Analyses and Design of Multilingual Student e-Service Information System

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Abstract- The research study is focused on conceptual development and evaluation of a new student e-Service Information System tailored to the specifics of a higher education institutions in North Macedonia. As Case Study we have designed a model which will emphasize the importance of a well-designed and properly implemented system in the improvement of student services, data centralization, data security, designing of reports for this higher education institution. Through the case study we aim to 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. The research study aim and goal is to present coherent ways how can transform the old way of student management in new using electronic services taking into account multicultural and multilingual specifics. Insights and recommendations are provided.
Keywords – Student e-Service Information System, Management Information system, evaluation of e-services

I. INTRODUCTION

Technology nowadays has touched and transformed almost every part of our life, making it easier and much more efficient to cope with our everyday problems. According to [8] during the last decade, Information Technology (IT) has been the primary force driving the transformation of roles in the education industry.

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 increase of number of higher education institutions, especially after private education institutions started operating 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.

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 from our region, 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 focused on the proper design, development and evaluation of a Student e-Service Information System which will server not only the needs of higher education institutions but their students as well. According to [1] in order to come up with ideas, recommendations, tools, techniques, concepts and methodologies supporting the processes of developing web-based information systems we need a better understanding of what characterizes development of large scale web-applications today [3], [9], who are involved, what expertise is needed, what are the essential problems, etc. This will be achieved through adhering all phases of software development life cycle (SDLC) in close cooperation with a higher education institution from this region as well as observation of other institutions with the aim of selecting the best practices for designing a system for managing student information following guidelines from [2] and investigate other student issues from enrolment through graduation.

II. MOTIVATION AND PURPOSE OF THE STUDY

The purpose of this research is to analyze an existing and design a new e-Service Information System following guidelines [4], [5], [6]. The system was also envisioned to be tailored to the specifics of a higher education institution in North Macedonia. UNT (University Mother Teresa) is chosen as a Case Study for this research and it will emphasize the importance of a well-designed and properly implemented system in the improvement of student services, data centralization, data security, designing of reports for this higher education institution. Moreover, through this case study we aim to compare 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. This research also aims to serve as

guidance for other higher education institutions that currently are not applying a centralized student information system in selecting the most suitable system that would enable them to offer more efficient services to their students and faculties.

III. RESEARCH METHODOLOGY

The research methodology used is quantitative research. Primary quantitative data has been mainly collected from questionnaires particularly designed for this research which has been distributed to the management and administration of school institution.The research methods used in this study consist of literature review from the secondary sources, collection of primary data through quantitative methods such as questionnaires and statistics analyzing tools like "Google Analytics".

The primary quantitative data was 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 implementing higher education institution and 35 other questionnaires are administered to the administration of the same institution. The total number of questionnaires that were administered is 70.

IV. 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.

	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%

Figure 1 Google analytics results of usage by country

	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: 11.88% (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%)

Figure 2 Google analytics results according to equipment usage

Gender	F
Previous educational background	(All)

Row Labels	Values: Count of StudentID	Sum of Average Grade	Average of Age	Average of Points from high school state exam	Sum of Exams Registered	Sum of Exams Pased
⊞Arkitekturë	98	787.16	20.56	135.3061224	1276	1067
⊟Inxhinieri ndërtimore (ndërtimtari) dhe infrastrukturë	4	24.66	22.00	139.5	36	29
Arkitekturë	1	0	23.00	119	0	0
Matematikë-Informatikë	1	8.44	21.00	154	12	9
Ndertimtari	1	7	23.00	139	13	11
Shkenca Shoqërore	1	9.22	21.00	146	11	9
⊞Juridik	7	49.37	21.14	118.4285714	74	61
⊞Media dhe Komunikim	12	98.22	21.00	126	167	152
⊞Menaxhment, Biznes dhe Ekonomi	108	617.89	21.22	121.7037037	1034	584
⊞Shkenca Kompjuterike dhe Inxhinieri	39	299.98	20.38	141.8717949	420	265
⊞Shkencat Politike	28	159.04	21.86	116.3214286	277	201
⊞Sistemet e Informacionit	9	60.83	22.22	111.6666667	82	54
Grand Total	305	2097.15	20.99	128.1901639	3366	2413

Figure 3 Female students in Construction Engineering

Gender	M
Previous educational background	(All)

Row Labels	Values: Count of StudentID	Sum of Average Grade	Average of Age	Average of Points from high school state exam	Sum of Exams Registered	Sum of Exams Pased
⊞Arkitekturë	188	1350.93	21.09042553	124.8457447	2107	1626
⊟Inxhinieri ndërtimore (ndërtimtari) dhe infrastrukturë	35	225.64	22.91428571	116.6857143	331	209
Arkitekturë	1	6.5	22	131	5	2
Ekonomi	1	0	25	106	0	0
Ekonomi	1	7.8	27	120	6	5
Ekonomi-Doganier	1	0	22	104	0	0
Elektroteknikë	2	8.91	28	68	11	11
Kontabilitet	1	7.33	22	105	10	3
Matematikë-Informatikë	1	7	20	153	10	6
Matematikë-Informatikë	1	7.45	40	4	13	11
Matematik-Informatik	4	33.6	21	124.5	39	30
Mjeksi e Pergjithshme	1	7.5	22	137	15	10
Ndërtimtari	2	6.63	21.5	129	15	8
Ndërtimtari	2	14.83	21.5	122	19	7
Ndertimtari e Larte	1	7.6	21	115	15	10
Shëndetesei	1	7.64	23	156	11	11
Shëndetësi-Teknik i dhëmbëve	1	6.82	22	128	18	11
Shkenca Natyrore	5	36.66	20	147.2	53	31
Shkencat e Natyres	6	38.38	20.33333333	136.8333333	59	35
Shoqeror	1	6.88	22	124	13	8
Teknik i informatikes	1	7	31	5	5	1
Teknik i Ndertimtaris	1	7.11	35	3	14	9
⊞Juridik	17	74.41	23.52941176	105.1176471	106	61
⊞Media dhe Komunikim	7	42.76	21.57142857	113	105	64
⊞Menaxhment i Mekatronikës	22	136.66	23.09090909	109.1818182	206	153
⊞Menaxhment, Biznes dhe Ekonomi	147	675.63	21.63265306	115.1519728	1051	420
⊞Shkenca Kompjuterike dhe Inxhinieri	323	1960.47	21.39009288	123.3622291	2628	1384
⊞Shkencat Politike	25	138.95	22.24	103.84	237	151
⊞Sistemet e Informacionit	21	117.24	22.14285714	117.047619	168	78
Grand Total	785	4722.69	21.57452229	120.2068025	6939	4146

Figure 4 Male students in Construction Engineering

The figures above show the results of the developed system when queried students grouped by gender in a specific field of study at University (Construction Engineering).

V. RESULTS AND DATA ANALYSES

Precondition for successful utilizing an e-service application is accessibility to computer and internet access. We found that the lack of computer and/or internet access is not an obstacle. We can see that 95% of users have used the system, and 87% have an internet access.

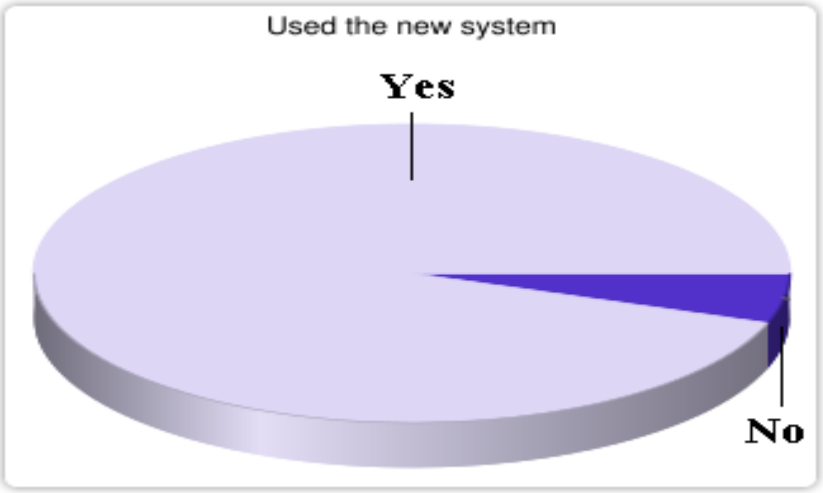

Figure 5 Used the new system

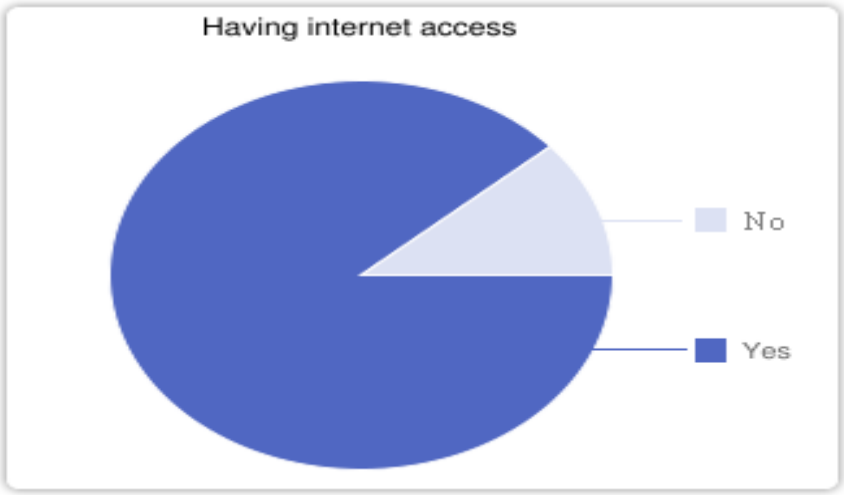

Figure 6 Having internet access (87%)

The results about the question Q3: Is the new student e-Service Information System an improvement compared to the classical manual method; and Q4: Does the approach of using e-services offer better quality management?

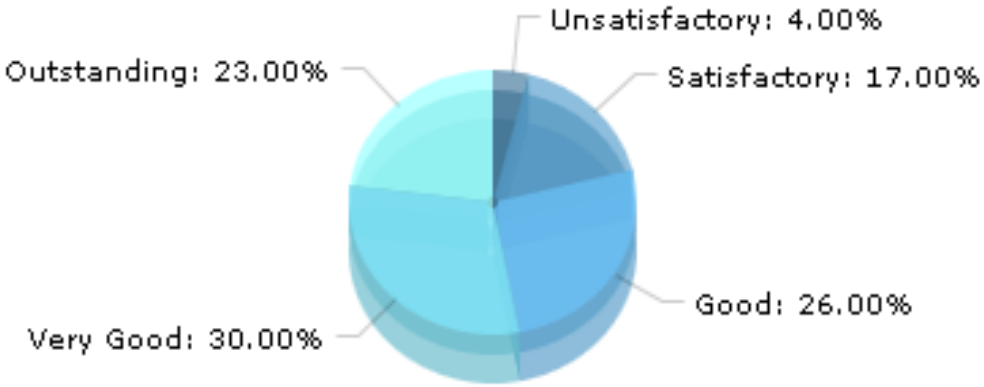

Figure 7 The new student e-Service Information System improvement compared to the classical manual method.

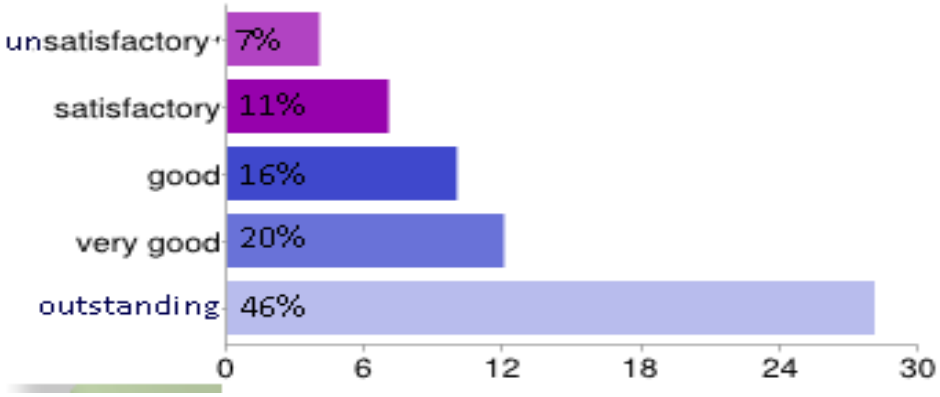

Figure 8 The use of e-services offers better quality management

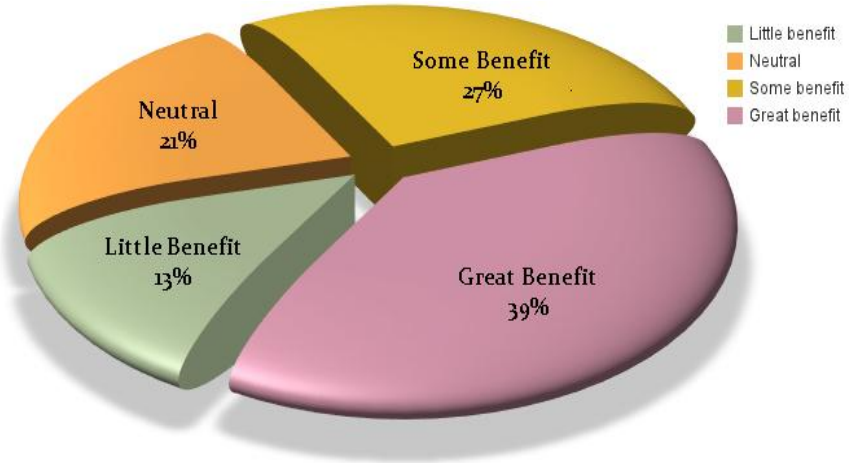

Figure 9 Feedback from student regarding the benefit of the new system

75% of users claim there is improvement in the school management using new student e-Service Information System, 15% claim it is good while 25% do not see any improvement. 82% of users claim that e-services offer better quality management compared with the classical one, 16% say the e-service is good while 7% are not satisfied with the quality of the e-services.

These results indicate that the new student e-Service Information System is accepted and is very good in aspect of improvement and better quality of management compared to the classical manual management which is expected, but still there are a percentage of users that are not satisfied.

Table 1. Correlation of Reliability of e-services with IT Skills level and accessibility to computer

Benefits of using the developed e-service system	IT Skills level					
	1 low		2 intermediate		3 advanced	
	Have a computer at home?					
	yes	No	yes	no	yes	no
Unsatisfactory	1.6%			1.6%		
Satisfactory	10%		5%	1.6%		
Good	8.3%		3.3%			
Very good	1.6%	1.6%	14.9%		11.6%	
Outstanding	1.6%		26.00%		14.5%	
Total	23.10%	1.60%	49.20%	0.00%	26.10%	0.00%

VI. CONCLUSION

We can conclude that the system is positively evaluated from the students as primary users of the system. The multilingual aspects of the application have been rated very good as well as attitude of users regarding different e-services. This means that the level confidence on using the system has a statistically significant relationship. We have verified the statistical significance of data and relationships.

Application of multilingual aspects of the application brings also additional issues that needs to be overlooked and investigated further. For example each field there should be defined the type of input it will allow. Then it should use filters to verify that only good input gets through and that it rejects any suspicious one. Also the Implementation of "known bad" filters for SQL reserved words and characters. Stored procedures could be used to interact with database and call procedures through a parameterized API. All input should be validated and all database users should run under the "least privilege" principle. You may need to define different roles, one for every type of query.

To apply a defence strategy against SQL injection, we should consider comprehensive input validation, the use of a parameterized API, and to never compose query strings on an ad-hoc basis. In addition, a strong SQL Server lockdown is essential, incorporating strong passwords.

We recommend focusing on enhancing the design by survey-ing the user experience and also increase their confidence towards e-services by organizing trainings and by presenting users (teachers, parents and administration officers) the real advantages of e-services management.

VII. REFERENCE

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