Assessing and Evaluating UBT Model of Student Management Information System using ANOVA

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***Abstract* — The research study focus is set in assessing the efficiency and impact of Student Management Information System in facilitating students during registration and examination periods in the aspect of efficiency, performance and usability. As Case Study is chosen University for Business and Technology-UBT, where the system has been designed and tailored to, implemented, tested, evaluated and re-engineered. The analyses tries to identify whether the developed UBT model shows improvement in student services, data centralization, data security, and the entire process of student eservices. Through the Case Study investigated several impacting factors. Afterwards evaluated the usability and user-friendliness of the developed UBT model and solutions of Management Information System and used ANOVA regression analyses to determine the impact. Insights and recommendations are provided.**

***Keywords* — Student Management Information System, ANOVA regression analyses, conceptual model of e-services**

1. Introduction

According to [8] during the last decade, Information Technology (IT) is the primary force that changes and transforms the roles in the education domain.

DOI: 10.18421/TEM53-10
https://dx.doi.org/10.18421/TEM53-10

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Previously the management information system in higher education institutions was done manually which created a lot of delays and discontent both among students and faculties. Moreover with the increased number of higher education institutions, especially after private education institutions started to operate in the Southeastern Europe, the need for better administrative services was paramount. Due to all this many public and private higher education institutions have tried to adopt various open source applications or develop custom made management information systems in order to better serve the needs of their students and staff (administrative and academic staff).

Even though these management information systems have greatly improved the services of these institutions in terms of security, centralization of data, designing of reports etc. they all have their limitations and many institutions face problems during their implementation. This is because the open source management information systems are developed by the community for global needs and not for specific needs of institutions, whereas the custom made management information systems lack in depth analysis of the needs of the sector due to their rapid development and unsuitable selection of development technologies.

Considering all these limitations and obstacles the purpose of this research study is to gather insights into proper design, development and evaluation of a Student Management Information System which will serve not only the needs of higher education institutions but their students as well.

According to [1] in order to come up with intiatives, ideas, techniques, concepts, recommendations and methodologies supporting the processes of devising information systems we need a better understanding of what characterizes development of large scale information systems today [3], [9], who are involved, what expertise is needed, what are the essential problems, etc.

2. Significance of the Study

Having in mind the focus of investment of European funds these days in application of information technology in the education systems, it is vital that higher education institutions understand better the elements contributing to the efficiency of their work and cost minimization.

Higher education institutions seeking accreditation from various relevant bodies continuously go through processes of updating existing software or implementing new ones in order to be able to meet the requirements of accreditation. With the improvement of technology these days leading Universities around the world are using well developed Information Systems for the purpose of improving their services to the students as well as facilitate the work of their administration.

However there is still a gap in the published research regarding the understanding of Universities for impacting factors especially in connecting administration with the academic specifics of education system [5].

Furthermore the old systems were built in various phases depending on the needs of the University and are usually lacking a final concept of design which will render the system unable to relate data.

Another problem that the Universities are facing is the increased number of students and their physical expansion in various locations as well as the need to access information and services from the distance for both students and staff. These issues were solved with the development of the new model that tries to integrate all the factors and address all the above mentioned deficiencies. The conceptual design of the new Management Information System emphasized the analyses of web technologies as discussed by [2], [7] which enable access of students and staff to their information from different places and execute similar in different mobile devices as well as enhance the quality of their services altogether.

According to [6] the main influencing factors of significance are those where investigation should be focused, in order to improve and make the system highly effective [4]. In such cases grounded theory methodology can be used as the basis for assessing the main critical factors, supported by analysis and other methods in order to determine the impacting level. They are important in identifying organizational objectives, and in relating the information needs of various groups to those objectives. This is the approach used in JUBILEE project. Within this project themes were identified, which emerged from the year 1, cycle 1, fieldwork data. The focus was on optimizing conditions which would result in the seamless and effective use of Electronic Information Services.

3. Research Methodology

The research methods used in this study consist of literature review of published research, collection of primary data through quantitative methods such as questionnaires and statistics analyzing tools like “Google Analytics”.

The primary quantitative data has been mainly collected from questionnaires particularly designed for this research, which will be distributed to the management and administration of a higher education institution.

As part of the quantitative primary data collection 35 questionnaires are administered to the students of the analysed as case study higher education institution and 35 other questionnaires are administered to the administration of the same institution. The total number of questionnaires that were administered was 70.

Based on the current situation of higher education institutions in the southeastern europe in terms of their information systems and e-Services the following hypotheses have been studied to achieve the purpose of this work:

H1 The developed UBT model of Management Information Systems will improve substantially the management of student issues from enrollment through graduation as well as managing institutional issues with external stakeholder in comparison with the old system consisting of different software and for some parts manually entry and processing of data.

H2 The UBT model of Management InformationSystem will improve the data centralization as well as increase the security and reliability of data.

H3 UBT model of Management InformationSystem improves student efficiency and satisfaction during registration and examination periods.

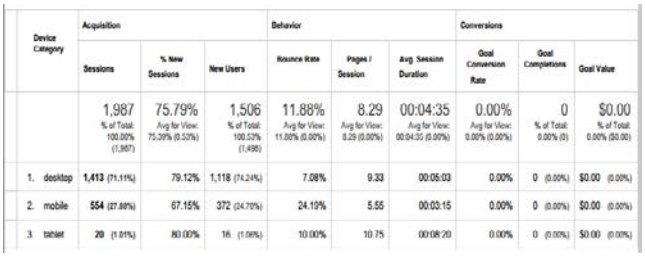
H4 Usability and user-friendliness of developed UBT model and solution of Management InformationSystem improves the efficiency of administration and increases their processing time.

4. Case Study Analysis

The case study investigates the capabilities of the web-based application by studying the results of google analytics during the peak time of exam registration. We also investigate several impacting factors through comparing the results of students from high school state exam and their fields of study with the results and performance in their chosen

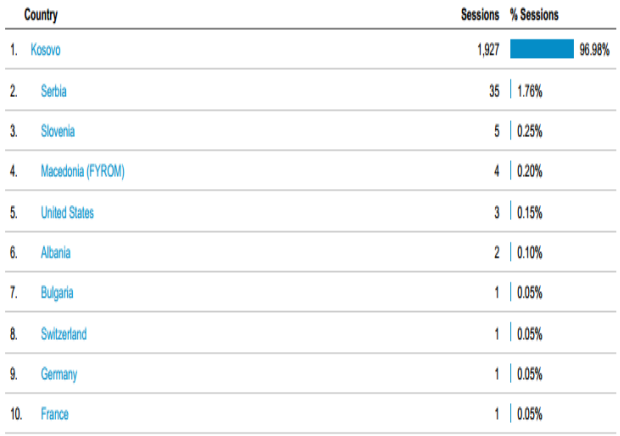
fields at University by analyzing the reports generated by a specific query from the system.

With regards to google analytics results the tables below shows the importance of constructing a software in web technology and its design responsiveness towards various equipment such as Desktop, Mobile and Tablets. They also show the percentage of students who were able to register their exams from inside the country where the university is located as well as from abroad.



Device Category	Acquisition			Behavior			Conversions		
	Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,987 % of Total: 100.00% (1,987)	75.79% Avg for View: 75.39% (0.53%)	1,506 % of Total: 100.53% (1,498)	11.88% Avg for View: 11.00% (0.00%)	8.29 Avg for View: 8.29 (0.00%)	00:04:35 Avg for View: 00:04:35 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	$0.00 % of Total: 0.00% ($0.00)
1. desktop	1,413 (71.11%)	79.12%	1,118 (74.24%)	7.08%	9.33	00:05:03	0.00%	0 (0.00%)	$0.00 (0.00%)
2. mobile	554 (27.88%)	67.15%	372 (24.70%)	24.19%	5.55	00:03:15	0.00%	0 (0.00%)	$0.00 (0.00%)
3. tablet	20 (1.01%)	80.00%	16 (1.06%)	10.00%	10.75	00:08:20	0.00%	0 (0.00%)	$0.00 (0.00%)

Fig 1. Google analytics results according to equipment usage



	Country	Sessions	% Sessions
1.	Kosovo	1,927	96.98%
2.	Serbia	35	1.76%
3.	Slovenia	5	0.25%
4.	Macedonia (FYROM)	4	0.20%
5.	United States	3	0.15%
6.	Albania	2	0.10%
7.	Bulgaria	1	0.05%
8.	Switzerland	1	0.05%
9.	Germany	1	0.05%
10.	France	1	0.05%

Fig 2. Google analytics results of usage by country

5. Results and Data Analysis

By analysing the data from the questionnaires consisting of 20 questions divided in three sections (introductory questions, general questions regarding the system, and questions regarding the evaluation of the developed system) administered on both samples, students and staff of the university, it turns out that the participation in the survey was even with 50 percent of respondents pertaining to the students group and the other 50 percent being staff. The division of the sample is presented in the table below in the form of frequency analysis.

Table 1 – Staff Student

	Frequency	Percent	Valid Percent	Cumulative Percent
Staff	25	50.0	50.0	50.0
Valid Student	25	50.0	50.0	100.0
Total	50	100.0	100.0	

In terms of analyzing the overall performance of the system and provide answers to the questions set by the first research objective, which is "To analyze the importance and benefits of Management Information System in higher education institutions in managing student issues from enrollment through graduation as well as managing institutional issues with external stakeholder", it turns out that 54 percent of respondents said the system works outstandingly, followed by 32 percent of respondents who thought that the system works very good and only 2 percent who rated the performance of the system as satisfactory. Whereas, in terms of the evaluation of the facilitation of services (such as Management of personal information, Exam enrollment, Grade monitoring, Extraction of various documents and Distance usage of the system), the data presented in the table 2 below shows that 64 percent of respondents were very much satisfied with Management of Personal Information, 62 percent were very much satisfied with Exam enrollment services and 56 percent were very much satisfied with both Grade monitoring and Extraction of Various document services, and finally 54 percent of respondents were very much satisfied with Distance usage of the system.

Based on the results we can understand that the majority of the respondents from both groups are highly satisfied with the overall performance of the system thus giving an answer to the above mentioned research objective, and proving our first hypothesis (H1: Management Information Systems will improve substantially the management of student issues from enrollment through graduation as well as managing institutional issues with external stakeholder in comparison with the old system consisting of different software and for some parts manually entry and processing of data.) to be accurate.

Table 2 - How important is the Management Information System in managing your issues within your educational process?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Satisfactory	1	2.0	2.0	2.0
	Good	6	12.0	12.0	14.0
	Very good	16	32.0	32.0	46.0
	Outstanding	27	54.0	54.0	100.0
	Total	50	100.0	100.0	

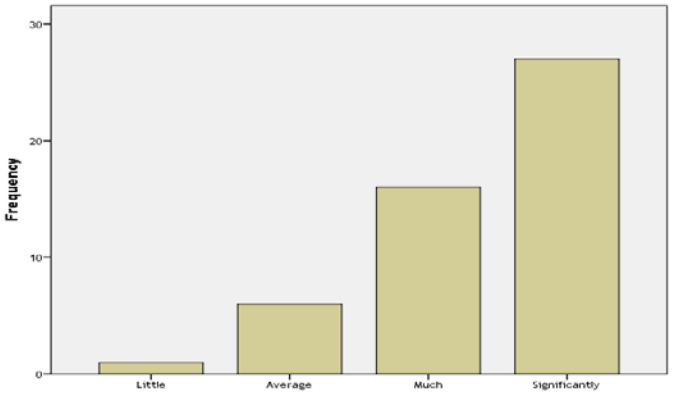


Fig 3. Analyses of user feedback on importance

Table 3 – Evaluation of different categories of the system

	Very Little	Little	Average	Significant	Very much
Management of personal information	2.0	2.0	10.0	22.0	64.0
Exam enrollment	2.0	0	12.0	24.0	62.0
Grade monitoring	2.0	2.0	12.0	28.0	56.0
Extraction of various documents	0	8.0	10.0	26.0	56.0
Distance usage of the system	2.0	0	6.0	36.0	54.0

6. Evaluation using Regresion Analyses

A regression analysis was made in order to test the validity of the factors included in the case study, as well as its applicability. The main variable, dependent variable of the analysis was grade average of students during their first year of studies. It was analyzed through measuring the impact of different factors on it. As it can be seen in the table of Variables Entered/Removed, the variables whose impact on the dependent variable grade average of students in the first year of study in the university was measured were field of study in high school, high school state exam, gender, and age.

In order to observe the effect of each of the independent variables (factors) included in the model on the dependent variable, ANOVA statistical analysis was used. It was obviously seen from the table of ANOVA that F statistics was significant, which indicates that the study is not an irrelevant one and it is applicable. This analysis could explain us only 11.8% of the effect that factors included in the model had on the grade average, as seen in the table of Model Summary. In order to have accurate data interpretation and results, a table that explained the significance and the meaning of each of the factors included in the model was generated.

In this table it can be noticed that field of study in high school appeared to be not significant to the regression analysis and did not have any impact on the average grade of the student during his/her first year of study in the university. On the other hand, analysis showed that there was a positive correlation among the high school state exam included as a factor in the model, and a student's grade average. The analysis noted that a student who scored higher points in the high school state exam had a tendency to have higher grade average during his/her first year in university, compared to a student who scored lower points in the high school state exam.

Another factor included in the model is gender, which appeared to have a positive correlation with the success of the student during his/her first year of studies in the university. In analysis it was seen that male students had a tendency to have higher grade average during their first year of studies compared to female students. When it comes to the impact of age on the grade average of a student during his/her first year in the university, it appeared to be insignificant. The analysis showed that there was not any kind of correlation between the factor of age and the grade average, proving that it does not have any impact on the grade average of a student during his/her first year in university. Based on the frequency analysis of students' previous fields of studies conducted on Statistical Package for Social Sciences SPSS we can see that the total number of students analyzed is 263 where the highest percentage is occupied by students whose previous field of study was natural sciences with 38.8 percent followed IT technicians with 26.2 percent whereas the remaining 35 percent of students come from other fields of studies.

In terms of correlation between the variable of High School State Exam Results and the variable of Grade Average of First Year Students there is positive correlation between them at a value of .260

which can be considered a low value. Therefore it can be stated that the results of High School State Exam have no impact in the Average Grade of First Year Students.

Regression Equation: Grade Average = 8.80 + 0.0054 Field of Study + 0.01034 High School State Exam - 0.472 Gender - 0.1082 Age

Table 4 - Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	Age, Gender, High School State Exam, Field of Study	.	Enter

a. Dependent Variable: Grade Average

b. All requested variables entered.

Table 5 - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.344[a]	.118	.104	.82959

a. Predictors: (Constant), Age, Gender, High School State Exam, Field of Study

Table 6 - ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	23.766	4	5.941	8.633	.000[b]
	Residual	177.559	258	.688		
	Total	201.324	262			

a. Dependent Variable: Grade Average

b. Predictors: (Constant), Age, Gender, High School State Exam, Field of Study

Table 7- Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.795	1.611		5.458	.000
	Field of Study	.005	.021	.017	.255	.799
	High School State Exam	.010	.003	.203	3.283	.001
	Gender	-.472	.150	-.188	-3.155	.002
	Age	-.108	.070	-.103	-1.548	.123

a. Dependent Variable: Grade Average

Table 8 - Regression Analysis Interpretation

	Is the p-value significant?	**What does this mean?**
F Statistic=8.633	Yes, Because it's p-value is 0.00, less than 0.05	It means that at least one of the independent variables have an effect on the depended variable
R-Squared = 11.8%	It does not have a p-value	11.8% of a student's average grade is explained by the model
Adjusted R-Squared = 10.44%	It does not have a p-value	11.44% of a student's is explained by the model
Coefficient field of study = 0.005	No, because it's p-value is 0.799, which is higher than 0.05	The dependent variable field of study has a p-value higher than 0.05, which shows that it is not significant and does not affect the dependent variable
Coefficient high school state exam = 0.01034	Yes, because its p-value is 0.001, which is less than 0.05	Holding other variables constant, for each additional point in the high school state exam, a student's average grade will be higher for 0.01034

Coefficient Gender = -0.472	Yes, because its p-value is 0.002, less than 0.05	Holding other variables constant, a male student will have 0.472 higher average grade than a female student
Coefficient age = -0.1082	No, because it's p-value is 0.123, which is higher than 0.05	The dependent variable age has a p-value higher than 0.05, which shows that it is not significant and does not affect the dependent variable
Y-intercept = 8.795	The significance of p-value is not important, because the y-intercept is always important	8.795 is the expected average grade for a female student with 0 points in high school state exam

7. Conclusion

We can conclude that the system is positively evaluated from the actors of the system. This means that the level confidence on using the system has a statistically significant relationship. Through this research we intend to define the most suitable form of analyzing, designing and evaluating the developed UBT model of Student Management InformationSystem for higher education institutions and implement it in a real life case for a higher education institution named UBT (University for Business and Technology). Infrastructure Services is built using the latest API standards Web and is able to return XML or JSON for customers. The idea behind this is to be able to highlight data in third-party systems that can be integrated in conjunction with the e-school system. Presentation / UI layer is built using the latest standards of technology in the world of the front-end. It contains all the key technologies for developing dynamic web applications to empower Ajax capabilities along with the basis of other JavaScript libraries for interaction easier for users and experienced friendly uses. We recommend giving effort to increase the user experience on e-applications and also increase the confidence towards e- applications by organizing trainings and by presenting users (teachers, parents and administration officers) the real advantages of e-management.

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