The Verification of Structural Decision-Making Model for Evaluating Education on Facebook

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Abstract

The aim of this paper is to present the work of the research team who tried to construct a model that explores general opinions of students about education on Facebook and also opinions of students about education on the social page for course E-marketing by using structural equation model.

Facebook has already been present at universities due to the fact that students use it as a primary source of information about news in courses, duties, and so on. The research team carried out an experiment in the course E-marketing at FE of VŠB – TUO, in which Facebook was used as a tool for communication between students and teachers. The research on the attitude of students towards education on Facebook was conducted by questioning using predefined variables. The first form of the model was designed by factor analysis with method Varimax, when six groups of factors that affect respondents´ opinions about education were defined. A structural equation model was used to verify the validity of the model. It appears that four groups of factors mainly affect respondents´ attitudes to this type of education according to the testing performed. These groups of factors are Engagement, Information and Modern Technologies, Lecturers and Scores, and Education on Facebook. The research team also determined statistically the most significant variables in these factors that affect the opinions of students about education the most.

Keywords: education on Facebook, social networks in education, student engagement, structural equation model

1. INTRODUCTION

Since its start in 2004, Facebook has gained popularity not only among young people and became the most popular online social network of its time. Today, this network has more than 980 million of users (almost 4 million in Czech Republic). This popularity of course was not left aside by companies, who started to use Facebook in their marketing communication. Today, Facebook is (together with website) the cornerstone of many companies, especially if they are on the consumer market and are oriented on young and middle generation.

Although the main purpose of Facebook is communication and entertainment, it can also be used for secondary and higher education. According to Socialbakers statistics, Facebook has 1 071 500 users in the category of 18-25 years in Czech republic, while Czech Statistical Office states there are 1 072 934 citizens of this age. Sure, some of these profiles are probably fake; however the penetration of Facebook in this generation is very high. The possibility of utilization of this network by university pedagogues is therefore obvious.

The aim of this paper is to present the work of the research team who tried to construct a model that explorer general opinions of students about education on Facebook and also opinions of students about education on social page of course E-marketing by using structural equation model. This method was constructed for usage in psychology and other social sciences. Researchers in

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the field of marketing management started to use it more recently, which is why we chose to use it also – we want to manage the educational course. As far as we know, there are no researches where this method is applied in the field of education using social networks.

2. BASIC KNOWLEDGE OF THE RESEARCH SUBJECT

2.1 Facebook in the university environment

There are many ways universities can use Facebook. The most common way is creation of University (or Faculty) profile on Facebook, where the school can post news about events that are happening, people can ask questions and discuss various subjects. Quite a lot of schools use this communication channel, for example Charles University of Prague or Masaryk University. Amongst faculties, we can also mention the profile of Faculty of Mechanical Engineering at VŠB – Technical University of Ostrava.

Less frequent way of using Facebook is communication and propagation of taught subjects. For example, we can mention profile of subject 'Marketing on the Internet' by Marek Střiteský from The University of Economics, Prague or 'Social Communication' by Olga Biernátová from Tomas Bata University in Zlín. Some pedagogues use different approach: Martin Adámek from University of Hradec Králové started Facebook page called 'Martin Adámek – tutoring', where he communicates with his students about all subjects taught by him.

Communication with students on Facebook profile was chosen by pedagogues of course E-marketing on the Faculty of Economics at VŠB - Technical University of Ostrava. The goal of the profile was to pass information complimenting lectures and tutorials, and to publish current scores from tutorials. Students were also invited to publish their own content related to the course on the page.

2.2 Researches of using Facebook in university environment

Before the research team could design the questionnaire, we had to study existing researches about the usage of social networks in education. Many researches currently deal with the topic of social networks and their importance in lives of students. For example, studies in United States demonstrate that Facebook is used by 85 % to 99 % of university and college students, which proves high penetration of this network amongst the target group (Jones & Fox, 2009). Smith and Caruso (2010) added that most of the students visit Facebook at least once per day.

Another subject of research is the opportunity of acquiring and maintaining social capital using Facebook. Ellison, Steinfield and Lampe (2007) define social capital as `the resources accumulated through the relationships among people'. Valenzuela, Park and Kee (2009) found that use of Facebook was positively related to civic participation, life satisfaction, and social trust.

The perception of one's privacy when interacting with official university or faculty profile on Facebook is also frequent research topic. Roblyer (2010) found that only 15 % of students perceive the existence of such profile as a breach of their privacy. On the contrary, it was confirmed that more personal and closer contact with pedagogues and university staff is motivating for the students and helps them to achieve better results. Research committed by Moran, Seaman and Tinti-Kane (2011) suggests that students are better prepared to use social networks in education than most of the faculties.

There are some disputes whether the usage of social networks in tutoring has an influence on student's engagement. Engagement is defined as 'time and effort students invest in educational activities that are empirically linked to desired college outcomes'(Kuh, 2009). Heiberger and Harper suppose that time spent on Facebook can influence engagement positively; while, in more recent study, Junco (2012) states that the influence is negative. He claims that students, who spend time on the network, have less time to study. Even he nonetheless says that presence of learning profiles on Facebook can enhance the engagement of students.

Adámek (2011) examined activity on his profile and found that students most appreciate information about the organization of his subjects. He claims the greatest advantage is the two-way communication and that the answers of pedagogue are available to all fans of the page, so the students don't need to ask questions which were already answered.

3. RESEARCH METHODS

3.1 Data collection

The data, which was used for subsequent modelling of factors effecting opinions on education at college using social net Facebook, was obtained in the questionnaire research. This questionnaire research was realized among students of the Faculty of Economics VŠB – TU Ostrava during the summer semester of the academic year 2012/2013. Questioning was realised during the last week of semester when students have already known quite clearly what was dealt with during the semester, student also have already known how social page was used and their opinion about method of education has been formed yet. We used online questioning because of general concept of the course was also connected with internet. The aim of the research was find out general opinions of students about education on Facebook and also opinions of students about education on social page of course E-marketing.

The population were students of E-marketing course that means students of 3rd year of bachelor's degree in Marketing and Business and students of 1st year of master's degree in Economics and Law in Business. The choice of these students was intentional because research team explored the impacts of existence of course E-marketing´s social page on social net Facebook towards to opinions about education on this social net, and therefore it was not appropriate to research attitudes and experiences of other respondents. Because the population had only 132 students, the sample was in this case equal to the population. The opinions of 112 respondents were obtained by this representative questioning.

The variables that were consulted by students were determined with assistance of secondary information from the literature research. Students of course E-marketing expressed their attitudes on a scale of 1 up to 5, where 1 corresponded to a positive statement and 5 corresponded to a negative statement. The statements (variables) were set up to find out opinions of students about innovativeness, entertainment value, importance, , utility, credibility and consistency of education on the social net Facebook, as well as involvement in discussions, activity on social page during lectures and after the end of the lectures and time spend on the lecture. The research team didn´t omit sensitive issues such as visibility of scores by others, fears of posting or submission of tasks on FB and many others.

3.2 Factor analysis

The research team used factor analysis to estimate the basic model for merging of originally 20 variables. Factor analysis uses basic statistical methods. These statistical methods are multiple regression and partial correlation. The multiple regression is a method of statistical explanation of the first type, when part of variance of one variable is explained by regression. It is explanation of variance of one variable by its relation to other variables. Partial derivative represents statistical explanation of the second type, when all the correlation of two variables is explained by their mutual correlation with another variable. It is an attempt to explain the correlation between two variables by their mutual covariance with the third variable. It means that mutual relation of variables is explained by their relation to another variable. (McDonald, 1990)

Factor analysis was made up by method Varimax, which was developed by Kaiser in 1958 and it "is indubitably the most popular rotation method by far. For varimax a simple solution means that each factor has a small number of large loadings and a large number of zero (or small) loadings. This simplifies the interpretation because, after a varimax rotation, each original variable tends to be associated with one (or a small number) of factors, and each factor represents only a small number of variables. In addition, the factors can often be interpreted from the opposition of few variables with positive loadings to few variables with negative loadings. Formally varimax searches for a rotation (i.e., a linear combination) of the original factors such that the variance of the loadings is maximized." (Abdi, 2003)

3.3 Structural equation model

Method of modelling using structural equations (hereinafter referred as structural modelling or SEM). Validity of the model proposed by research team with factor analysis was tested with this method. Structural modelling is used to investigate relations among observed and unobserved variables, where every unobserved variable usually consists of several observed variables. Residual variable may also be present in the model. It shows errors of estimate or errors of measurement (Urbánek, 2000). Nachtigall (2003) claims, that general structural model consist of two parts – measurement model and unobserved variables model.

Measurement model comprises relations between the unobserved variables. If one of the unobserved variables constitutes unobserved variable, it is called proxy variable. If it is measured by several observed variables, it is so called indicator (Navrátilová, 2013).

Observed variables correlate only with measured unobserved variable, so `variance explained by linear dependency of observed variable on unobserved variable represents every 'valuable' variance of the observed variable' (Urbánek, 2000, p. 67). The model does not interpret the residual segment of the variance. Residual variance can be considered as unobserved variable.

Measurement model can be algebraically defined as the system of two equations in matrix form:

$$x = \Lambda_x \zeta + \delta , \quad (1)$$

$$y = \Lambda_y \eta + \varepsilon , \quad (2)$$

where x stands for indicator of unobserved variable ζ, y is indicator for unobserved variable η, ζ is unobserved exogenous variable, η is unobserved endogenous variable, Λ_x and Λ_y are matrixes of structural coefficients for relations of variables x and ζ and variables y and η , δ and ε are

residual variables for *x* and *y*. Covariation matrixes Θ_δ and Θ_ε of the residual variables are also included in the measurement model. These matrixes are usually diagonal, and residual variables don't correlate in the model.

Unobserved variables model depicts the relations between unobserved variables. This model detects, which unobserved variable is independent (endogenous). We can say that the exogenous variable is not influenced by any of the independent variable, whilst endogenous variable is influenced by other variables. Unobserved variables model can be interpreted as:

$$\eta = B\eta + \Gamma \xi + \zeta \quad (3)$$

where B a Γ are the matrixes of structural coefficients of unobserved endogenous, (exogenous) variables, ζ are measurement errors (disturbances) and Φ is covariation matrix of unobserved exogenous variables, and Ψ is covariation matrix of prediction errors. Aforementioned variables are also present in this equation.

The validity of proposed model can be proven with multiple chi-squared tests. The root mean square error of approximation (RMSEA) index or comparative fit index (CFI) can be named as one of the most used. It is also appropriate to point out the Cronbach´s Alpha index. Normed fit index (NFI) measures the room for improvements in the model.

The value of Cronbach´s Alpha should be (in optimal case) higher than 0.7. Reached value of 0.5 can be enough according to number of used observed variables in unobserved variable. The higher number of used observed variables means the higher value of Cronbach´s Alpha should be reached. If the unobserved variable exceeds 0.5 and higher, we can mark it as valid. The RMSEA index should of value 0.08 and lower. The lower is its value, the more the proposed model fits real data. Value of the CFI index should be close to 1.000. NFI index should be also close to 1.000.

4. STRUCTURAL EQUATION MODEL FOR EDUCATION ON FACEBOOK

In following part, there are explained variables entered into model and also the validity of tested model is verified.

4.1 Variables in model

The basis of research was 20 variables. During testing in total 4 observed variables were eliminated because of the highest validity of model. These were variables fears of posting on FB page, visibility of scores by other students on the FB page, number of posts on the FB page and important information on FB page, that were not categorized into any factor under factor analysis or that had negative regression coefficient.

We found out the factor analysis was valid and was successful in 79,9 %.

Tab. 1 – KMO Test for factor analysis. Source: authors' own.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,799
Bartlett's Test of Sphericity	Approx. Chi-Square	415,847
	df	120
	Sig.	,000

Following Tab. 2 shows reached communalities, which mean rations of unobserved variable on variance of observed variable.

Tab. 2 – Communalities. Source: authors' own.

Communalities		
	Initial	Extraction
Entertainment value of the page on Facebook	1,000	,568
Innovativeness of the FB page	1,000	,503
Utility of the FB page	1,000	,550
Credibility of information on the FB page	1,000	,547
Personal approach of lecturers on the FB page	1,000	,672
Visibility of their scores on the FB page	1,000	,599
Frequency of lectures on FB	1,000	,688
Utility of information on the page	1,000	,514
Topics of the contributions on the page	1,000	,582
Involvement in discussions	1,000	,637
Submission of the assignments on FB	1,000	,484
Facebook page in the concept of course	1,000	,308
Opinion on the department after the lecture	1,000	,513
Activity on the page after the end of lectures	1,000	,562
Importance of the use of modern technologies by lecturers	1,000	,381
Time spend on the lecture	1,000	,392

Extraction Method: Principal Component Analysis.

Tab. 3 – Output of factor analysis. Source: authors' own.

Total Variance Explained									
dimension	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Vari-ance	Cumula-tive %	Total	% of Vari-ance	Cumu-lative %	Total	% of Vari-ance	Cumu-lative %
1	4,355	27,216	27,216	4,355	27,216	27,216	2,735	17,095	17,095
2	1,691	10,567	37,783	1,691	10,567	37,783	2,155	13,468	30,564
3	1,324	8,272	46,055	1,324	8,272	46,055	1,821	11,381	41,944
4	1,130	7,064	53,119	1,130	7,064	53,119	1,788	11,175	53,119
5	,998	6,359	59,478						
6	,892	5,574	65,053						
7	,863	5,391	70,444						
8	,768	4,797	75,241						
9	,685	4,281	79,523						
10	,608	3,802	83,325						
11	,584	3,652	86,977						
12	,507	3,166	90,143						
13	,440	2,748	92,891						
14	,418	2,614	95,506						
15	,416	2,599	98,104						
16	,303	1,896	100,000						

Extraction Method: Principal Component Analysis.

According to Kaiser Normalization we got 4 new factors as is shown in Tab. 3. According to reached value of Cumulative % Rotation Sums of Squared Loadings this model explains 53,119 % of variability of tested data.

By factor analysis with method Varimax 16 variables were categorized based on their mutual relations (Tab. 4). We obtained 4 groups of factors, which were then included in the model, whose validity was verified by structural equation model.

Tab. 4 – Output of factor analysis. Source: authors' own.

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
Involvement in discussions	,735			
Activity on the page after the end of lectures	,702			
Topics of the contributions on the page	,665			,368
Time spend on the lecture	,572			
Utility of information on the page	,496			0,473
Entertainment value of the page on Facebook	,477		,437	
Credibility of information on the FB page		,723		
Innovativeness of the FB page		,691		
Utility of the FB page	,313	,657		
Facebook page in the concept of course		,514		
Importance of the use of modern technologies by lecturers		,423		
Personal approach of lecturers on the FB page			,799	
Visibility of their scores on the FB page			,737	
Opinion on the department after the lecture	,471		,501	
Frequency of lectures on FB				,794
Submission of the assignments on FB				,687

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

There are 20 variables in tested model. Number of observed variables is 16, number of unobserved variables is 20, including 16 residual variables. Following Tab. 5 shows variables in structural equation model.

Tab. 5 - Variables in structural equation model. Source: authors' own.

Type of variable	Label of variable	Name of variable in model
Observed variables	E1 - E6	Factors effecting engagement
	IaMT1-IaMT5	Opinions about using modern technologies
	LaS1 - LaS3	Factors affecting scores of lecturers and lectures
	EoF1 - EoF2	Opinions about education on Facebook
Unobserved variables	E	Engagement
	IaMT	Information and Modern Technologies
	LaS	Lecturers and Scores
	EoF	Education on Facebook
Residual variables	e1 - e16	

The unobserved variable „Engagement" (E) is measured by the observed variables E1 - E6, which shows Tab. 5. These observed variables express factors related to students activity on social page of course, its utility and entertainment. Specifically the following factors were evaluated:

E1 involvement in discussions,

E2 activity on the page after the end of lectures,

E3 utility of information on the page,

E4 entertainment value of the page on Facebook,

E5 time spend on the lecture,

E6 topics of the contributions on the page.

The second unobserved variable „Information and Modern Technologies" (IaMT) is measured by five observed variables IaMT1 - IaMT5. These observed variables assess feelings of students about using modern technologies for finding out information and for education. Exactly we explored the students' feelings about:

IaMT1 credibility of information on the FB page,

IaMT2 utility of the FB page,

IaMT3 innovativeness of the FB page,

IaMT4 Facebook page in the concept of course,

IaMT5 importance of the use of modern technologies by lecturers.

The third unobserved variable „Lecturers and Scores" (LaS) is measured by the observed variables LaS1 - LaS3. These observed variables evaluate factors effecting attitudes to lecturers and approaches to scores. Variable LaS1 deals with personal approach of lecturers on the FB page, variable LaS2 identifies respondents´ attitude to visibility of their scores on the FB page and variable LaS3 deals with opinion on the department after the lectures.

The last unobserved variable „Education on Facebook" (EoF) is measured by two observed variables EoF1 a EoF2. These observed variables judge approaches of respondents to education

on social net Facebook. Variable EoF1 focuses on opinion of respondents to submission of the assignments on FB and variable EoF2 to frequency of lectures on FB.

4.2 Validity of model

Following Fig. 1 shows the relationships between different variables in model of measurement and also the values of standardized regression coefficients.

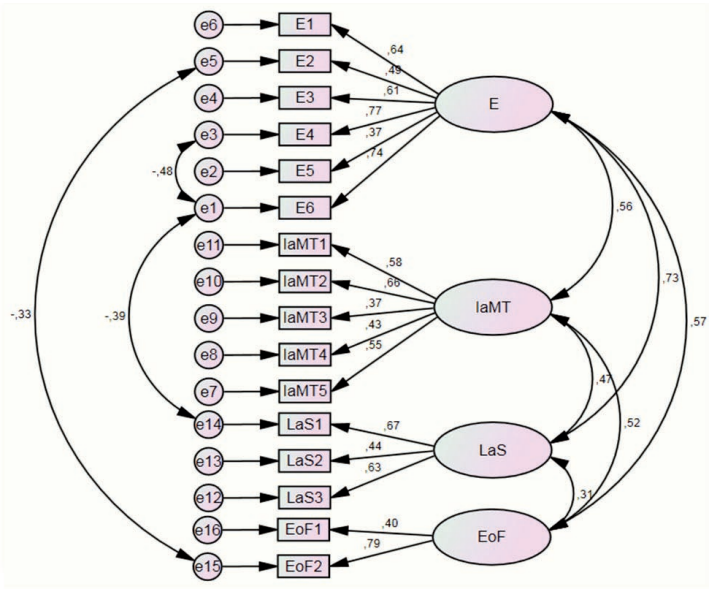

Fig. 1- Regression coefficients in model of measurement. Source: authors' own.

The illustrated regression coefficients indicate the strength of relations between observed variable and corresponding unobserved variable. The recommended value of standardized regression coefficients is at least 0.5, optimally 0.7 (Hair et al., 2010). This condition is met by all variables except for the variable E2, E5, IaMT3, IaMT4 and LaS2 and EoF1. These variables that indicate factors activity on the page after the end of lectures (E2), time spend on the lecture (E5), innovativeness of the Facebook page (IaMT3), Facebook page in the concept of course (IaMT4), visibility of my scores on the Facebook page (LaS2) and submission of the assignments on Facebook (EoF1), are not statistically reliable, although they are statistically significant. This fact can affect validity of the model.

According to the calculated regression coefficients, variables entertainment value of the page on Facebook and topics of the contributions on the page are the most significant variables that determine the unobserved variable „Engagement" (E). Variables utility of the Facebook page and credibility of information on the Facebook page determine the most the unobserved variable „Information and Modern Technologies" (IaMT). Unobserved variable „Lecturers and Scores" (LaS) is the most determined by variable personal approach of lecturers on the Facebook page. The respondents' opinions about frequency of lectures on Facebook is the most important for unobserved variable „Education on Facebook" (EoF).

All relations between unobserved variables E, IaMT, LaS a EoF are statistically significant, however relations between unobserved variable „Education on Facebook“ and „Lecturers and Scores“ and unobserved variable „Lecturers and Scores“ and „Information and Modern Technologies“ appear statistically unreliable.

To evaluate the validity of the model research team used at first indicator Cronbach´s Alpha, that value should be more than 0.5, in optimal case 0.7, for each unobserved variable. This indicator takes the value of 0.761 for unobserved variable "Engagement" (see in the output of SPSS Tab. 6). For unobserved variable "Information and Modern Technologies" was reached value of 0.639, for unobserved variable "Lectures and Scores" 0.571 and for unobserved variable "Education on Facebook" 0.483. It is possible to determine this model as valid.

Tab. 6 – Reached values of Cronbach´s Alpha for each unobserved variable. Source: authors' own

Reliability Statistics			
Unobserved variable	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Engagement	,761	,765	6
Information and Modern Technologies	,639	,650	5
Lectures and Scores	,571	,587	3
Education on Facebook	,483	,484	2

According to index RMSEA, which should have values of 0.08 and lower, this model is optimal, because index RMSEA in this case is 0.000. This model is optimal also according to Comparative Fit Index (CFI) with reached value 1.000. However Normed Fit Index (NFI) with reached value 0.791 indicates that there is a possibility for improvement in fit of data and model. Reached values of indexes from the program SPSS Amos are shown below (see Tab. 7 and Tab. 8).

Tab. 7 – Reached value of RMSEA. Source: authors' own.

RMSEA	
Model	RMSEA
Default model	,000
Independence model	,155

Tab. 8 – Reached values of NFI and CFI. Source: authors' own.

Baseline Comparisons		
Model	NFI Delta1	CFI
Default model	,791	1,000
Saturated model	1,000	1,000
Independence model	,000	,000

In Tab. 7 and in Tab. 8 there are used default, independence and saturated models. Default model means the researchers´ structural model. Independence model is one of complete independence of all variables in the model, it means all correlations of all variables are zero. Independence model can be also called uncorrelated variables model and is the most restricted. The most fit indexes are zero. Saturated model on the other had is one in which the number of estimated parameters equals the number of data points. That means there are variances and covariances among the observed variables. Saturated model is the least restricted. The most goodness of fit measures are one for a saturated model. If the saturated model has a parsimony ratio of zero, the independence model has a parsimony ratio of one. (Byrne, 2009)

4.3 Possibilities for model improvement

There are possibilities for improvement of model in case of 5 observed variables (mentioned above) that was determinate as statistically unreliable because of low regression coefficients. It appears that factors activity on the page after the end of lectures (E2), time spent on the lecture (E5), innovativeness of the Facebook page (IaMT3), Facebook page in the concept of course (IaMT4), visibility of my scores on the Facebook page (LaS2) and submission of the assignments on Facebook (EoF1) are not suitable for this tested model.

4.4 Interpretation of tested model

This proposed model confirmed that students' opinions about education on social net Facebook are influenced by 4 groups of factors which can by defined as factor Engagement, Information and Modern Technologies, Lecturers and Scores and Education on Facebook. Following variables entertainment value of the page on FB and topics of the contributions on the page, utility of the Facebook page and credibility of information on the Facebook page, personal approach of lecturers on the Facebook page and frequency of lectures on Facebook were determined as the most statistically significant variables that effect respondents' attitudes about education on Facebook.

Students expected that education is entertaining, that was met. Students also considered posted topics on the page relatively close to them, which met their expectations about not discuss only distant topics during course. Students also evaluate this education as very credible and also useful. Students find out lecturers personal approach on FB page to students as positive and think that courses should be taught on social page more often than before.

Variables time spent on the lecture, innovativeness of the FB page and submission of the assignments on FB was determined as variables that affect students' attitude to education on Facebook at least. Lecturers do have to consider these factors too much.

5. CONCLUSION

The paper solved problem of university education on the social net Facebook. The model that was at first designed by factor analysis using method Varimax was verified by structural equation model. In model of measurement there were explored relations between 16 observed variables to four unobserved variables, which were variable Engagement, Information and Modern Technologies, Lecturers and Scores and Education on Facebook.

Research team proved statistically reliable relations of all proposed observed variables to the unobserved variables using standardized regression coefficients except for 6 variables. These exceptions were factors activity on the page after the end of lectures (E2), time spend on the lecture (E5), innovativeness of the Facebook page (IaMT3), Facebook page in the concept of course (IaMT4), visibility of my scores on the Facebook page (LaS2) and submission of the assignments on Facebook (EoF1).

Regarding the relations between four unobserved variables, it appears that there is statistical significance among all unobserved variables, but we can consider as statistically unreliable relations unobserved variable „Education on Facebook" and „Lecturers and Scores" and unobserved variable „Lecturers and Scores" and „Information and Modern Technologies".

Although there is a possibility for model improvement according to normed fit index NFI, indicators RMSEA and CFI that were used for verifying the validity of model indicate the model is optimal.

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