

## DETERMINATION OF CRITICAL ACHIEVEMENT FACTORS IN DISTANCE EDUCATION BY USING STRUCTURAL EQUATIONMODEL : A CASE STUDY OF E-MBA PROGRAM HELD IN SAKARYA UNIVERSITY

Hayrettin EVİRGEN<sup>1</sup>Metin ÇENGEL<sup>2</sup>  
Sakarya University, Sakarya, Turkey  
<sup>1</sup>*evirgen@sakarya.edu.tr*, <sup>2</sup>*cengel@sakarya.edu.tr*,

### ABSTRACT

Nowadays, distance learning education has been started to become familiar in behalf of classical face to face education(F2F) model. Web based learning is a major part of distance education systems. Web based distance learning can be defined shortly as an education type which doesn't force students and educators being into the same mediums.

This education model has a student-centered structure. In this type of education students can learn given lectures without dependancy of time and place. And also students can communicate with their educators via various technology platforms. This is a fact that there are many factors have been effecting achievement of students in web-based distance learning. The success of students can be increased while determining weighted achievement factors.

This study aims for determining critical achievement factors in a case study of e-mba distance education program held Sakarya University, by using structural equality model.

**Keywords:** *Internet, Web based distance learning, Factors of achievement, Structural equality model*

### 1. INTRODUCTION

Continuously developing technology and changing requirements force making changes on common learning methods. Due to increasing demands for education and learning subjects, discussions on radical thoughts about mentioned subjects become more visible. Common base of developed alternative learning methods is creation of a practical medium for overcoming insufficiencies of classical learning methods. The most popular distance based model is web based education model(WBE).

Because of increasing usage rates of information technologies, educators have been highlighted importance of inevitable global education requirements. These requirements force educators for developing new education and learning programs and models(İşman, 2005).

In web based education models reachability of educational web portal, easy and simple design of portal and logical relations among portal page contents can increase success of students during learning process. So it is assumed to be a direct proportional relation between properties of web portals and success rates. Starting with that point, for investigation content first hypotesis is determined as follows;

H<sub>1</sub>: Sensation of students about properties of web portal is directly relational with their achievements during learning process.

It is assumed that access types of lectures and direct communication links with lecturers can contribute positively on success of students in distance learning web portals. So it is expected that technology used in we portal effects achievements of students. After mentioning this expectation the second hypotesis is determined as follows;

H<sub>2</sub>: Sensation of students about used technology in web portal is directly relational with their achievements during learning process.

In web based education models ,logical relations among portal page contents can increase success of students during learning process.So it is expected to be a direct proportional relation between usability of web portals and success rates. After mentioning this expectation the third hypotesis is determined as follows;

H<sub>3</sub>: Usability of web portal is directly relational with achievements of students during learning process.

In web based education models,properties of web portal can increase satisfaction of students during learning process. So it is assumed to be a direct proportional relation betweenproperties of web portals and student satisfaction. Starting with that point, for investigation content fourth hypotesis is determined as follows;

H<sub>4</sub>: Properties of web portal is directly relational with student satisfaction during learning process.

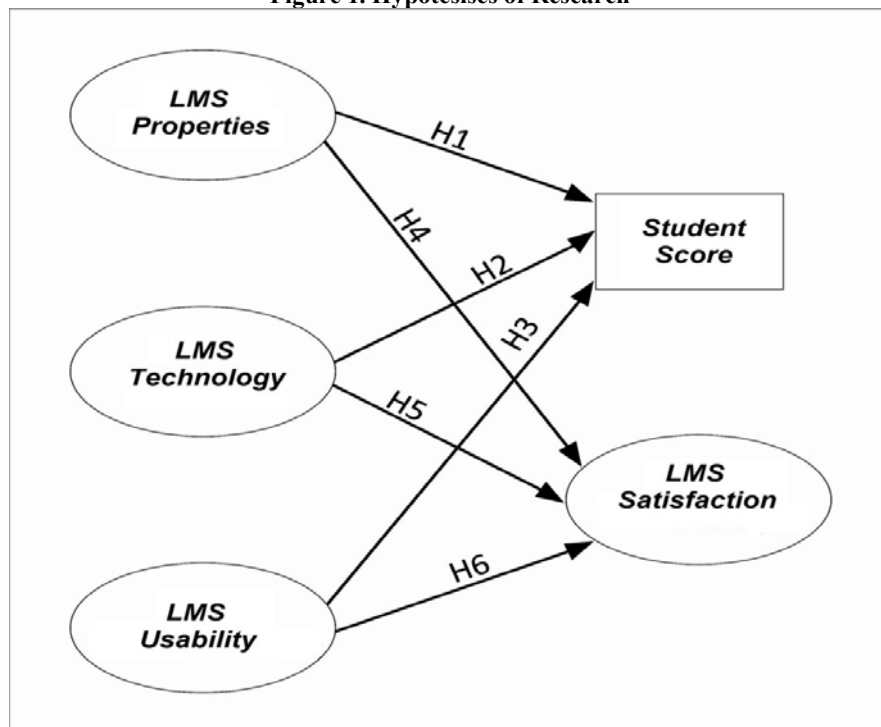
In web based education models, access types of lectures and direct communication links with lecturers can improve satisfaction of students. So it is expected that technology used in we portal effects satisfaction of students. After mentioning this expectation the fifth hypotesis is determined as follows;

H<sub>5</sub>: Sensation of students about used technology in web portal is directly relational with their satisfactions during learning process.

In web based education models usability of web portalcan increasesatisfaction of students during learning process. So it is assumed to be a direct proportional relation betweenusability of web portals and student satisfaction rates. Starting with that point, for investigation content sixth hypotesis is determined as follows;

H<sub>6</sub>: Usability of web portal is directly relational with satisfaction of students during learning process.

**Figure 1. Hypotesises of Research**



## 2. RESEARCH METHODOLOGY

### 2.1 Aim Of Research

This study aims for determining critical achievement factors in a case study of e-mba distance education program held Sakarya University, by applying data mining techniques on enrolled students' own ideas, web portal log informations and overall scores recorded in student office databases. Another purpose of this study is to investigate relations between identified factors and students' satisfactions.

### 2.2 Sampling Process

By the purpose of determining critical achievement factors in a case study of e-mba distance education program held Sakarya University, In 2008-2009 education year a survey held among 350 students enrolled this program via internet platform. Data collecting tools used during investigation have been prepared along with literature Research and three achievement factors have been determined. In the first phase of survey, demographic structure and fact questions are inquired, in the second phase factor questions are inquired. First factor comprises six questions about technology, second one comprises seven questions about property, third one comprises seven questions about usability and forth factor comprises six questions about satisfaction.

On the other side, applying data mining techniques on Sakarya University Distance Learning Management Systems' (DLMS) logsloginnumbersofenrolledstudentshavebeen acquired. For the indicator of student achievements, overall scores of students have been acquired into student affairs database records.

### 2.3 Data and Information Analysis

Due to testing identified hypotheses, structural equality model is used. Before applying mentioned equality model, reliability of used scales has been identified. For reliability scale, importance of internal consistency phenomenon has been highlighted. This scale guarantees a common scalability base for variables. This scale has been investigated by using Cronbach Alpha method. For minimal limits of Cronbach Alpha coefficient is taken as 0.70 value. This value is an applicable value in literature(Hair et al.,1998). Results of Alfa coefficient and scale variables acquired in investigation process are given in Table-1.

Table 1. Reliability Coefficients of ScaleUsedDuringInvestigationProcess

<b>Technology</b>	<b>Alfa Coefficient</b>
<b>C1.</b> For reaching lectures, presenting contents as asynchronous methods effect achievement. <b>C2.</b> For reaching lectures, presenting contents as synchronous methods effect achievement. <b>C3.</b> Communicating lecturers via e-mail effects achievement. <b>C4.</b> Communicating lecturers via portal forums effects achievement. <b>C5.</b> Online Communication with lecturers at least once a week in a known periods effects achievement. (Chat ,Msn ,Perculus etc) <b>C6.</b> Ability of Portal's social interactive medium effects achievement.	<b>0.94</b>
<b>Properties</b>	<b>0.89</b>
<b>D1.</b> Reachability of portal effects achievement. <b>D2.</b> Easy and simple design of portal effects achievement. <b>D3.</b> Clear and understandable contents effect achievement. <b>D4.</b> Consistency and harmony among portal pages effects achievement. <b>D5.</b> Edaquate update periods of platform effect achievement. <b>D6.</b> Symmetric establishments of portal platform' components effect achievement. <b>D7.</b> Answering my own satisfactions of portal effect achievement.	
<b>Usability</b>	<b>0.87</b>
<b>F1.</b> Consistency of presented items in different page effects achievement. <b>F2.</b> Easy and simple design of portal's page effects achievement. <b>F3.</b> Easy access to information needs effects achievement. <b>F4.</b> Access speed of portal effects achievement. <b>F5.</b> Existence of support sections effects achievement. <b>F6.</b> Contributing adequate answers about directed questions effects achievement.	
<b>Satisfaction</b>	<b>0.91</b>
<b>J1.</b> I feel happy when I surfs in portal. <b>J2.</b> I loss my time-sense when I surfs in portal. <b>J3.</b> It is easy to use portal <b>J4.</b> Design of portal is modern and dynamic <b>J5.</b> Design of portal is cool. <b>J6.</b> Visual aspects of portal is satisfactory.	

After exhibiting reliability of scales, identifying relational weight dependencies between each variable and each factor explanatory factor analysis has been handled and results has been shown in Table-2.

Table2. Explanatory Factor Analysis Results

<b>Factor Type</b>	<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F1</b>
<b>TECHNOLOGY</b>				
<b>C1</b>	<b>0.543</b>			
<b>C2</b>	<b>0.775</b>			
<b>C3</b>	<b>0.834</b>			
<b>C4</b>	<b>0.750</b>			
<b>C5</b>	<b>0.841</b>			
<b>C6</b>	<b>0.765</b>			
<b>PROPERTIES</b>		<b>0.755</b>		
<b>D1</b>		<b>0.752</b>		

<b>D2</b>		<b>0.605</b>		
<b>D3</b>		<b>0.687</b>		
<b>D4</b>		<b>0.863</b>		
<b>D5</b>		<b>0.589</b>		
<b>D6</b>		<b>0.574</b>		
<b>USABILITY</b>				
<b>F1</b>			<b>0.755</b>	
<b>F2</b>			<b>0.552</b>	
<b>F3</b>			<b>0.605</b>	
<b>F4</b>			<b>0.755</b>	
<b>F5</b>			<b>0.552</b>	
<b>F6</b>			<b>0.755</b>	
<b>SATISFACTION</b>				
<b>J1</b>				<b>0,823</b>
<b>J2</b>				<b>0,798</b>
<b>J3</b>				<b>0,554</b>
<b>J4</b>				<b>0,723</b>
<b>J5</b>				<b>0,623</b>
<b>J6</b>				<b>0,523</b>

After validation and reliability of scales used in investigation, for the aim of determining relations among properties, technology, usability, achievements and satisfaction of students in web technology based distance learning models, a structural equality model has been developed. structural equality model is a statistical approach that identifies relations among measured (observed) and hidden variables (Hoyle, 1995). structural equality model has become familiar with model testings for last many years among social scientists (Sütütemiz, 2006). The main reason for becoming familiar this model among social scientists is presenting a multi-test medium among all measured and hidden variables.

Figure 3. Technology Factor-DFA

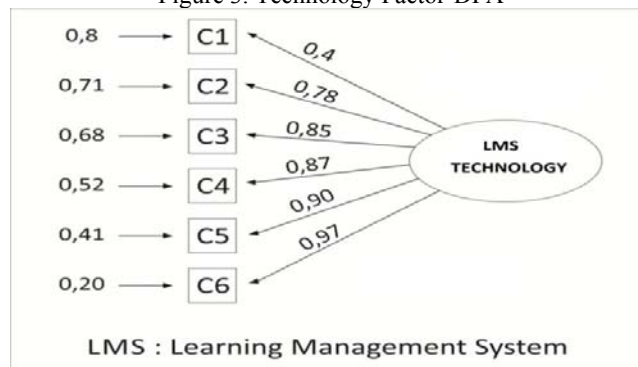


Table 3. Technology Factor Fit Indexes

Technology	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,71 / 2	,787	,837	,770	,789	,065

After applying confirmatory factor analysis method on technology factor, error values belong to C1 measured variable have great covariance value with other variables so C1 variables have been eliminated from analysis process. After applying this action relations among variables are shown in Figure-3 and final fit index are given in Table-4.

Figure 4. Technology Factors DFA(1.Modification)

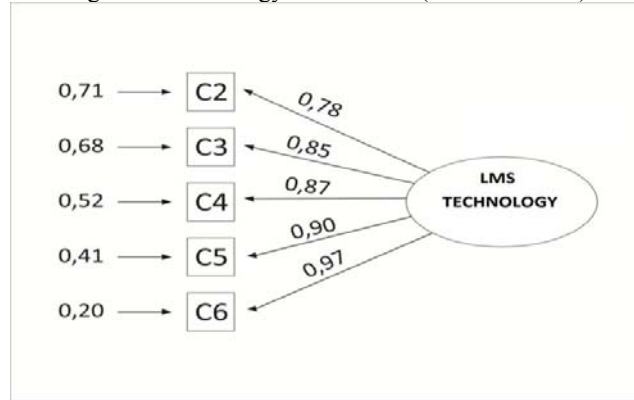


Table 4. Technology Factor(1.Modification) Fit Indexes

Technology	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,71 / 2	,947	,927	,930	,919	,093

Figure 5. PropertiesFactor DFA

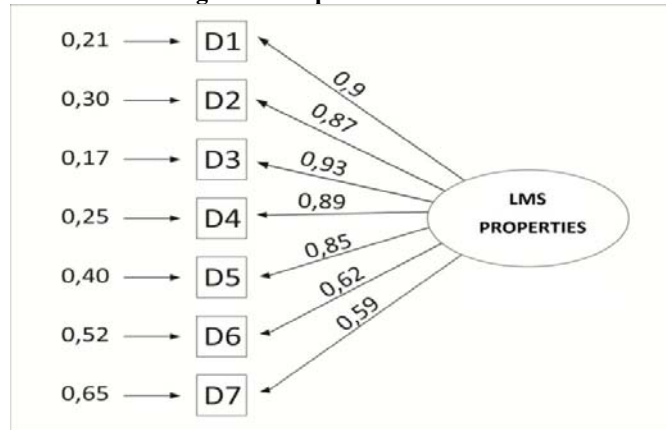


Table 4. Properties Factor Fit Indexes

Properties	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,065 / 5	,791	,864	,838	,921	,098

After applying confirmatory factor analysis method on properties factor, error values belong to D6 and D7 measured variable have great covariance values with other variables so D6 and D7 variables have been eliminated from analysis process. After applying this action relations among variables are shown in Figure-6 and final fit index are given in Table-5.

Figure 6. Properties Factor DFA(1.Modification)

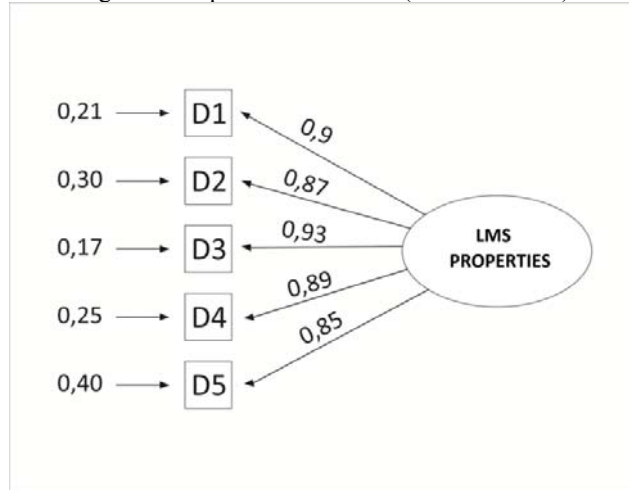


Table 5. Properties Factor(1.Modification) Fit Indexes

Properties	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,065 / 5	,911	,924	,938	,921	,038

Figure 7. Usability Factor DFA

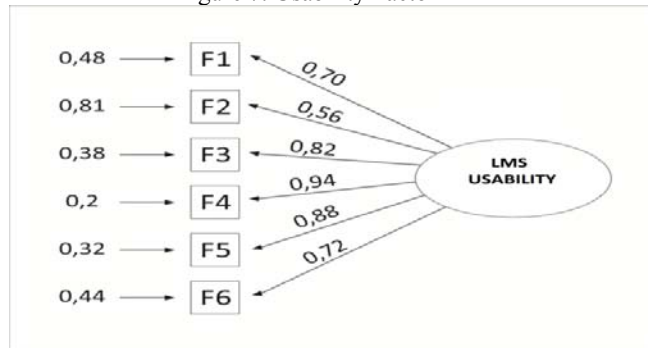


Table 6. Usability Factor Fit Indexes

Usability	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,065 / 5	,799	,884	,898	,881	,068

After applying confirmatory factor analysis method on usability factor, error values belong to F2 measured variable has great covariance value with other variables so F2 variables have been eliminated from analysis process. After applying this action relations among variables are shown in Figure-8 and final fit index are given in Table-7.

Figure 8 Usability Factor DFA (1.Modification)

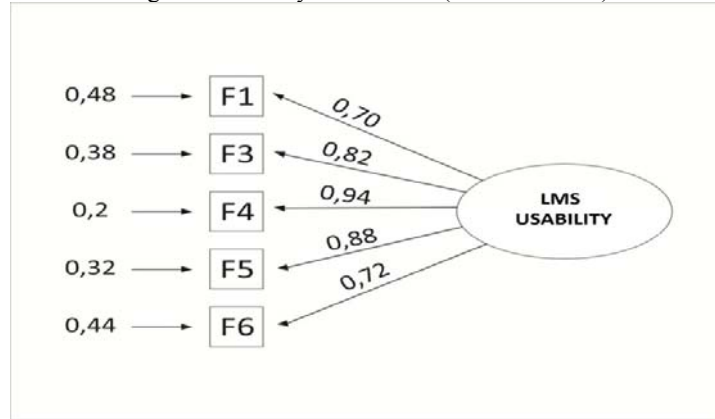


Table 7. Usability Factor(Modification)

Presentatio n	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	4,024 / 2	,928	,986	,929	,979	,012

Figure9. Satisfaction Factor DFA

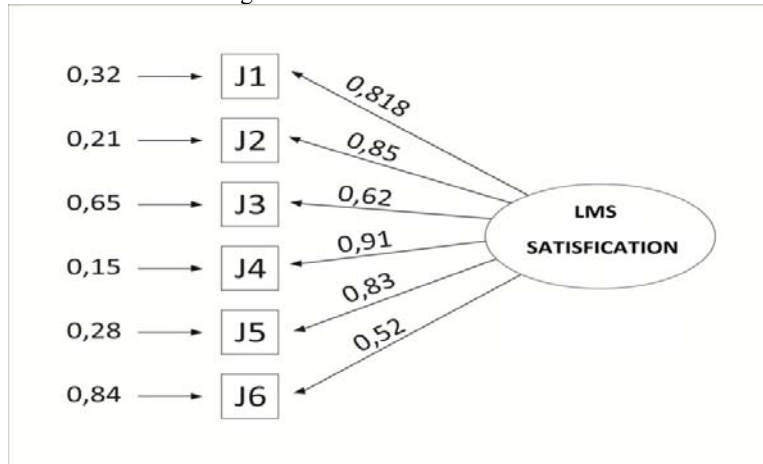


Table 8.Satisfaction Factor Fit Indexes

Satisfaction	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,065 / 5	,779	,864	,858	,861	,058

After applying confirmatory factor analysis method on satisfaction factor, error values belong to J3 and J6 measured variable have great covariance values with other variables so J3 and J6 variables have been eliminated from analysis process. After applying this action relations among variables are shown in Figure-10 and final fit index are given in Table-9.

Figure 10. Satisfaction Factor DFA(1.Modification)

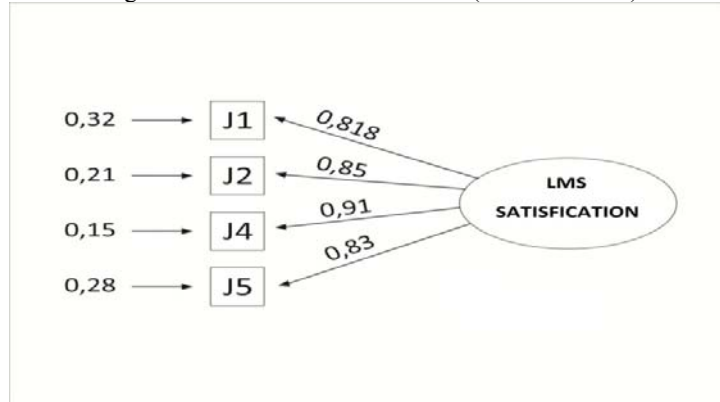


Table 9.Satisfaction Factor (1.Modification) Fit Indexes

Satisfaction	Fit Indexes					
	$\chi^2/df$	GFI	AGFI	TLI	CFI	RMSEA
	6,065 / 5	,979	,964	,958	,961	,019

After validation and reliability of scales used in investigation, for the aim of determining relations among properties, technology, usability, achievements and satisfaction of students in web technology based distance learning models, a structural equality model has been developed. Structural equality model is a statistical approach that identifies relations among measured(observed) and hidden variables(Hoyle, 1995). Structural equality model has become familiar with model testings for last many years among social scientists(Sütütemiz, 2006). The main reason for becoming familiar this model among social scientists is presenting a multi-test medium among all measured and hidden variables.

**3. RESULTS OF RESEARCHES**

In this part of study, application of structural equality model for testing demographic structures and research hypotheses has been handled and results of researches have been given.

**3.1 Demographic Properties of Research Sample**

Statistical informations about demographic properties of 350 students enrolled e-mba distance education program held Sakarya University in 2008-2009 education year, such as frequency and percentage distributions are given in Table-10.

Table 10. Statistical Informations About Demographies in Survey

Sexuality	Frequency	Percentage
Male	207	74,2
Female	72	25,8
<b>Total</b>	<b>279</b>	<b>100</b>
Working Condition		
Works	237	88,5
Doesn't work	42	11,5
<b>Total</b>	<b>279</b>	<b>100</b>
Educational Situation		
Business Administration	187	67
Science	9	3,2
Engineering	56	20,1
Others	27	9,7
<b>Total</b>	<b>279</b>	<b>100</b>

As seen in Table-10, number of males is nearly three times greater than number of females. Number of working participant students is nearly eight times greater than number of unworkings. This is an expected result, because distance learner students always have working opportunities. 67 percent of participant students graduated from 4-year business administration program before enrolled distance learning programme. 20.1 percent of participant students graduated from engineering program, 3.2 percent graduated from science program and 9.7 percent



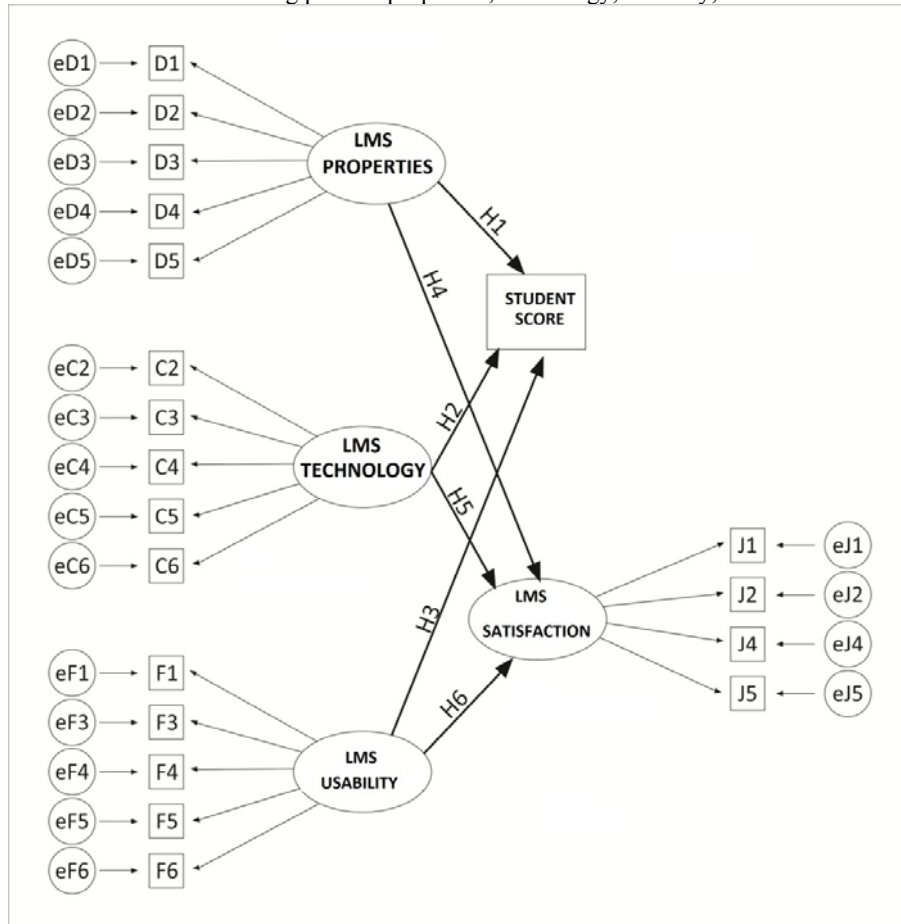
graduated from other program before enrolled distance learning programme. This type of distribution confirms E-MBA programme’s being continuous of business administration programs.

**3.2. Implementation of Structural Equality Model**

For the aim of determining relations among properties, technology, usability, achievements and satisfaction of students enrolled in e-mba distance education program held Sakarya University , a structural equality model has been used. This model implemented via AMOS Statistical Simulation Package Software.

Students’ sensations about properties of portal’s page have been measured via seven variables, technology measured via six variables, usability measured via six variables, satisfaction measured via six variables, and overall scores of student have been acquired by student affairs database records. As highlighted above, before applying mentioned equality model, reliability of used scales has been identified by using Cronbach Alpha method and validation of used scales has been determined by confirmatory factor analysis method. After implementing confirmatory factor analysis method, it has been brought out that error values have high rated covariance value both with theirselves and other variables. This make increases in total variance. After confirmatory factor analysis method; five variables of students’ sensations about properties of portal’s page, five variables about technology, five variables about usability, and four variables about satisfaction, totally 19 variables have been added into structural equality model. Figure-11 shows relations among portal’s properties, technology, usability, satisfaction and scores.

Figure 11. Relation Model among portal’s properties, technology, usability, satisfaction and scores.



Results of a structural equality model for the aim of determining relations among properties, technology, usability, achievements and satisfaction of students enrolled in e-mba distance education program held Sakarya University, are given in Table-11 and Table-12.

Table 11. Results for Research Model of Fit Godness Indexes

<b>Fitness Indexes</b>	<b>Model</b>
X <sup>2</sup> (Chi Square)	112,88
Freedom Degree	101
p (Goodness Degree)	0,001
x <sup>2</sup> /df	1,047
GFI (Godness Fit Index)	0,923
AGFI (Adjusted Fit Godness Index )	0,891
RMR (Root Mean Sqaure of Remainder )	0,026
IFI (Increased Fit Godness Index )	0,938
CFI (Comparated Fit Goodness Index)	0,958
NFI (Normed Fit Goodness Index )	0,969
TLI( Tucker-Lewis Index)	0,923
RFI (Relativitive Fit Goodness Index )	0,920
RMSEA (Root Mean Sqaure of Rapprochement Error )	0,027

Evaluation of harmony between data and model, three basic criterias are investigated during implementation of structural equality model. This criterias are Chi-square/df, goodness of fit) and RMSEA values. If results of analysis shows similarities among expected values and acquired values, it can be said that there is an harmony between data and model.

Goodness statistics of investigated model are given in Table-11. In Table-12, perfect harmony between research model and data is shown into research model column and perfect harmony between model and data is shown into ideal model column.

When examining results shown in Table-7, Chi-square statistic taken into analysis is meaningful at 0.01 goodness level. However, because of excessive sensitiveness of Chi-square value to sample values requires another indicator for measuring harmony between model and data(Baker, Parasuraman, Grewal, Voss, 2002). So other harmony measurement criterias should be examined.

One of other harmony measurement criterias is CMIN/DF value. This ratio need to be near zero or alt least to be under five(Yoo, Donthu, Lee, 2000). In Research model, this value is measured in 3,674. This value confirms reasonable harmony between model and data.

One of another harmony measurement criterias is Goodness of Fit Index-GFI. This index gets a value between zero and one. This index need to be combined assessments by CFI(Comparative Fit Index), NFI(Normed Fit Index), TLI(Tucker-Lewis Index), RFI(Relative Fit Index) ve IFI(Incremental Fit Index). This mentioned sub-index get also a value between zero and one. Index value becoming near to one shows harmony between model and data.

As seen in Table-11, 0.923-GFI value, 0.969- NFI value, 0.920- RFI value, 0.9381- IFI value, 0.925- TLI value and 0.958-CFI value are measured. This confirms reasonable harmony between our model and data.

One of another harmony measurement criterias is RMSEA value. In Research model, this value is measured in 0,027. This value confirms reasonable harmony between model and data. . Hoelter ,05 and ,01 indexes give minimum sample size in reliable interval of test hypoteses.Holding research hypoteses into 95 percent of reliability interval and 0.05 goodness value, required sample size should be 99 and holding 99 percent of reliability interval and 0.01 goodness value, required sample size should be 110. Number of samples used in this research is 350 and this value is enough for satisfied results.

Table 12. Hypotesis Test Results of Structural Model

	<b>MLE : Non-Std MLE</b>	<b>Standart Ht.</b>	<b>t</b>	<b>Hypotesis Results</b>
<b>Properties→Score</b>	0,228:0307	0,138	2,229	H1: YES
<b>Technology→Score</b>	0,051:0,047	0,148	0,321	H2:NO
<b>Usability→Score</b>	0,208:0,207	0,139	1,229	H3: YES
<b>Properties→Satisfaction</b>	0,218:0307	0,138	2,129	H4: YES
<b>Technology→Satisfaction</b>	0,256:0,042	0,141	3,621	H5: YES
Usability→Satisfaction	0,049:0,017	0,122	1,121	H6:NO
<b>*** p&lt; 0,01; **p&lt; 0,05; *p&lt;0,10</b>				

H1 tests relation between properties and student scores. For model, site properties ( $r=0.228$ ) means positive and meaningful effects on student achievements ( $t=2,229$ ;  $p<0,05$ ). One unit increase in properties factor effect 0.228 unit increase at student achievements. So that H1 hypothesis confirms itself.

H2 tests relation between technology and student scores. For model, technology doesn't mean any effects on student achievements ( $p<0,587$ ). So that H2 hypothesis can not be accepted.

H3 tests relation between usability and student scores. For model, site usability ( $r=0.208$ ) means positive and meaningful effects on student achievements ( $t=2,209$ ;  $p<0,041$ ). One unit increase in usability factor effect 0.208 unit increase at student achievements. So that H3 hypothesis confirms itself.

H4 tests relation between properties and student satisfaction. For model, site properties ( $r=0.218$ ) means positive and meaningful effects on student satisfaction ( $t=2,129$ ;  $p<0,04$ ). One unit increase in properties factor effect 0.218 unit increase at student satisfactions. So that H4 hypothesis confirms itself.

H5 tests relation between technology and student satisfaction. For model, technology ( $r=0.256$ ) means positive and meaningful effects on student satisfaction ( $t=3,621$ ;  $p<0,044$ ). One unit increase in technology factor effect 0.256 unit increase at student satisfactions. So that H5 hypothesis confirms itself.

H6 tests relation between site usability and student satisfaction. For model, site usability doesn't mean any effects on student satisfaction ( $p:0,637$ ). So that H6 hypothesis can not be accepted.

#### 4. CONCLUSION

In E-MBA web based distance education program, there are meaningful regression results about relations among variables of site properties, used technology, site usability, achievements and satisfaction of enrolled students as shown in Table-11. In another sayings, H1, H3, H4 and H5 hypotheses confirm themselves. On the other side, it is shown that H2 and H6 hypotheses can not be valid on this model.

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