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ANALYSIS OF FACTORS INFLUENCING PERCEIVED QUALITY OF E-LEARNING

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Abstract: *This paper aims to present results of an survey conducted on 120 e-learners participating in an one-year vocational program. We have found factors that could be important measures of quality of e-learning programs and environments and as such could be useful in practice.*

Keywords: *e-learning quality, factor analysis*

1. INTRODUCTION

There is a number of implicit and explicit frameworks designed to theoreticaly support e-learning practice. Founded on earlier theoretical frameworks, they identify the factors that need to be considered in efforts of creation good quality e-learning experiences. Several of these frameworks suggest key components that influence the quality of the e-learning experience: technology, pedagogy, organizational context and creativity [1], [2].

It is not yet clear how learners perceive e-learning environments, and in what ways they assist or impede learners in their learning [3], [4]. Imel [5] reports that much e-learning fails to live up to learner's expectations. It would be better to focus attention on the student's experience of e-learning and "to listen to student's voices in seeking to extend our knowledge of e-learning" [6].

When designing an e-learning course or setting up an e-learning environment [7], instructors are faced with many considerations and decisions that consequently affect how students experience instruction, construct and process knowledge.

Course design, learning material, and electronic course environment can account for the overall perceived quality of the e-learning experience. The quality of the learning environment and the easiness of using a learning management system also contribute to the success and course satisfaction of an e-learning course and performance. Some of key quality-gaining strategies can be grouped into the following elements [9]:

Assisting user retention (promoting "learnability"), putting the user in control, creating logical and consistent screen design and providing efficient user guidance.

Interaction between students and an instructor: interaction supports knowledge construction, motivation, and the establishment of a social relationship. The exchange of information regarding educational content as well as socio-emotional information is important for learning.

Interaction with peer students: this aspect consists of communication processes, where students exchange information of the course contents and socio-emotional information.

Individual learning processes: e-learning students may receive ample opportunities to practice and apply what they are learning.

Course outcomes: course outcomes may refer to cognitive, such as theoretical and methodical knowledge, skills required for problem solving, personal/social competences and emotional variables, satisfaction with a course. Liaw and Huang [10] suggested that four elements should be considered when developing e-learning environments: environmental characteristics, environmental satisfaction, learning activities, and learners' characteristics.

The aim of this paper is to explore which elements of the e-learning process are influencing learner's perceived quality of the experience.

2. MATERIAL AND METHODS

This research was conducted between March and April 2010 with the following aims:
1. To find out demographical characteristics of learners
2. To find out attitudes towards e-learning *per se*
3. To find out attitudes towards e-learning tehnology
4. To extract factors that influence perceived quality of e-learning experience

Total of 120 learners participated in this research, of wich 69(57.5%) responded.. Learners were adults participating in an one-year e-learning program Information technology. The program was a vocational one, leading to certificate. Data was gathered by administrating electronically prepaired questionairre, having two types of questions: question with dichotomous answers (yes/no) and questions with Likert-scale graded answers (7-grades scale) Results are obtained by using statistical software (SPSS ver 18). Factor analysis was employed to extract factors that could describe features of e-learning system perceived as important for quality, in simpler and more clear way.

3. RESULTS

Firstly, demographic features of learners are presented. Country of residence, gender and previous education were analyzed. Also, data on habits and routines regarding computer and internet usage were collected and are presented. Previous experience with e-learning was also noted. Average age of learners was 32±1.12 years. Results of demographic composition and computer/internet usage are presented in Tables 1-7.

Table 1. Learners by country of residence

		Frequency	Percent
Country	-	1	1.4
	Bosnia	12	17.4
	Montenegro	1	1.4
	Czech Republic	1	1.4
	Croatia	1	1.4
	Italy	3	4.3
	Macedonia	1	1.4
	Norway	1	1.4
	Sweden	1	1.4
	Slovenia	1	1.4
	Serbia	45	65.2
	UK	1	1.4
	Total	69	100.0

Table 2. Learners by gender

		Frequency	Percent
Gender	Male	46	66.7
	Female	23	33.3
	Total	69	100.0

Table 3. Learners by professional usage of computer

		Frequency	Percent
Professional user	Yes	46	66.7
	No	23	33.3
	Total	69	100.0

Table 4. Computer usage frequency

		Frequency	Percent
Daily use	Yes	67	97.1
	No	2	2.9
	Total	69	100.0

Table 5. Daily time online

		Frequency	Percent
Time	Up to 1 hour	4	5.8
	Up to 2 hours	13	18.8
	Up to 8 hours	6	8.7
	At least 4 hours	28	40.6
	over 8 hours	17	24.6
	Very rarely	1	1.4
	Total	69	100.0

Table 6. Previous e-learning experience

		Frequency	Percent
First e-learning course	Yes	66	95.7
	No	3	4.3
	Total	69	100.0

Table 7. Learners by educational level

	Frequency	Percent

Level	University	14	20.3
	High School	10	14.5
	Elementary	2	2.9
	Vocational, 4 yrs	25	36.2
	Vocational, 3 yrs	8	11.6
	College	10	14.5
	Total	69	100.0

It is evident that most of learners were domiciles (65%), with one notable exception – Bosnia and Herzegovina (17%).

Males are predominant (male to female ratio is 2:1), and educational level is mostly at secondary level (more than 60%), while maintaining relatively high number of college and university graduates (35%). Vast majority of learners are professional and frequent users of internet (67% professional users, only 7% of users spend online up to one hour daily). Generally, the group of learners that participated in the study can be described as well educated digital natives.

Factor analysis was used to extract a simpler subset of more complex items than questions asked, hoping to construct a meaningful system of factors influencing perceived quality of e-learning. Table 8 presents matrix of rotated factors, indicating significant factor loadings in bold. We have decided to assume a nine-factor solution, for having eigenvalue dropping below 1 (Image. 1) for tenth potential factor.

Table 8. Extracted factors

	Component									
	1	2	3	4	5	6	7	8	9	10
I can better understand problems from my professional life after having learned from the system	**.830**	.006	.026	-.068	.004	.130	-.005	-.171	.179	-.067
Learning content is practically useful	**.742**	.239	-.153	.001	.008	.113	.134	.022	-.018	.009
I am satisfied with the content	**.669**	.052	.344	.134	-.265	.013	.071	.120	-.097	.183
I am satisfied with the ratio of multimedia content	**.664**	-.048	.350	.048	-.173	.096	.210	-.042	-.132	.049
I am satisfied with the learning system	**.636**	.315	.445	.105	-.071	-.203	-.026	.117	.038	-.032
My friends and colleagues should be informed on this system	**.589**	.511	.101	-.010	.050	.150	-.024	.122	.111	.058
I am satisfied with the content quality	**.586**	.402	.272	-.057	.043	.092	.003	.019	-.208	-.261
The course I am taking satisfies my learning needs	**.584**	.340	.150	-.105	.198	.113	.149	.128	.136	-.047
I would like to enroll more distance learning courses	**.561**	.359	-.115	.249	-.025	.126	-.176	.171	-.002	.045
This way of learning will help me to learn more effectively in the future	**.529**	.496	.090	.034	.139	.187	.037	-.010	.399	-.082
Content is information-rich	**.509**	.026	.232	-.200	.042	.388	.140	-.123	-.056	-.125
Off line learning material is of a great use	**.496**	-.168	.160	.233	.317	.027	-.033	-.021	-.262	.152
I am happy with my decision to learn on-line	**.469**	.377	.109	.333	-.235	.403	-.090	-.009	-.096	.043
On-line learning motivates me to learn more	**.141**	.705	.014	.095	.072	.041	-.061	-.022	.065	.110
Distance learning does not excess any serious disadvantages compared to the traditional learning	.135	**.671**	.060	-.095	-.119	.227	.053	-.211	-.156	-.034
I am satisfied with my communication with teachers	.208	**.543**	.424	.073	-.136	.005	.102	.323	-.055	.163
The system is a great tool to make me learn more	.332	**.541**	.279	-.065	-.121	.245	.124	.116	-.267	.068
My internet speed is a satisfactory one	.054	.224	**.738**	-.039	-.063	-.028	.020	-.155	.100	-.043
I would benefit of the system more If I had a faster internet connection	-.008	.091	**-.618**	.090	.179	-.087	.067	.146	.221	.136

I find the system easy to use	.209	-.017	**.610**	.000	.108	.310	.062	.419	.099	.249
I am familiar with internet use	.369	.065	**.563**	.095	.011	.229	.232	.431	-.037	.019
The system works fine	.379	.390	**.542**	.060	-.103	.018	.093	-.027	-.120	.007
Information provided in the learning material is up to date and punctual	.436	.053	**.527**	.061	.017	.179	.230	.115	.294	.045
I would like more multimedia in the learning material	.143	.036	-.037	**.869**	.019	-.040	.037	.010	.091	-.040
I would like to watch recorded classes of top professors	-.040	.104	-.038	**.805**	.162	.132	-.076	.062	.090	.066
I like to watch video lessons	6.336E-5	-.096	.064	**.755**	.298	.150	.026	.007	-.056	-.062
Weekly learning schedule would help me learning	.011	-.037	-.050	.137	**.847**	-.089	.019	-.007	.118	-.062
Dayly learning schedule would help me learning	-.023	-.039	-.184	.185	**.846**	-.094	.032	-.011	.116	-.031
The system should be an internet-based only. I do not need any offline material	.023	-.036	.012	-.338	**-.547**	-.096	.326	-.086	.412	-.029
Recorded narator voice helps me learning a lot	.073	.323	-.163	.179	**.390**	-.130	.241	.327	-.300	-.012
E-learning is a useful way of learning	.211	.355	.125	.116	-.207	**.715**	.092	.067	.064	-.018
I have saved a great deal of time because I did not commute to attend classes	.140	.326	.072	.169	-.081	**.616**	.122	-.134	.141	.096
I would like more practical examples	.131	-.118	.009	.307	.060	**.590**	-.022	.273	.095	.225
System menus and commands are logical and easy to use	.395	.143	.329	-.112	-.012	**.467**	-.082	.223	-.195	-.037
The most of the material I download I read only after having it printed	-.108	.195	.091	.072	-.201	-.187	**-.724**	.119	.300	.032
I am on-line only enough to fetch the material I need. Then I learn offline.	-.169	-.002	-.163	.128	.190	.009	**-.680**	-.070	-.018	.144
I learn on-line, I read out of the screen and I am always connected to the Internet	.175	.087	.144	-.035	-.120	-.139	**.640**	-.036	.097	.341
I should communicate more with my classmates by means of email.	-.097	.173	-.109	.228	.131	.160	**.567**	.270	.338	.008
Thematic disscussion forums would be very beneficial for my learning	-.221	.125	.099	.416	.198	.126	**.558**	.242	.192	-.127
I use disscussion forums frequntly when I need to find out someting	-.003	-.196	.004	-.011	-.028	.050	.056	**.685**	.140	-.038
I post comments to news articles frequently	-.190	.130	-.246	.184	.037	-.133	.076	**.590**	.155	-.167
I am dissapointed with the way e-learning works.	-.338	-.205	-.218	.051	-.032	-.198	.093	**-.526**	.177	-.079
I read blogs a lot	.054	-.096	-.035	.167	.114	.121	.034	.203	**.727**	.025
I learn in my own way and follow my own schedule	.075	.123	-.102	-.067	-.292	.348	.013	-.092	.061	.585
On-line learning was the only way to attend this course for me	.037	.267	.198	.016	-.014	.094	-.034	.068	-.306	.532
I feel uncomfortable when have to use computer	-.245	-.073	-.328	-.114	.216	-.062	-.120	-.089	.224	.426
Some functions of the system are significantly difficult than others	-.294	-.279	-.187	.197	.082	-.238	.217	-.220	.236	.408

4. DISSCUSSION

We have tried to explain our findings in the form of attributing exact, precise and complete set of information to each factor. Having in mind methodologically complex field of factor analysis we have presented our findings in both tabelar and descriptive form.

In Table 9 we are desctibing extracted factors, as to our best understanding.

Content quality and relevance – This is the most important factor comprising pedagogical and quality features of the material. While still highly perceptive in nature, and thus very subjective, this factor incorporates judgements of material quality, personal content with desicion to participate in e-learning, practical applicability of the learning and, maybe the most

interesting, advocacy feature, which we can read as very sincere and very high opinion of content quality and relevance.

E-learning as a way of quality and motivating interactive learning – E-learning perceived as a „real“ learning alternative, motivating a learner for more learning experience.

Table 9. Factor descriptions

Factor	Decsription
1	Content quality and relevance
2	E-learning as a way of quality and motivating interactive learning
3	Technical quality of the system and infrastructure
4	Degree of multimediality
5	Time management, asked guidance and offline help for students
6	Time-saving feature of the system and practical application of the knowledge
7	Communication with classmates
8	Active participation in electronic communications
9	Importance of blogs

Technical quality of the system and infrastructure – State of art e-learning software (mostly LMS in web architecture) is not a sufficient prerequisite for quality learning experience – also adequate infrastructure is needed.

Degree of multimediality – Video material strictly attached to the learning needs makes the first choice in students measuring of degree of multimediality of the learning content.

Time management, asked guidance and offline help for students – Time management seems to be a very desireable feature of the system, but having in mind results that point to great difference between students preference to time management features with respect to learning styles, we stay cautious in over-generalization. Rather, we would say that time management feature can be of advantage to certain students. We call this feature asked guidance.

Time-saving feature of the system and practical application of the knowledge – It has been reported frequently that saving time is one of the greatest advantages of e-learning perceived by participants. Here we see that vocational-oriented students see time saving meaningful only if time spent to on-line classes is practically useful.

Communication with classmates – Desire for communication and socializing was also reporten in multiple papers.

Active participation in interactive electronic communications – Participating in on line disscussions, digging for information in disscussion forums indicate that similar feature should be included into LMS

Importance of blogs – Trend in social networking.

Finally, we have analyzed overall satisfaction with the system in respect to learner's gender (Table 10). It is found that male learners are more satisfied (Chi square showed that there is a statistically significant difference p=0.02)

Table 10. Gender to overall satisfaction

		Gender		
		male	female	Total
I am satisfied with the learning content (1-not satisfied at all, 7-completely satisfied)	2	0	2	2
	3	0	2	2
	4	7	2	9
	5	12	3	15
	6	18	5	23
	7	9	9	18
	Total	46	23	69

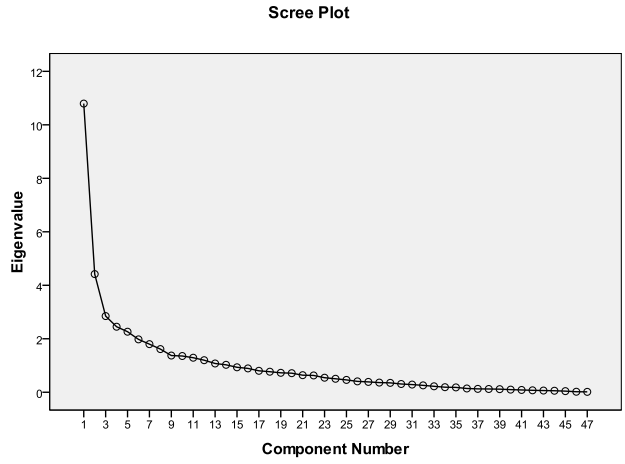

Image 1. Screen plot for extracted factors

5. CONCLUSION

This research pointed to two major findings. First – there is a measurable set of features of an e-learning system that contribute to the perceived quality of the system. And, when analyzing these features, the more important ones are content quality, content relevance, motivation for learning and interaction in learning. We were a bit surprised not to find any of technological "bells and whistles", but, results are indeed encouraging: e-learners are still serious and demanding learners, and e-learning community should be aware of that.

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