. As a result, a total of 15 items were suggested to be removed, and five items were suggested to be added following the suggestions of all experts. The researchers made the necessary arrangements and corrections on the scale. Thus, the scale's item pool was finalised at 57 items in line with the related literature review, pre-participant interviews, and expert opinions.

Exploratory and confirmatory factor and discrimination analyses were included in the validity analyses phase of the scale. The exploratory factor analysis aimed to reveal the factor structure of the 57-item scale in a group of 290 participants. Accordingly, rotation was not used in the first stage. It was observed that the items with factor loadings of 0.60 and above were collected in two dimensions. As a result, the final scale consisting of two dimensions and 18 items was achieved (Appendix 1). It was determined that the Barlett's test result for the final version of the scale, consisting of 18 items, was significant ($p < .05$), and the KMO value was 0.894. In order for the data to be accepted as suitable for factor analysis, Bartlett's test must be significant ($p < .05$), and the KMO value must be 0.60 and above (Tabachnick & Fidell, 2013). Cattell's Scree Test also supported this two-factor structure. According to the final exploratory factor analysis results with the Promax rotation method, the first factor explained 34.83% of the variance, and the second factor explained 18.03% of the variance. The total variance explained by the two-factor structure was 52.86%. It was determined that the items under the two dimensions had very high factor loadings and there were no overlapping items.

The final version of the scale obtained from exploratory factor analysis underwent confirmatory factor analysis. To confirm the structure of the financial literacy scale, which consists of two sub-dimensions and 18 items, it was reapplied to another group of 290 people. The DWLS method was preferred as the parameter estimation method. Then, the goodness of fit values for the confirmatory factor analysis results of the scale were revealed. According to the values, χ^2, χ^2/df, and RMSA values did not seem to be in the acceptable range, while CFI, TLI, GFI, NFI, RFI, IFI, and AGFI values were in the good fit range, and SRMR was in the acceptable fit range.

In this framework, considering the fit indices, it is expected that the χ^2 value will not be significant (Kline, 2015; Tabachnick & Fidell, 2013). In this study, a significant value was achieved ($p < .05$). However, as the χ^2 value is affected by sample size and tends to become significant as the sample increases (Tabachnick & Fidell, 2013), the χ^2/df value should be examined. Kline (2015) and Tabachnick and Fidell (2013) state that for χ^2/df, 0-2 is a good fit and 2-5 is an acceptable fit. In this study, the value of χ^2/df was 5.61, beyond the acceptable values. However, since the value of 5.61 is close to the acceptable limit value of 5, it can be interpreted that the fit of the data in the scale model is not bad.

CFI and TLI values close to or above 0.95 (Hoyle, 2014; Hu & Bentler, 1999) or 0.90 and above (Hair *et al.*, 2014) are indicators of good fit. In this study, both values were 0.97, indicating a good fit. GFI and AGFI values of 0.90 and above are accepted as indicators of excellent fit (Gana & Broc, 2019). In this study, the GFI value was found to be 0.98, and the AGFI value was found to be 0.96, indicating a good fit. In addition, NFI, RFI, and IFI values between 0.95

and 1.00 indicate excellent fit (Marsh *et al*., 2006). In this study, the NFI value was 0.97, the RFI value was 0.96, and the IFI value was 0.97, which indicate an excellent fit.

According to Hoyle (2014) and Hu & Bentler (1999), an RMSEA value close to or less than 0.06 indicates good fit, while according to Hair *et al*. (2014), values between 0.05 and 0.08 are acceptable fit and values of 0.05 and less are indicators of good fit. In addition, Schermelleh-Engel *et al*. (2003) states that the values are moderate between 0.08 and 0.10, and unacceptable if above 0.10. The value of 0.12 in this study does not show an acceptable fit. The range of 0.05 to 0.10 for the SRMR value is an indicator of acceptable fit (Browne & Cudeck, 1993; Gana & Broc, 2019). The SRMR value of 0.09 obtained in this study indicates an acceptable fit. For that reason, it can be said that most goodness of fit values shows good fit and that the two-dimensional and 18-item structure of the Financial Literacy Scale is confirmed.

Measurement invariance is crucial in psychological measurement tools to ensure that the same underlying construct is being assessed across different groups, as failing to establish invariance may lead to misleading conclusions regarding group differences (Atılgan & Deniz, 2023). In this context the measurement invariance of the scale was tested over the gender. For this, a four-stage hierarchical approach to invariance testing (configural, metric, scalar, and strict invariance) was applied in MG-CFA. The MG-CFA results suggest that the Financial Literacy model achieved strict invariance across gender. Although certain goodness-of-fit indices and difference test values marginally exceeded the specified thresholds, these deviations were minimal. Since most of the difference tests are in the appropriate range (Chen, 2007; French & Finch, 2006), it can be said that strict invariance is provided according to gender.

The literature has different findings regarding the relationship between gender and financial literacy. While some studies state that there is a positively significant relationship in favour of women (Özen & Kaya, 2015), some studies state that there is a positively significant relationship in favour of men (Yıldız Contuk, 2018), and some studies have found no relationship (Gümüş & Dağdelen, 2017; Tursun *et al*., 2020; Uyar & Atalay, 2021). Therefore, it can be said that there is no consensus in the literature on the relationship between gender and financial literacy. This may be due to the lack of measurement invariance of the relevant measurement tools. Since the scale developed in this framework provides measurement invariance in the context of gender, its use in gender comparisons may yield more valid results. Moreover, it is known that various variables, such as age, occupation, financial education, place of residence, parental education level, and especially socioeconomic level also affect financial literacy (Amiranashvili, 2023; Bilir & Ergün, 2024; Herawati *et al*., 2020; Minho, 2021; Özer, 2022; Tetik & Işıldak, 2022). The fact that the measurement invariance of this study was limited in the context of the gender variable can be presented as a limitation. For future studies, investigating the measurement invariance according to variables, such as socioeconomic level, age, and occupation, and to compare the financial literacy levels according to these factors may be recommended.

The discrimination of the scale was tested in the lower and upper 27% groups. Accordingly, the financial literacy scores of 290 participants were ranked from higher to lowest, and 78 participants were assigned to each group. It was determined that the mean financial literacy score of the upper group was 76.78 and 46.13 for the lower group. Accordingly, the difference of 30.65 points between the averages was significant. Thus, it can be said that the scale can distinguish the upper and lower groups, and this result provides support for construct validity.

Cronbach’s Alpha, Ordinal Alpha, McDonald’s Omega, and AVE (Average Variance Extracted) were calculated for the scale's reliability. An internal consistency value of .70 and above indicates good internal consistency (Hair *et al*., 2014), and AVE values of 0.50 and above are offered (Yaşlıoğlu, 2017). All the internal consistency coefficients were quite high. For example, the Cronbach's Alpha internal consistency coefficient for the entire two-factor financial literacy scale, which was confirmed by confirmatory factor analysis, was 0.90; for the "Financial Planning" sub-dimension, and 0.91; for the "Investment and Market Knowledge"

sub-dimension was 0.89. Thus, it can be emphasised that the two-factor financial literacy scale is reliable.

In addition, the item-total correlations of the items in the "Financial Planning" sub-dimension varied between 0.62 and 0.73. The item-total correlations of the items in the "Investment and Market Knowledge" sub-dimension varied between 0.47 and 0.75. Item total correlations for the entire financial literacy scale varied between 0.39 and 0.66. Besides, item-total correlation coefficients of the model were found to be 0.30 and above, as emphasized in the literature (Büyüköztürk, 2009). So, the item total correlation values of the scale are quite good.

As a result, after the validity and reliability studies, the Financial Literacy Scale, consisting of two dimensions and 18 items, has high validity and reliability and has measurement invariance across genders. The scale is useful for university students and applicable to relevant age groups. Testing the scale in different contexts, various variables, and cultural frameworks is thought to yield more robust and healthy data.

Acknowledgments

This study was supported by The Scientific and Technological Research Council of Türkiye (TÜBİTAK) as a project coded "1919B012214571" within the scope of "2209-A University Students Research Projects Support Program 2022/2".

Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number**: Uşak University, 17.05.2023, 2023-121.

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Beyza Nur Görken: Collecting data, investigation, resources. **Mehmet Fatih Kaya**: Methodology, software and analysis, writing-original draft, supervision.

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APPENDIX

Finansal Okuryazarlık Ölçeği (Original Scale in Turkish)

Aşağıda üniversite öğrencilerinin finansal okuryazarlık düzeyini belirlemeye yönelik ifadeler bulacaksınız. Ölçeğin cevaplanma süresi yaklaşık üç dakikadır. Lütfen kendinize uygun olduğunu düşündüğünüz seçeneğe (X) işareti koyunuz.

Not: Ölçek yazarların yazılı iznine ihtiyaç duyulmadan kaynak gösterilerek kullanılabilir.

Boyutlar	**Maddeler (Ters kodlanacak madde yok)**
Finansal Planlama (FP)	1-2-6-8-10-11-13-15-17-18
Yatırım ve Piyasa Bilgisi (YPB)	3-4-5-7-9-12-14-16

(1) Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kararsızım (4) Katılıyorum (5) Kesinlikle Katılıyorum

1	Aylık harcamalarımı planlamak benim için önemlidir.	1	2	3	4	5
2	Borcum olduğunda rahatsız olurum.	1	2	3	4	5
3	Kendimi başarılı bir yatırımcı olarak değerlendirebilirim.	1	2	3	4	5
4	Finans ve ekonomi konularındaki güncel gelişmeleri takip etmeye çalışırım.	1	2	3	4	5
5	Kripto varlıklarla ilgili terimler hakkında bilgi sahibiyim (Blokzincir, merkeziyetsiz finans, NFT, soğuk cüzdan, staking, madencilik vb.).	1	2	3	4	5
6	Aylık zorunlu giderlerimi (kira vb.) zamanında ödemeyi tercih ederim.	1	2	3	4	5
7	Ulusal ekonomik gelişmeleri yakından takip ediyorum.	1	2	3	4	5
8	Bütçemi aşmamak için fiyatları karşılaştırarak alışveriş yaparım.	1	2	3	4	5
9	Yatırım seçenekleri hakkında bilgi sahibiyim (örneğin, hisse senetleri, yabancı borsalar, tahviller, eurobond, fon, altın-gümüş gibi emtialar, kripto vb.).	1	2	3	4	5
10	Ani durumlar için yedek bütçe ayırırım.	1	2	3	4	5
11	Harcama yapmadan önce alacağım şeye ihtiyacım olup olmadığına karar veririm.	1	2	3	4	5
12	Telefonumda bankacılık uygulamaları dışında çeşitli finansal mobil uygulamalar bulunmaktadır.	1	2	3	4	5
13	Her gelir düzeyi için bütçe planlaması gereklidir.	1	2	3	4	5
14	Uluslararası ekonomik gelişmeleri yakından takip ediyorum.	1	2	3	4	5
15	Borçlarımı (Fatura, kredi kartı vb.) zamanında ödemeyi tercih ederim.	1	2	3	4	5
16	Ekonomik konulardan (izlemekten, okumaktan, dinlemekten vb.) keyif alırım.	1	2	3	4	5
17	Paramı idareli kullanmak için harcama yaparken dikkatli davranırım.	1	2	3	4	5
18	Düzenli olarak tasarruf etmek benim için önemlidir.	1	2	3	4	5

Financial Literacy Scale (Translated Version)

Below you will find statements to determine the financial literacy level of university students. The response time of the scale is approximately three minutes. Please tick (X) the option you think is appropriate.

Note 1: The scale must be adapted to the related language and culture when used. The translated version should not be used as it is.

Note 2: The scale can be used by citing this study, without the authors needing written permission.

Dimensions	**Items (No item to be reverse coded)**					
Financial Planning (FP)	1-2-6-8-10-11-13-15-17-18					
Investment and Market Knowledge (IMK)	3-4-5-7-9-12-14-16					
(1) Strongly Disagree. (2) Disagree (3) Undecided (4) Agree (5) Strongly Agree						
1	It is important for me to plan my monthly expenses.	1	2	3	4	5
2	I feel uncomfortable when I owe money.	1	2	3	4	5
3	I can consider myself a successful investor.	1	2	3	4	5
4	I try to follow current developments in finance and economics.	1	2	3	4	5
5	I have knowledge about terms related to crypto assets (Blockchain, decentralised finance, NFT, cold wallet, staking, mining, etc.).	1	2	3	4	5
6	I prefer to pay my monthly compulsory expenses (rent, etc.) on time.	1	2	3	4	5
7	I closely follow national economic developments.	1	2	3	4	5
8	I shop by comparing prices so as not to exceed my budget.	1	2	3	4	5
9	I have knowledge about investment options (e.g., stocks, foreign stock exchanges, bonds, Eurobonds, funds, commodities such as gold-silver, crypto, etc.).	1	2	3	4	5
10	I keep a reserve budget for sudden situations.	1	2	3	4	5
11	Before I spend, I decide whether I need what I am going to buy.	1	2	3	4	5
12	I have various financial mobile applications on my mobile phone other than banking applications.	1	2	3	4	5
13	Budget planning is necessary for each income level.	1	2	3	4	5
14	I closely follow international economic developments.	1	2	3	4	5
15	I prefer to pay my debts (invoice, credit card etc.) on time.	1	2	3	4	5
16	I enjoy economic subjects (watching, reading, listening, etc.).	1	2	3	4	5
17	I am careful when spending in order to use my money sparingly.	1	2	3	4	5
18	It is important for me to save money regularly.	1	2	3	4	5