

Article

Mobile Application Software Requirements Specification from Consumption Values

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Abstract: In today's society, mobile applications are becoming more popular and providing several advantages. However, users will resist using a product regardless of how well-tested or solid it is if the wrong requirements are implemented. Understanding the factors that influence the purchase of mobile applications can provide useful information for mobile application design and development. Hence, the purpose of this research is to better understand the impact of consumption values on customers in order to identify the software requirements for a mobile application. This study analyzes the possible behavioral changes of similar groups of university students in a five-year period. For this purpose, a questionnaire is administered to engineering faculty students in 2017 (46 females and 66 males) and 2021 (45 females and 90 males) to better understand customer behavioral changes. The findings highlight the significance of conditional value in customer behavior when purchasing mobile applications. Even though the other consumption values were found to have a negligible effect, there is some evidence indicating that the impact of consumption values on different target customer groups may vary considering their gender and familiarity with apps. Further research needs to be conducted to better understand the possible impact of age, cultural differences, education levels, and special considerations such as visually impaired people. Therefore, this study encourages mobile application designers and developers to raise awareness for the effect of consumption values such as conditional value on their customers' mobile application purchasing behaviors. The possible impact of the consumption values needs to be deeply understood, specifically for the target customer groups, and it should be considered in the software requirements specification (SRS), which is one of the important principles that allow software under consideration for development to function. As a result, a better understanding of consumption values will help developers design and develop better applications by specifying software requirements and marketing strategies.

Keywords: software quality; software requirements specification; mobile application; consumption values



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1. Introduction

Software requirements specification (SRS) is one of the design concepts that must be followed in order for software under development to function properly [1]. To increase business value, it is critical to select requirements that satisfy all stakeholder interests and preferences within defined technical constraints [2]. Mobile applications (apps) are software systems that provide services to meet the needs and desires of mobile users. Today, mobile technology provides numerous benefits and is widely used by society. Aside from social interaction, communication, and entertainment, they also provide services such as banking and government operations. Furthermore, mobile learning is becoming increasingly popular as a supplement to traditional educational programs. Because mobile platforms are more adaptable, students can access educational options from anywhere and at any

time. In the case of higher education, this flexibility is important to support the learning process by giving learners some options for arranging their time and place for learning. Understanding mobile phone usage behaviors in that regard is critical in order to provide appropriate educational mobile apps for learners [3,4]. Previous research has identified social, emotional, epistemic, and conditional consumption values as factors influencing consumer behavior in relation to mobile apps [5]. However, the impact of consumption values on customers is very poorly evaluated in the literature for better identifying mobile software requirements. By better understanding the relationship between consumption values and customer behaviors, some insights can be gained to guide and improve the software requirements stage during mobile software development.

More specifically, in the literature, there is no study investigating the impact of university students' behaviors on mobile apps. University students are a group of mobile app customers representing the younger generation with more technology-oriented life styles. Hence, their behavioral impact on mobile apps can provide several insights for mobile app developers. In order to address this gap in the literature, this study attempts to understand the impact of university students' behaviors on mobile apps. In other words, this study is designed to investigate the behavioral intention (BI) of university students on mobile apps. It primarily focuses on the theory of consumption values to explain the BI of university students' mobile app purchases and attempts to comprehend behavioral differences between the years 2017 and 2021. It is also intended to identify the consumption values (e.g., social, emotional, epistemic, and conditional values) that have the greatest influence in explaining the BI.

2. Background of the Study

2.1. Mobile Application Purchase Intention

A mobile app is a software system that runs on a mobile device. Applications are the most widely used and emerging mobile technology today, and they can be downloaded from mobile app stores or the internet. There are various types of apps for different purposes and needs of customers, such as education, entertainment, social media and banking, etc. Consequently, the quality of a system depends on the selection of the customer's needs. Mobile app software systems' overall quality has been affected by their perfect requirements since the advent of software engineering [6].

2.2. Consumption Values

One of the most prevalent theories in the literature for better understanding consumer behavior and developing appropriate marketing strategies is the theory of consumption values. An earlier study [7] investigated consumption values, and a subsequent study identified four factors (e.g., social, emotional, epistemic, and conditional values) as influencing factors on consumers' behavior in relation to apps [5]. The term "social value" refers to "the perceived utility derived from an alternative's association with one or more specific social groups," which are stereotyped demographic, socioeconomic, and cultural-ethnic groups. Emotional value is defined as "the perceived utility derived from an alternative's ability to arouse feelings or affective states" as measured by a profile of feelings associated with the alternative. The capacity of an alternative to arouse curiosity, provide novelty, and/or satisfy a desire for knowledge is defined as epistemic value. Finally, conditional value is defined as "the perceived utility acquired by an alternative as a result of the specific situation or set of circumstances confronting the decision maker," which is the presence of antecedent physical or social contingencies that enhance its functional or social value. Previously, studies were conducted on the factors influencing the behavioral intention of higher education learners on apps in various locations such as East Africa [8] and learner groups such as medical students [9]. As a result, there are very few studies in the literature analyzing the affective factors on university students' app behaviors. The impact of social, emotional, epistemic, and conditional values on Turkish university students' app-related behavior is investigated in this study.

2.2.1. Functional Value

The functional value of a product is determined by its ability to perform its function and provide a service. In other words, functional value is the beneficial effect of a product, such as quality and price, as well as the product's durability and dependability [7,10,11], which has been identified as an effective factor in customers' preferences for the product. As a result, the following hypothesis has been established for this study:

2.2.2. Social Value

Aside from functional value, social value is an important factor that influences customer preferences for a product [7]. Social pressure is viewed as a motivator for consumers to make decisions [12].

2.2.3. Emotional Value

Emotions, it is claimed, have a significant impact on the formation of consumption preferences [13]. Emotional value is defined as the emotional state and perception caused by the emotions evoked by the consumption of a specific product [7].

2.2.4. Epistemic Value

Products with epistemic value increase consumers' desire for new experiences by increasing their need for innovation, curiosity, and knowledge [7]. Customers are more likely to buy a product that has innovative features, piques their curiosity, and gives them the feeling of gaining new experiences and knowledge [14].

2.2.5. Conditional Value

Conditional factors such as time and place are reported to play an important role in consumers' preference for a product [15], where customers' purchase decision may be affected by a change in their personal stations [16].

3. Research Framework

There are very few studies that investigate the effect of consumption values on mobile app purchase behavioral intention by taking into account the behavioral changes of higher education students over time. These studies are summarized in Table 1.

Table 1. Earlier research focusing on the effect of consumption values on mobile app purchase behavior.

Ref.	Summary
[17]	Suggests focusing on functional, conditional, epistemic, and emotional values when it comes to mobile app payments.
[18]	Shows a significant relationship between functional, social, contextual, and epistemic values and usage intention for food delivery mobile apps.
[19]	Reports that contextual value influences mobile app users' behavioral intentions via the mediation of functional, social, emotional, and epistemic values. Their equational model, on the other hand, is based on the effect of conditional value on other consumption values.

Hence, this study aims to understand the effect of five independent variables, which are defined as functional value, social value, emotional value, epistemic value, and conditional value, on mobile app purchase intention, according to the defined hypothesis and research questions of the study.

Research Questions and Hypothesis of the Study

The following research questions (RQ) and hypotheses were attempted to be answered.

RQ1: Which of the following consumption values (e.g., social, emotional, epistemic, and conditional values) has the greatest influence on explaining the BI?

H1: Functional value influences Mobile App Purchase Behavioral Intention positively.

H2: Social value influences Mobile App Purchase Behavioral Intention positively.

H3: Emotional value influences Mobile App Purchase Behavioral Intention positively.

H4: Epistemic value influences Mobile App Purchase Behavioral Intention positively.

H5: Conditional value has a positive effect on Mobile App Purchase Behavioral Intention.

RQ2: Can the consumption value theory explain the BI of mobile app purchase? Is there a distinction between 2017 and 2021 by means of gender, purchase of app, app usage duration and number of installed apps?

Accordingly, the research framework was developed as seen in Figure 1.

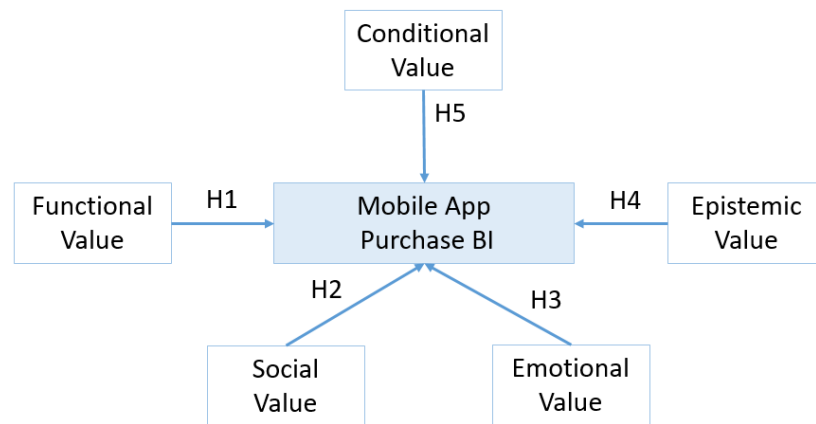


Figure 1. Research framework.

4. Method

This study is designed to better understand the impact of consumption values on mobile app customers’ BI. This study is conducted with university students who represent a specific customer group using mobile apps frequently. Hence, the results of this study do not aim to generalize the findings but to find evidence on the impact of consumption values. The research methodology of this study is shown in Figure 2.

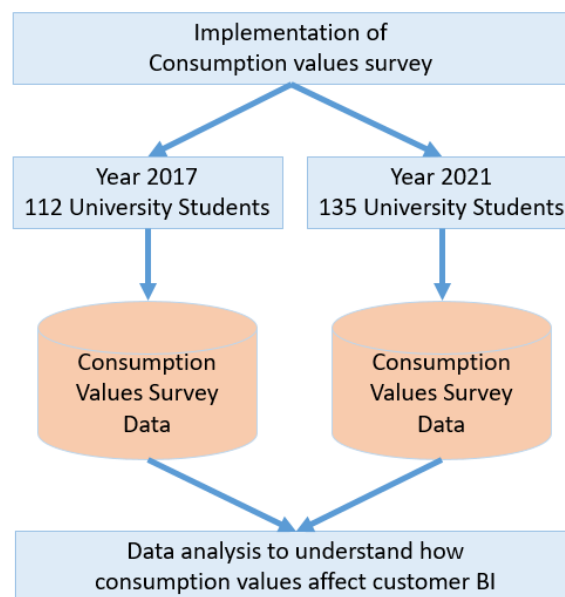


Figure 2. Research methodology.

Accordingly, a consumption values survey [19] was given to the participants in this study, who were engineering faculty students from a higher education organization, in order to understand the differences in app usage in different conditions. The survey includes 33 questions. There were 3 questions for demographic information, 6 for app usage information, and 24 for research variable questions. The survey questions for research variables included 5 items related to Functional Value, 4 items related to Social Value, 5 items related to Emotional Value, 3 items related to Epistemic Value, 3 items related to Conditional Value, and 4 items related to Behavioral Intention. Students volunteered to take part in this study. In 2017, 112 people took the survey online for the first time (46 Female, 66 Male). The same online survey was then administered to 135 participants in 2021 (45 Female, 90 Male). The study is being conducted with ethical approval from the “Atilim University Human Research Ethics Board” under the number E-59394181-604.01.02-9058. The data was analyzed anonymously using the SPSS 26.0 program with a 95% confidence level. Table 2 shows the mean, standard deviation (SD), minimum and maximum, and median statistics for numerical (quantitative) variables.

Table 2. Descriptive statistics of age, number of apps and duration of app usage variables by years.

Variables	Year	Min	Max	AVG	SD
Age	2017	21	35	27.38	2.15
	2021	17	31	21.49	2.42
	Total	17	35	24.16	3.73
# Apps Installed	2017	4	135	40.35	26.82
	2021	0	155	39.29	32.65
	Total	0	155	39.77	30.09
App Usage Duration	2017	1	13	6.86	2.21
	2021	0	16	8.80	2.86
	Total	0	16	7.92	2.76

#: Abbreviation of the word “number of”.

According to Table 2, the average age of survey respondents in 2017 is 27.38, while it is 21.49 in 2021. Skewness and kurtosis values are calculated to examine the conformity of the scale scores with the normal distribution as a result of the exploratory factor analysis. Kurtosis and skewness values obtained from scale scores ranging from +3 to −3 are considered adequate for the normal distribution [20–24]. As a result, the scale scores for both 2017 and 2021 were accepted as having a normal distribution (Skewness/Kurtosis coefficients were within the limits). Therefore, parametric methods were employed in the analysis. This study employed the Pearson correlation test, the independent groups t-test, and the one-way ANOVA test. The model was tested using Process Regression. The Pearson correlation test is a method for determining the direction and strength of a linear relationship between two independent quantitative variables. The independent groups t-test compares two independent groups in terms of a numerical (quantitative) variable. One-way ANOVA is a test technique used to compare independent k ($k > 2$) groups in terms of a numerical (quantitative) variable. Because the scale items are at the Likert level, the non-parametric method was used in scale expression comparisons. A measurement model was developed to better understand the impact of consumption values on behavioral intention. This model attempted to explain behavioral intent for app purchase. To better understand the differences between each scale item, comparisons for the distribution of levels of participation in scale statements and comparison by year were performed. The comparisons were made using the year, age, gender, and app purchase behavior.

5. Results

The construct validity of the scales used in the study was determined using exploratory factor analysis. The Kaiser–Meyer–Olkin (KMO) and Bartlett tests were used to determine whether the scale was appropriate for factor analysis. While the KMO coefficient is calcu-

lated to test the sample size, the Bartlett test is used to examine the normal distribution condition. The KMO test measurement result should be 50 or higher in this context, and the Bartlett sphericity test result should be statistically significant [25,26]. Factor load values were examined during the factor analysis process by assigning or removing scale items from factors.

KMO values and Bartlett test results were calculated during the scale factor analysis (see Table 3). Hence, the sample size is adequate for factor analysis ($KMO > 0.500$). Within the context of the Bartlett test, the X^2 value was calculated and found to be statistically significant ($p < 0.05$). As a result, the normal distribution condition was satisfied.

Table 3. KMO and Bartlett Test results.

Subscale	KMO and Bartlett Test		
	KMO	X^2	p
Functional Value	KMO		0.606
	Bartlett Test	X^2	577.472
		p	0.000
Social Value	KMO		0.829
	Bartlett Test	X^2	581.965
		p	0.000
Emotional Value	KMO		0.820
	Bartlett Test	X^2	504.485
		p	0.000
Epistemic Value	KMO		0.726
	Bartlett Test	X^2	378.742
		p	0.000
Conditional Value	KMO		0.658
	Bartlett Test	X^2	207.746
		p	0.000
Behavioral Intention	KMO		0.646
	Bartlett Test	X^2	238.530
		p	0.000

The data were found to be suitable for factor analysis based on the results of the KMO and Bartlett tests. The scree plot and the number of items determined the scales' one-dimensionality. As a result, the item factor distributions are shown in Table 4.

The factor loads of the functional value scale are made up of 5 questions with scores ranging from 0.741 to 0.662. The factor's total variance explained rate was calculated to be 49.849%, and the CA coefficient was calculated to be 0.745. The social value scale factor loads are made up of four questions with scores ranging from 0.888 to 0.855. The factor's total variance rate explained was calculated to be 75.776%, and the CA coefficient was calculated to be 0.893. The emotional value scale factor loadings are made up of 5 questions with scores ranging from 0.842 to 0.637. The factor's total variance rate explained was calculated to be 61.756%, and the CA coefficient was calculated to be 0.835. The epistemic value scale factor loads are made up of three questions with scores ranging from 0.908 to 0.859. The factor's total variance rate explained was calculated to be 79.264%, and the CA coefficient was calculated to be 0.867. The conditional value scale factor loads are made up of three questions with scores ranging from 0.872 to 0.746. The factor's total variance rate explained was calculated to be 67.956%, and the CA coefficient was calculated to be 0.752. The behavioral intention scale factor loads are made up of four questions with scores ranging from 0.884 to 0.393. The factor's total variance rate explained was calculated to be 53.321%, and the CA coefficient was calculated to be 0.633.

Table 4. Factor distributions of items and reliability analysis results.

Subscale	Item	Factor Load	VRE	CA
Functional Value	Mobile apps have acceptable standard of quality.	0.741	49.849	0.745
	The price of mobile app is economical.	0.732		
	Mobile apps offer consistent quality.	0.697		
	The mobile app is good for current price level.	0.695		
	Mobile apps fulfill my needs as well.	0.662		
Social Value	Using mobile app gives me social approval.	0.888	75.776	0.893
	Using mobile app makes a good impression on other people.	0.870		
	Using mobile app helps me to feel acceptable by others.	0.869		
	Using mobile app improves the way I am perceived.	0.855		
Emotional Value	Using mobile app makes me feel good.	0.842	61.576	0.835
	Using mobile app gives me pleasure.	0.823		
	Using mobile app makes me feel relax.	0.817		
	Using mobile app is an enjoyment.	0.787		
	Using mobile app is interesting.	0.637		
Epistemic Value	Mobile apps enable me to test the new technologies.	0.908	79.264	0.867
	Mobile apps make experiment with new ways of doing things.	0.903		
	Mobile apps arouse my curiosity.	0.859		
Conditional Value	When in an unfamiliar environment of get lost, using mobile app can help me to identify my current location and further direction.	0.872	67.956	0.752
	When I am in uncertain circumstances and need more information to facilitate decision, mobile apps can provide related real-time information (e.g., bus arrival time, weather, stocks) to help me make the decision.	0.849		
	No matter what time or place is, using mobile apps can assist me complete those thing that I want to do.	0.746		
Behavioral Intention	I expect my use of mobile apps to continue in the future.	0.884	53.321	0.633
	I intend to use mobile apps in the near time.	0.828		
	I would use mobile apps without hesitation to satisfy my needs.	0.715		
	I predict that I would use mobile apps in the short term.	0.393		

VRE: Variance Rate Explained; CA: Cronbach's Alpha.

5.1. Measurement Model Evaluation

In this study, the measurement model's reliability, convergent validity, and discriminant validity were assessed.

The assessment of convergent validity is the initial stage of measurement model evaluation [27]. Therefore, convergent validity was assessed by evaluating the factor loadings of every indicator and the average variance extracted (AVE). From Table 5, all values of $AVE \geq 0.5$ indicate that the measurement model provided sufficient convergent validity. Additionally, [28,29] states that convergent validity is achieved when all items that make up the structure are statistically significant. It is also suggested that if the composite reliability (CR) value exceeds 0.7, the convergent validity will be accepted even if the AVE value remains below 0.5. All subscales met this criterion, resulting in convergent validity ($CR > 0.700$). Moreover, although the CA coefficient calculated to be 0.633 for behavioral intention is smaller than others, it still reliably indicates an acceptable level of reliability as the coefficient is between 0.6 and 0.8 [30]. Additionally, the variance inflation factor (VIF) should be far below 10, typically less than or close to 3, so that there is no "multiple linkage problem" between variables [31,32]. Accordingly, there is no autocorrelation (multiple connection problem).

Table 5. Convergent validity and reliability.

Variables	# Indicators	CA	CR	AVE	VIF
Functional Value	5	0.745	0.832	0.498	1.241
Social Value	4	0.893	0.926	0.758	1.508
Emotional Value	5	0.835	0.888	0.616	1.765
Epistemic Value	3	0.867	0.920	0.793	1.364
Conditional Value	3	0.752	0.864	0.680	1.401
Behavioral Intention	4	0.633	0.810	0.533	1.405

#: Abbreviation of the word "number of".

To ensure discriminant validity, it is important that the square root of the AVE be greater than the correlation between the factors [33]. As can be seen in Table 6, this criterion was met in all subscales.

Table 6. Discriminant validity.

Variables	FV	SV	EMV	EPV	CV	BI
Functional Value (FV)	0.706					
Social Value (SV)	0.282	0.870				
Emotional Value (EMV)	0.330	0.560	0.785			
Epistemic Value (EPV)	0.289	0.159	0.409	0.890		
Conditional Value (CV)	0.290	0.101	0.231	0.316	0.824	
Behavioral Intention (BI)	0.247	0.059	0.216	0.348	0.489	0.730

The structural model was then evaluated in order to test hypotheses. The effects on the dependent variable were determined using a multiple linear regression test. Multiple linear regression testing is a type of model analysis that is used to determine the direction and magnitude of the effect of multiple independent variables on the dependent variable. Table 7 shows that the model developed to determine the factors influencing behavioral intention is statistically significant (model $p < 0.05$). The epistemic value ($\beta = 0.185$) and conditional value ($\beta = 0.402$) variables have a statistically significant positive effect on behavioral intention ($p < 0.05$). Hypotheses H4 and H5 are thus accepted. H1, H2, and H3 are rejected because functional value, social value, and emotional value are ineffective ($p > 0.05$). Conditional value (H5), according to the beta value, plays the most important role in explaining app purchase intention (behavioral intention), which answers RQ1.

Table 7. Factors affecting behavioral intention.

Independent Variable	Effect			Model		
	β	t	p	R2	F	p
Functional Value	0.076	1.255	0.211			
Social Value	−0.065	−0.974	0.331			
Emotional Value	0.059	0.815	0.416	0.288	19.535	0.000 *
Epistemic Value	0.185	2.973	0.003 *			
Conditional Value	0.402	6.822	0.000 *			

* $p < 0.05$ significant effect, $p > 0.05$ no significant effect; Multiple linear regression.

Furthermore, the model explains the RQ1 by calculating the R2 of the model as 0.288, indicating that the proposed independent variables, conditional value and epistemic value, can account for the variation in app purchase intention to a degree of 28.8%. This demonstrates that the consumption values theory can be used to explain app purchase intention (behavioral intention).

Table 8 that the model developed in 2017 to determine the factors influencing behavioral intention is statistically significant (model $p < 0.05$). The epistemic value ($\beta = 0.237$) and conditional value ($\beta = 0.310$) variables have a statistically significant positive effect on behavioral intention ($p < 0.05$). As a result, H4 and H5 are acceptable. H1, H2, and H3 are rejected because their functional, social, and emotional values are ineffective ($p > 0.05$). Conditional value, according to the beta value, plays the most important role in explaining app purchase intention (behavioral intention), which answers RQ2. Furthermore, the model explains the RQ2 for the year 2017 by calculating the R2 of the model as 0.299, indicating that the variation in app purchase intention can be accounted for to a degree of 29.9% by the proposed independent variables, which are epistemic value and conditional value. This demonstrates how the theory of consumption values can be used to explain app purchase intent (behavioral intention).

Table 8. Factors affecting behavioral intention based on year.

Year	Independent Variable	Effect			Model		
		β	t	p	R2	F	p
2017	Functional Value	0.156	1.785	0.077	0.299	9.035	0.000 *
	Social Value	-0.119	-1.194	0.235			
	Emotional Value	0.156	1.297	0.197			
	Epistemic Value	0.237	2.398	0.018 *			
	Conditional Value	0.310	3.636	0.000 *			
2021	Functional Value	0.067	0.827	0.410	0.298	12.379	0.000 *
	Social Value	-0.034	-0.391	0.696			
	Emotional Value	0.024	0.264	0.792			
	Epistemic Value	0.158	1.900	0.060			
	Conditional Value	0.456	5.585	0.000 *			

* $p < 0.05$ significant effect, $p > 0.05$ no significant effect; Multiple linear regression.

The 2021 model developed to determine the factors influencing behavioral intention is statistically significant (model $p < 0.05$) (see Table 9 where n and % denote the frequency and the percentage of the categorical –qualitative- variables, respectively). The conditional value ($\beta = 0.456$) variable influences behavioral intention in a statistically significant and positive way ($p < 0.05$). Epistemic, functional, social, and emotional value are all ineffective ($p > 0.05$). As a result, H5 is accepted for 2021, while the other hypotheses are rejected. Additionally, for the year 2021, the model explains the RQ2 by calculating the R2 of the model as 0.298, which indicates that the variation in app purchase intention can be accounted for to a degree of 29.8% by the proposed independent variable, which is a conditional value. This demonstrates how the theory of consumption values can be used to explain app purchase intent (behavioral intention).

Table 9. Distribution and relation of demographic characteristics by year.

		2017		2021		Total		χ^2	<i>p</i>
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Gender	Female	46	41.1	45	33.3	91	36.8	1.575	0.209
	Male	66	58.9	90	66.7	156	63.2		
	Total	112	100.0	135	100.0	247	100.0		
Purchase of App	Yes	64	57.1	79	58.5	143	57.9	0.048	0.827
	No	48	42.9	56	41.5	104	42.1		
	Total	112	100.0	135	100.0	247	100.0		
App Usage Duration	<5 years	21	18.8	9	6.7	30	12.1	54.338	0.000 *
	6–7 years	51	45.5	16	11.9	67	27.1		
	8–9 years	25	22.3	63	46.7	88	35.6		
	>9 years	15	13.4	47	34.8	62	25.1		
	Total	112	100.0	135	100.0	247	100.0		
# App Installed	<20	25	22.3	39	28.9	64	25.9	12.814	0.012 *
	20–29	20	17.9	19	14.1	39	15.8		
	30–39	18	16.1	39	28.9	57	23.1		
	40–59	24	21.4	12	8.9	36	14.6		
	>59	25	22.3	26	19.3	51	20.6		
	Total	112	100.0	135	100.0	247	100.0		

* $p < 0.05$ significant relationship, $p > 0.05$ no significant relationship; Chi-square test. #: Abbreviation of the word “number of”.

5.2. Distribution Analysis

There is a statistically significant relationship between the respondents’ years of app use and the number of apps installed on their mobile phones ($p < 0.05$).

As seen from Table 9, the app usage times of respondents in 2021 are higher (34.8%). In 2017, the number of apps installed on mobile phones was higher (22.3%). The relationship was not significant for gender and app purchase ($p > 0.05$).

The Chi-square test results for the distribution and relationship of most frequently used app types by year show a statistically significant relationship between the use of social media and game apps, which are among the most frequently used apps, and the year ($p < 0.05$). While the use of social media apps (81.5%) was higher in 2021, the use of game apps was higher in 2017 (33.9%). The relationship was not significant in other app types ($p > 0.05$).

The results of the t-test for the distribution of participation levels in scale statements and comparison by year. There is a statistically significant difference between the years of respondents in terms of the level of agreement ($p < 0.05$). In Table 10, only the significant statements were listed. From the table, it can be observed that only the statement that belongs to the “behavioral intention” category is higher for 2021. Other statements for the given scales are higher for 2017.

Table 10. Distribution of participation levels in scale statements and comparison by year.

Scale	Statements	2017		2021		TOTAL		t	p
		AVG	SD	AVG	SD	AVG	SD		
Functional Value	The mobile app is good for current price level.	3.40	0.88	2.78	1.18	3.06	1.10	4.716	0.000
	Mobile apps fulfill my needs as well.	3.35	0.82	2.64	1.17	2.96	1.09	5.540	0.000
Social Value	Using mobile app gives me social approval.	2.70	1.27	2.15	1.19	2.40	1.26	3.487	0.001
	Using mobile app makes a good impression on other people.	2.85	1.15	2.50	1.18	2.66	1.18	2.365	0.019
	Using mobile app helps me to feel acceptable by others.	2.70	1.29	2.24	1.27	2.45	1.30	2.765	0.006
Emotional Value	Using mobile app makes me feel good.	3.36	1.15	2.75	1.35	3.02	1.30	3.826	0.001
	Using mobile app gives me pleasure.	3.64	0.98	3.27	1.19	3.44	1.11	2.735	0.007
	Using mobile app is interesting.	3.71	0.97	3.22	1.21	3.44	1.13	3.471	0.001
Epistemic Value	Mobile apps make experiment with new ways of doing things.	4.47	0.72	4.05	0.96	4.24	0.89	3.819	0.000
	Mobile apps enable me to test the new technologies.	4.31	0.68	4.07	0.91	4.18	0.82	2.285	0.023
Behavioral Intention	I would use mobile apps without hesitation to satisfy my needs.	4.46	0.72	4.66	0.69	4.57	0.71	−2.251	0.025

5.3. Scale Comparisons

According to the results of the t-test, there was a statistically significant difference between years in terms of functional value, social value, emotional value, and epistemic value scores ($p < 0.05$). The levels of functional value (3.69), social value (2.75), emotional value (3.58), and epistemic value (4.28) were higher in 2017. The difference was not significant for conditional value and behavioral intention scores ($p > 0.05$).

Additionally, the results of the comparison of scale scores by gender according to years with a t-test showed that in 2017, there was a statistically significant difference between men and women in terms of functional value scores ($p < 0.05$). Women's functional value (3.80) level is higher. In 2021, there is a statistically significant difference between men and women in terms of behavioral intention scores ($p < 0.05$). Men's behavioral intention (4.29) level is higher. The difference in the other scores is not significant ($p > 0.05$). On the other hand, there is no statistically significant difference between men and women in terms of all scale scores, regardless of the year ($p > 0.05$).

There is a statistically significant difference in terms of functional value scores between those who purchased an app and those who did not in 2017 ($p < 0.05$). App purchasers have a higher functional value (3.78). There is a statistically significant difference in terms of emotional value score between those who purchased an app and those who did not in 2021 ($p < 0.05$). The emotional value (3.36) level is higher for app purchasers. The difference in the other scores is not significant ($p > 0.05$). Regardless of the year, there is a statistically significant difference in the functional value, social value, emotional value, and behavioral intention scores of those who buy apps and those who do not ($p < 0.05$). Those who buy apps have higher levels of functional value (3.63), social value (2.66), emotional value (3.49), and behavioral intention (4.23). The difference was not significant for conditional and epistemic value scores ($p > 0.05$).

According to the results of the ANOVA shown in Table 11, in 2017, there was no statistically significant difference between the app duration groups in terms of all scale scores ($p > 0.05$). In 2021, there is a statistically significant difference between the app duration groups in terms of the functional value scale score ($p < 0.05$). Functional value (3.59) is the highest level among those who have been using an app for 8–9 years. The difference in other scores is not significant ($p > 0.05$). Furthermore, as can be deduced from

Table 12, there was no statistically significant difference between the app duration groups in terms of all scale scores, regardless of years ($p > 0.05$).

Table 11. Comparison of scale scores by mobile application usage period in years.

Variables	Years	2017					2021				
		<i>n</i>	Avg	Sd	F	<i>p</i>	<i>n</i>	Avg	Sd	F	<i>p</i>
Functional Value	<5	21	3.60	0.62	0.668	0.573	9	3.18	0.58	2.884	0.038 *
	6–7	51	3.67	0.42			16	3.05	0.65		
	8–9	25	3.74	0.38			63	3.59	0.72		
	>9	15	3.80	0.45			47	3.38	0.79		
Social Value	<5	21	2.50	1.14	2.141	0.099	9	2.67	0.78	2.200	0.091
	6–7	51	2.60	1.08			16	1.83	0.82		
	8–9	25	2.96	1.03			63	2.30	1.01		
	>9	15	3.25	1.01			47	2.53	1.15		
Emotional Value	<5	21	3.44	0.87	0.903	0.442	9	3.27	0.48	0.918	0.434
	6–7	51	3.52	0.81			16	2.95	0.84		
	8–9	25	3.72	0.74			63	3.12	1.01		
	>9	15	3.76	0.43			47	3.35	0.99		
Epistemic Value	<5	21	4.24	0.57	0.956	0.416	9	3.89	0.62	0.916	0.435
	6–7	51	4.24	0.68			16	3.85	1.00		
	8–9	25	4.24	0.60			63	4.15	0.84		
	>9	15	4.53	0.50			47	3.94	0.88		
Conditional Value	<5	21	4.44	0.64	0.708	0.549	9	4.00	0.62	2.463	0.065
	6–7	51	4.32	0.57			16	4.48	0.44		
	8–9	25	4.33	0.53			63	4.46	0.59		
	>9	15	4.53	0.47			47	4.19	0.82		
Behavioral Intention	<5	21	4.10	0.44	1.669	0.178	9	4.03	0.51	1.104	0.350
	6–7	51	4.02	0.59			16	4.20	0.61		
	8–9	25	4.17	0.62			63	4.30	0.63		
	>9	15	4.38	0.58			47	4.09	0.79		

* $p < 0.05$ significant relationship, $p > 0.05$ no significant relationship; ANOVA test.

From Table 13, the results of the ANOVA test also showed that there is a statistically significant difference between the number of groups of apps used in 2017 in terms of social value and emotional value scale scores ($p < 0.05$). The social value level is highest among those who use 30–39 (3.14), 40–59 (3.13), and 40–59 (3.88) apps, and the emotional value level is highest among those who use 40–59 apps. There is a statistically significant difference between the number of groups of apps used in 2021 in terms of conditional value and behavioral intention scale scores ($p < 0.05$). Conditional Value is highest in 30–39 apps (4.50), 59 (4.51), and behavioral intention is highest in 30–39 apps (4.35). The difference in the other scores is not significant ($p > 0.05$).

Table 12. Comparison of scale scores by mobile application usage time.

Variables	Years	<i>n</i>	Avg	Sd	F	<i>p</i>
Functional Value	<5	30	3.48	0.63	0.903	0.440
	6–7	67	3.52	0.55		
	8–9	88	3.63	0.64		
	>9	62	3.48	0.74		
Social Value	<5	30	2.55	1.03	0.852	0.467
	6–7	67	2.41	1.07		
	8–9	88	2.49	1.05		
	>9	62	2.71	1.15		
Emotional Value	<5	30	3.39	0.77	0.404	0.750
	6–7	67	3.38	0.85		
	8–9	88	3.29	0.98		
	>9	62	3.45	0.90		
Epistemic Value	<5	30	4.13	0.60	0.196	0.899
	6–7	67	4.15	0.78		
	8–9	88	4.18	0.77		
	>9	62	4.08	0.84		
Conditional Value	<5	30	4.31	0.65	0.748	0.525
	6–7	67	4.36	0.55		
	8–9	88	4.42	0.57		
	>9	62	4.27	0.76		
Behavioral Intention	<5	30	4.08	0.45	1.491	0.217
	6–7	67	4.06	0.60		
	8–9	88	4.26	0.62		
	>9	62	4.16	0.75		

Table 13. Comparison of scale scores by number of mobile applications used in separation years.

Variables	Number of Mobile Apps	2017					2021				
		<i>n</i>	Avg	Sd	F	<i>p</i>	<i>n</i>	Avg	Sd	F	<i>p</i>
Functional Value	<20	25	3.56	0.45	1.307	0.272	39	3.27	0.78	1.816	0.129
	20–29	20	3.76	0.26			19	3.18	0.75		
	30–39	18	3.86	0.54			39	3.61	0.78		
	40–59	24	3.66	0.49			12	3.40	0.60		
	>59	25	3.69	0.49			26	3.57	0.64		
Social Value	<20	25	2.48	1.08	2.934	0.024 *	39	2.19	1.04	1.119	0.350
	20–29	20	2.25	1.06			19	2.51	1.13		
	30–39	18	3.14	1.17			39	2.19	1.08		
	40–59	24	3.13	1.06			12	2.69	1.08		
	>59	25	2.77	0.89			26	2.55	0.87		

Table 13. Cont.

Variables	Number of Mobile Apps	2017					2021				
		<i>n</i>	Avg	Sd	F	<i>p</i>	<i>n</i>	Avg	Sd	F	<i>p</i>
Emotional Value	<20	25	3.19	0.78	3.396	0.012 *	39	3.08	1.00	1.315	0.268
	20–29	20	3.43	0.73			19	3.38	0.91		
	30–39	18	3.81	0.67			39	2.99	0.99		
	40–59	24	3.88	0.74			12	3.40	0.96		
	>59	25	3.64	0.74			26	3.43	0.84		
Epistemic Value	<20	25	4.08	0.83	1.873	0.120	39	3.76	0.99	1.707	0.152
	20–29	20	4.30	0.47			19	4.16	0.88		
	30–39	18	4.19	0.60			39	4.11	0.80		
	40–59	24	4.54	0.55			12	3.89	0.74		
	>59	25	4.28	0.52			26	4.26	0.72		
Conditional Value	<20	25	4.17	0.73	1.191	0.319	39	4.03	0.83	3.140	0.017 *
	20–29	20	4.35	0.51			19	4.35	0.72		
	30–39	18	4.46	0.57			39	4.50	0.59		
	40–59	24	4.46	0.47			12	4.42	0.51		
	>59	25	4.45	0.45			26	4.51	0.43		
Behavioral Intention	<20	25	4.05	0.56	0.851	0.496	39	3.98	0.73	2.494	0.046 *
	20–29	20	4.26	0.59			19	4.13	0.91		
	30–39	18	4.14	0.67			39	4.35	0.58		
	40–59	24	4.19	0.52			12	4.02	0.54		
	>59	25	3.98	0.57			26	4.41	0.51		

* $p < 0.05$ significant relationship, $p > 0.05$ no significant relationship; ANOVA test.

Moreover, when the results of scale scores compared by the number of mobile applications used (Table 14) are analyzed, it can be observed that there is a statistically significant difference in terms of social value, emotional value, epistemic value, and conditional value scores among those who use different apps regardless of the year ($p < 0.05$). Social value (2.98), emotional value (3.72), and epistemic value (4.32) were highest in users of 40–59 apps, while 30–39 (4.49) and more than 59 (4.48) users had the highest conditional value level. The difference in the other scores is not significant ($p > 0.05$).

According to Pearson correlation test results, in 2017, there was no statistically significant relationship between age, number of apps, duration of app usage, and all scale scores ($p < 0.05$). According to Table 15, there is a positive and statistically significant relationship between age and functional value, social value, emotional value, epistemic value, and number of apps, and epistemic value and conditional value ($p < 0.05$) in 2021. Relationships with duration of app usage are not significant ($p > 0.05$).

Table 14. Comparison of scale scores by number of mobile applications used.

Variables	Number of Mobile Apps	<i>n</i>	Avg	Sd	F	<i>p</i>
Functional Value	<20	64	3.38	0.68	2.091	0.083
	20–29	39	3.48	0.62		
	30–39	57	3.69	0.72		
	40–59	36	3.57	0.53		
	>59	51	3.63	0.57		
Social Value	<20	64	2.30	1.06	2.726	0.030 *
	20–29	39	2.38	1.09		
	30–39	57	2.49	1.19		
	40–59	36	2.98	1.07		
	>59	51	2.66	0.88		
Emotional Value	<20	64	3.12	0.92	3.401	0.010 *
	20–29	39	3.41	0.81		
	30–39	57	3.25	0.98		
	40–59	36	3.72	0.84		
	>59	51	3.53	0.79		
Epistemic Value	<20	64	3.89	0.94	2.823	0.026 *
	20–29	39	4.23	0.70		
	30–39	57	4.13	0.74		
	40–59	36	4.32	0.68		
	>59	51	4.27	0.62		
Conditional Value	<20	64	4.09	0.79	4.461	0.002 *
	20–29	39	4.35	0.61		
	30–39	57	4.49	0.58		
	40–59	36	4.44	0.48		
	>59	51	4.48	0.44		
Behavioral Intention	<20	64	4.01	0.67	1.590	0.178
	20–29	39	4.20	0.75		
	30–39	57	4.29	0.61		
	40–59	36	4.13	0.52		
	>59	51	4.20	0.58		

* $p < 0.05$ significant relationship, $p > 0.05$ no significant relationship, ANOVA test.

Table 15. Relationship between scale scores and age, number of apps and duration of app usage.

Variables	Value	2017			2021			Total		
		Age	# App Installed	App Usage Duration	Age	# App Installed	App Usage Duration	Age	# App Installed	App Usage Duration
Functional Value	r	−0.008	0.005	0.076	0.057	0.135	0.105	0.184 **	0.097	0.016
	p	0.937	0.961	0.426	0.514	0.119	0.225	0.004	0.128	0.806
Social Value	r	−0.089	0.132	0.165	0.089	0.054	0.078	0.152 *	0.088	0.038
	p	0.352	0.164	0.082	0.304	0.533	0.368	0.017	0.169	0.551
Emotional Value	r	−0.012	0.162	0.081	−0.014	0.085	0.095	0.163 *	0.113	0.006
	p	0.902	0.089	0.395	0.870	0.325	0.275	0.010	0.075	0.923
Epistemic Value	r	−0.049	0.098	0.127	0.054	0.154	0.016	0.141 *	0.136 *	−0.011
	p	0.607	0.303	0.181	0.536	0.075	0.853	0.027	0.033	0.868
Conditional Value	r	0.109	0.092	−0.031	−0.038	0.177 *	−0.038	0.034	0.147 *	−0.044
	p	0.254	0.335	0.742	0.664	0.040	0.663	0.597	0.021	0.495
Behavioral Intention	r	0.025	−0.086	0.160	0.028	0.181 *	0.003	−0.033	0.082	0.076
	p	0.793	0.366	0.092	0.744	0.036	0.972	0.607	0.199	0.232

** $p < 0.01$, * $p < 0.05$ significant relationship, $p > 0.05$ no significant relationship, $0 < r < 0.299$ weak, $0.300 < r < 0.599$ moderate, $0.600 < r < 0.799$ strong, $0.800 < r < 0.999$ is too strong; Pearson correlation test. #: Abbreviation of the word “number of”.

6. Discussion

A measurement model was developed in this study to better understand the effect of consumption values on the behavioral intention of app purchase. As a result, behavioral intent for app purchase was attempted to be explained, which shed light on the software requirements specification for an app. The model explained the behavioral intention of app purchase for the year 2017 as 0.299, which indicates that the variation of app purchase intention can be accounted for 29.9% by the epistemic value and conditional value. Furthermore, for the year 2021, the model shows 0.298, indicating that the proposed independent variable, the conditional value, can account for a variation in app purchase intention to 29.8%. Afterwards, detailed comparisons for the distribution of levels of participation in scale statements and comparisons by year were performed to better understand the differences between each scale item. The comparisons were performed based on year, age, gender, and app purchase behavior.

Based on the findings of this study, the conditional value contributes the most to the purchase intention of apps. The conditional value influence on general app users' behavioral intentions through the other consumption values was also reported in an earlier study [19]. However, in this study, our results highlight the direct effect of the conditional value on the purchase of mobile apps. This result encourages software developers to have a deeper understanding of the requirements for the conditional values influencing the app being developed.

This result is supportive of an earlier study that reported that facilitating conditions have a significant positive effect on East African higher education students' acceptance of mobile learning [8]. Therefore, app development companies should incorporate the conditional aspect when developing and promoting the product, especially targeting higher education groups. Epistemic value is also proven to be able to affect app purchase intention. This result supports an earlier result indicating a significant effect of epistemic values on people's behavioral intention to use apps [19]. Therefore, it is highly suggested for software developers to provide sufficient information focusing on conditional values when developing apps.

According to the comparisons of the number of apps installed, mostly used app types, and each survey question, there are significant results. Consumers installed a higher number of apps on their phones in 2017, and most of the apps installed are game apps. The situation changed in 2021, and consumers installed mostly social media apps. The COVID-19 pandemic may have influenced this change in the installed app types of the learners as they could not socialize during the pandemic period. However, social network services are also reported as the most common purpose for using mobile internet on smartphones [34].

Additionally, there is a significant difference in the price levels between the years; 2017 has better price levels than 2021. According to the findings, students' needs were better met in 2017; they received more social approval, and they felt more that using the app made a good impression on others and that they were accepted by others. Additionally, in 2017, students found that using apps was more interesting than in 2021, and they felt enabled to test new technologies with their app usage in 2017. On the other hand, students who participated in 2021 reported having a greater intention to use an app in the future without hesitation.

Based on the comparison results of the theory of consumption values, functional value, social value, epistemic value, and emotional value questions scored higher in 2017 compared to 2021. When the comparisons were repeated according to gender, female consumers' functional value results were higher than those of male consumers in 2017. On the other hand, in 2021, male participants' behavioral intention results are higher than those of female consumers.

Consumers who had previously purchased apps had higher functional value results in 2017 compared to those who had not previously purchased an app. In 2021, however, emotional value results are higher for consumers who previously purchased apps versus consumers who did not previously purchase an app. In general, without year distribution, consumers who purchased an app before have higher functional value, social value, emotional value, and behavioral intention results compared to those who did not purchase an app before.

App usage duration also has significant differences, such that the functional value result is higher for the consumers who used an app for 6–7 years than for 8–9 years in 2021.

In 2017, the number of apps installed showed significant differences in social value and emotional value for consumers. The social value results are higher for those who installed fewer than 20 apps than for those who installed 30–39 and 40–59 apps. Additionally, the results are higher for the consumers who installed 20–29 apps than 30–39 and 40–59 apps. Consumers who installed fewer than 20 apps had higher emotional value results than those who installed 30 to 39 or 40 to 59 apps.

The number of apps installed in 2021 shows significant differences for consumers' conditional value and behavioral intention results. The social value results are higher for consumers who installed fewer than 20 apps than those who installed 30 to 39 apps or more than 59 apps. Consumers who installed fewer than 20 apps had higher behavioral intentions than those who installed 30 to 39 or more than 59 apps.

In total, without year distribution, the number of apps installed shows significant differences for social value, emotional value, epistemic value, and conditional value results for consumers. Consumers who installed 40–49 apps had higher social value results than those who installed less than 20 or 20–29 apps. Consumers who installed fewer than 20 apps had higher emotional value results than those who installed 20–29 or more than 59 apps. Additionally, it is higher for 30–39 apps than for 40–59 apps. Consumers who installed fewer than 20 apps had higher epistemic value than those who installed 20–29, 40–59, or more than 59 apps. Consumers who installed fewer than 20 apps had higher conditional value results than those who installed 30 to 39 apps or more than 59 apps.

In 2021, there is a positive and statistically significant relationship between age and functional value, social value, emotional value, and epistemic value, and between the

number of apps and epistemic value and conditional value. It can be said that as people get older, their functional, social, emotional, and epistemic values increase.

7. Conclusions

Software requirements specification is one of the key points of the software development process. It is needed to find out the important needs of the users for the system under development. Hence, the core requirements that can be implemented under the limitations of budget, resources, and time must be fulfilled, which eventually results in user fulfillment. As a result, the purpose of this study is to analyze the consumption values of higher education students in order to understand the important requirements of apps. The results of this study showed that conditional value contributed the most to the purchase intention of apps for higher education students. This study provides several insights for mobile application designers and developers to better understand the impact on customer behaviors. First, it should be highlighted that consumption values have an impact on customer behaviors for purchasing mobile applications. Among them, the conditional value has more influence on general app users' behavioral intentions than the other consumption values for higher education students. Additionally, the comparison results were provided to better understand the consumer's needs for app usage. Choosing the right requirements will enable stakeholders' interests and preferences to be met within defined technical constraints, thereby enhancing business value. It is therefore important to select the right system based on the customer's needs.

This study has certain limitations. First, the results of this study show the behaviors of higher education students in Turkey. Further research needs to be conducted to better understand the cultural effect on different groups as well. Additionally, there are some indications, based on some evidence, indicating the possible impact of mobile application experience on customers, gender, and age. Hence, further research needs to be conducted to better understand the influence of these factors and the effect of consumption values on mobile application customers.

Moreover, the impact of consumption values on customers having some specific needs, such as visually impaired people [35], may also show different behaviors, which also needs to be further researched.

According to the results, further research in this direction could potentially provide several insights for mobile application developers to better understand the influence of consumption values on customer behaviors. The results also suggest that application developers deeply understand the impact of consumption values on potential customers and design and develop mobile applications accordingly.

To conclude, an extensive inference on consumption values will help developers with a better design and development process by specifying the software requirements as well as marketing strategies for apps.

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