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COMPOSABILITY, COMPREHENSIBILITY AND CORRECTNESS OF WORKING SOFTWARE

INVITED PAPER

PAPERS

Influence of Student Computer Literacy on Qualifications for Creating Virtual Learning Environments

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Abstract - This paper presents the results of research into computer literacy among students from informatics study programmes, and their qualifications in the area of creating virtual learning environments. The participants in the study were students from Serbia, Croatia, Hungary, Macedonia and Slovakia. It is evident that clear differences exist, but similarities as well in terms of computer literacy among students at technical universities in the region. Computer literacy is seen to influence the choice of methods employed for testing the effectiveness of web applications. It is necessary to make changes to the curricula at informatics faculties, and to highlight web usability terms, as well as to introduce subjects that will deal with testing web applications in the context of virtual learning environments.

Keywords: virtual learning environments, computer literacy, web applications, cognitive walkthrough

I. INTRODUCTION

Given that virtual learning environments (VLE) are becoming more accessible to students, and that limitations have largely disappeared when it comes to learning and work, particularly for those studying information technology, there is a need to explore student abilities and skills in the area of creating virtual learning environments independently. In the course of exploring this, we are able to compare the extent to which students are prepared to create virtual learning environments, from the computer literacy standpoint. However, global changes affecting our universities today call for guidance and agreement on defining teacher functions in virtual environments and their corresponding competencies [1].

One of the many uses of VLEs is that they provide opportunities for the designers to make use of various learning tools such as course announcements, online course documents, online or database self-assessment tests as well as making use of other online examination forms, and links to webpages that can aid learning. These tools provide students with the ability to make use of such resources as are not only convenient but also immediate [2].

II. THEORETICAL BACKGROUND

A. Virtual learning environments

A VLE is "a collection of integrated tools enabling the management of online learning, providing a delivery mechanism, student tracking, assessment and access to resources" [3].

The basic function and the main task of such systems is generally to enable students to design, organize and present courses easily. Due to the proliferation of information on the Internet, it is evident that a large amount of unverified or incorrect information is used by students completing assignments.

B. Research goals and hypothesis

At universities, there is autonomy in creating the study programme curriculum. Hence, there are many different study programmes that relate to IT. No research has been conducted which compares study programmes and their unification in terms of developing standard competences that IT engineers should have when creating virtual learning environments. This paper seeks to examine the habits of students from IT courses in different regions where they create virtual learning environments, as well as the use of information technology in general. It also aims to determine which evaluation techniques students use when testing the usability of their web applications.

The research hypothesis is: The choice of techniques when creating virtual learning environments, as well as the ability to test web application usability, depends on student computer literacy.

Sub-hypotheses: Students are familiar with the term web usability; Students practice testing the usability of their web applications.

Procedures that prove the existence of similarities or differences between subsamples confirm the hypothesis regarding similarity, or else reject it (they confirm the alternative hypothesis), i.e. indicate the existence of

differences. During hypotheses testing, the critical value of p is used, which indicates the risk involved in drawing conclusions. If $p>0.100$ there is no reason not to accept the initial hypothesis. To reject the initial hypothesis, two thresholds of significance will be used. In the case where $0.10> p>0.05$ an alternative hypothesis is accepted, with an increased risk of concluding, when $p<0.05$ an alternative hypothesis is accepted, and it is said that there are substantial (significant) differences.

Defining hypotheses for implemented procedures is performed in the following manner:

By MANOVA procedure, hypothesis H1 is tested, and it reads as follows:

H1 There are no significant differences between the subsamples for the observed thematic unit.

A1 There are significant differences between some subsamples for the observed thematic unit.

Hypothesis H2 is tested by discriminant analysis procedure:

H2 There is not a clearly defined boundary between subsamples for the observed thematic unit.

A2 There is a clearly defined boundary between some subsamples for the observed thematic unit.

C. Survey instruments

A questionnaire featuring 33 fields was created for the purpose of this survey. The first three questions relate to respondents' gender, year of study, and the faculties at which they study. The following operational tasks have accordingly been set in the research:

- to present basic parameters for student ability to create virtual learning environments, according to the faculty at which they study,
- to identify similarities and differences in abilities among students from technical sciences faculties to create virtual learning environments, according to the faculty at which they study,
- to define student characteristics for each faculty,
- to determine homogeneity among students from each faculty.

The area of this research consists of 5 thematic units:

- the ability of students to use computers, which is examined according to their potential to use Text (txt_ed), Picture (pic_ed), Sound (sound_ed), Video (video_ed), Animation (anim_ed), and Database editors(db_ed);
- student habits when using the Internet (the time students spend online, devices they use to access the Internet, Internet availability, the social networks they use);
- examining students according to their use of smart phones and their operating system;
- student characteristics in terms of using distance learning systems (Cloud technology, E-learning material, Online courses, E-learning technologies, experiences in creating e-learning materials);
- the ability to create virtual learning environments (most often the use of Web applications, creating WA experience, Web usability, Testing web applications, Usability testing with users).

Each assessment has 3 modalities: beginner (beg), medium (med) and expert (exp).

D. Participants and data collection

Participants in the research were students at the following faculties:

- Technical faculty "Mihajlo Pupin" (TFMP), Zrenjanin (97 respondents);
- Subotica Tech (ST) - College of Applied Sciences/Department of Informatics (33 respondents);
- Óbuda University, Budapest (6 respondents);
- Eotvos Lorand University (ELU) - Faculty of Informatics (74 respondents);
- South-West University "Neofit Rilski", Blagoevgrad (2 respondents);
- Faculty of Electrical Engineering and Informatics, Technical University (TUKE) of Kosice (206 respondents);
- University Goce Delcev (UGD) in Stip (63 respondents);
- University of Shkodra "Luigj Gurakuqi" Albania (1 respondent);
- Faculty of Organization and Informatics (FOI), University of Zagreb (176 respondents, students in the first year of undergraduate studies).

III. RESULTS

In accordance with the research goals, by means of a methodological approach and the set hypotheses, the difference within the 5 thematic units will be analyzed in the cause of this research. Based on the implemented analyses, we shall determine the characteristic of each subsample, as well as the distance between them, in order to calculate the contribution of characteristics, and the contribution of the thematic unit to the characteristics. This paper presents the results related to student computer literacy and its influence on qualifications for creating virtual learning environments and testing web applications.

TABLE I. CHARACTERISTICS AND HOMOGENEITY OF STUDENTS

	TFMP	ST	ELU	TUKE	UGD	FOI	dpr %
txt_ed	beg"	med"	exp"	-	exp*	beg*, med*	35.885
pic_ed	exp"	-	beg*	med*	exp*	beg"	20.574
db_ed	beg"	beg*	med*	med"	exp*	-	15.311
anim_ed	exp"	beg"	beg*	-	exp*, med"	med*	14.354
video_ed	exp*	exp"	beg*	beg"	med*	-	7.656
sound_ed	exp*	med"	beg*	beg"	med*, exp"	-	6.220
n/m	53/97	20/33	43/74	120/206	37/63	109/176	
%	54.64	60.61	58.11	58.25	58.73	61.93	

hmg - homogeneity; ctb % - contribution from marking according to characteristics

Based on the consideration and sample analysis of 649 respondents, in accordance with the applied methodology, the logical sequence of the research is to determine the that there is a clearly defined border between the faculty at which the respondent's study, i.e. it is possible to determine the characteristics of each faculty at which the respondent's study, in relation to the assessment on the use of computers.

The feature of each subsample is mostly defined by students with Text editor, because the contribution from marking the characteristics is 35.89%, followed by: Picture editor (20.57%), DB editor (15.31%), Animation editor (14.35%), Video Editor (7.66%), and Sound editor (6.22%). Homogeneity, TFMP is 54.64%, ST is 60.61%, ELU is 58.11%, TUKE is 58.25%, UGD is 58.73%, and FOI is 61.93%.

Based on the above, it can be said that 53 out of 97 respondents have TFMP characteristics, homogeneity is 54.6% (lower), which means that 44 respondents demonstrate other characteristics, and not the characteristics of their own group, and ST characteristics are seen for 20 out of 33 respondents, homogeneity is 60.6% (higher), because 13 respondents show other characteristics, ELU characteristics are seen for 43 out of 74 respondents, homogeneity is 58.1% (lower), because 31 respondents show other characteristics, while TUKE characteristics are seen for 120 out of 206 respondents, homogeneity is 58.3% (lower), because 86 respondents show other characteristics, and UGD characteristics have 37 out of 63 respondents, homogeneity is 58.7% (lower), because 26 respondents show other characteristics, also FOI characteristics are seen for 109 out of 176 respondents, homogeneity is 61.9% (higher), because 67 respondents show other characteristics.

TABLE II. GROUPING STUDENTS ACCORDING TO COMPUTER LITERACY

	distance
TFMP,FOI	.45
TUKE,UGD	.65
TFMP,TUKE	.71
TFMP,ST	.90
TFMP,ELU	1.26

The analysis will be conducted based on an assessment of student ability to use and create a virtual learning environment through their experience of creating Web applications, and years of experience in creating Web applications, Web usability knowledge, as well as habits during the testing of web applications, and habits during usability testing with users.

Based on the results it is possible to discern the characteristics of students from each faculty in relation to their experience in creating Web applications. Therefore, TFMP has a more expressed feature of N". ST feature is not defined. ELU feature is not defined, TUKE has a more expressed feature of Y", UGD has a more expressed feature of Y*, FOI has a more expressed feature of N*.

Since p=.000 $\chi 2$ –on the test, one can say that there is a correlation between the faculty at which they study and Web applications, since χ=.351 the correlation is low.

TABLE III. SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE STUDENTS ACCORDING TO CREATING VIRTUAL LEARNING ENVIRONMENTS

	χ	R	F	p	k.dsk
wb_app	.351	.375	21.116	.000	.006
WA_exp	.391	.397	24.127	.000	.034
web_us	.123	.124	2.003	.076	.010
test_WA	.343	.346	17.485	.000	.135
test_user	.284	.242	8.002	.000	.037

Legend: k.dsk represents the discrimination coefficient

As p <.1 the alternative hypothesis A3 is accepted, which means that there is a significant difference between some faculties at which the respondent's study, in: Web applications (.000), Creating WA experience (.000), Web usability (.076), Testing web applications (.000) and Usability testing with users (000).

The discrimination coefficient indicates that there is the largest contribution to discrimination between the faculties at which the respondent's study in relation to web applications, i.e. that the difference is biggest, in: Testing web applications (.135), Usability testing with users (.037), Creating WA experience (.034), Web usability (.010), Web applications (.006).

A. *Characteristics and homogeneity of students in relation to creating virtual learning environments*

The feature of each student subsample is mostly defined by Testing web applications, because the contribution from marking according to characteristics is 60.81%, followed by: Usability testing with users (16.67%), Creating WA experience (15.32%), Web usability (4.50%), Web applications (2.70%), and the faculty at which they study (.00%). Homogeneity in TFMP is 50.52%, in ST it is 60.61%, in ELU it is 64.86%, in TUKE it is 55.34%, in UGD it is 60.32%, and in FOI it is 77.27%.Based on the above, it can be said that TFMP characteristics are seen for 49 out of 97 respondents, homogeneity is 50.5% (lower), which means that 48 respondents have characteristics other than the ones of their group, and ST characteristics are seen for 20 out of 33 respondents, homogeneity is 60.6% (higher), because 13 respondents have other characteristics, ELU characteristics are seen for 48 out of 74 respondents, homogeneity is 64.9% (higher), because 26 respondents have other characteristics, and TUKE characteristics are seen for 114 out of 206 respondents, homogeneity is 55.3% (lower), because 92 respondents demonstrate other characteristics, and UGD characteristics are seen for 38 out of 63 respondents, homogeneity is 60.3% (higher), because 25 respondents have other characteristics, also FOI characteristics have 136 out of 176 respondents, homogeneity is 77.3% (higher), because 40 respondents demonstrate other characteristics.

IV. DISCUSSION

The results of the above research indicate that the following are established:

1) the difference between the students (.000) in relation to computer literacy, at Text editor (.000), at Picture editor (.000) at Animation editor (.000), at Sound editor (000), at DB editor (.000), at Video editor (.001). The existence of the border (000) is confirmed for Text editor, Picture editor, DB editor, Animation editor, Video editor, and Sound editor.

2) the difference between the students (.000) in relation to the habits when creating virtual learning environments, at Creating WA experience (.000), at Web applications (.000), at Testing web applications (.000), at Usability testing with users (.000), at Web usability (.076). The existence of the border (.000) is confirmed for testing web applications, Usability testing with users, Creating WA experience, Web usability, and Web applications.

Based on the assessments of respondents on computer literacy, it can be said that:

- TFMP has the following characteristics: for Text editor, values are beg", for Picture editor, values are exp", for DB editor, values are beg", for Animation editor, values are exp", for Video editor, values are exp*, for Sound editor, values are exp*, and homogeneity is 54.64% (53/97).
- ST has the following characteristics: for Text editor, values are med", for Picture editor, values are -, for DB editor, values are beg*, for Animation editor, values are beg", for Video editor, values are exp", for Sound editor, values are med", and homogeneity is 60.61% (20/33).
- ELU has the following characteristics: for Text editor, values are exp", for Picture editor, values are beg*, for DB editor, values are med*, for Animation editor, values are beg*, for Video editor, values are beg*, for Sound editor, values are beg*, and homogeneity is 58.11% (43/74).
- TUKE has the following characteristics: for Text editor, values are -, for Picture editor, values are med*, for DB editor, values are med", for Animation editor, values are -, for Video editor, values are beg", for Sound editor, values are beg", and homogeneity is 58.25% (120/206).
- UGD has the following characteristics: for Text editor, values are exp*, for Picture editor, values areexp*, for DB editor, values are exp*, for Animation editor, values are exp*, med", for Video editor, values are med*, for Sound editor, values are med*, exp", and homogeneity is 58.73% (37/63).
- FOI has the following characteristics: for Text editor, values are beg*, med*, for Picture editor, valuesare beg", for DB editor, values are -, for Animation editor, values are med*, for Video editor, values are -, for Sound editor, values are -, and homogeneity is 61.93% (109/176).

Based on the research results on the habits when creating virtual learning environments, one can say that:

- TFMP has the following characteristics: for Testing web applications, values are "othr", for Usability testing with users, values are -, for Creating WA experience, values are no_exp", 2-4 y", for Web usability, values are -, for Web applications, values are N", and homogeneity is 50.52% (49/97).
- ST has the following characteristics: for Testing web applications, values are heur_eval", for Usability testing with users, values are summ_UT*, don't use*, for Creating WA experience, values are -, for Web usability, values are N*, for Web applications, values are -, and homogeneity is 60.61% (20/33).
- ELU has the following characteristics: for Testing web applications values arecog_walk*, don't use, for Usability testing with users, values aresumm_UT", don't use", for Creating WA experience, values are2-4 y*, for Web usability,

values areN", for Web applications, values are-, and homogeneity is 64.86% (48/74).

- TUKE has the following characteristics: for Testing web applications values are don't use*, cog_walk", for Usability testing with users, values arethk_al", for Creating WA experience, values are2- y", for Web usability, values are-, for Web applications, values areY", and homogeneity is 55.34% (114/206).
- UGD has the following characteristics: for Testing web applications values areheur_eval*, othr*, for Usability testing with users values arethk_al*, othr*, for Creating WA experience, values are2- y*, 5+ y*, for Web usability values areY*, for Web applications, values areY*, and homogeneity is 60.32% (38/63).
- FOI has the following characteristics: for Testing web applications, values are-, for Usability testing with users, values areeye_track*, "othr", for Creating WA experience, values areno_exp*,for Web usability, values are-,for Web applications, values areN*, and homogeneity is 77.27% (136/176).

When it comes to the assessment of respondents on the use of computers, the border is clearly defined between the faculties at which they study, and so it is possible to determine their characteristics.

V. CONCLUSION

We must find ways to discover how students respond to the content. For example: making sure you have accurate, consistent contents; focus on action points during each week's homework assignment. How many students are failing to submit their homework on time? How much revision have students engaged in over the semester?

The best web-teachers make it part of their weekly routine to interact with students. There is no greater skill you can develop than to have a deep understanding of how your students think. There is only one way to develop this: by consistent interaction with your individual students.

Test usability once per week. Monitor how each student tries to complete a task in a week.

In the research presented in this paper, we analyzed a sample of 649 respondents drawn from the population, which was divided into 6 subsamples according to the faculty at which they studied.

The main research hypothesis, that the choice of techniques when creating virtual learning environments as well as the ability to test the usability of web applications depends on the computer literacy of students, is confirmed.

Sub-hypotheses: students are familiar with the term web usability and students practice testing the usability of their web applications have not been confirmed, because it is observed that many students are not familiar with the term web usability, as well as that a small percentage of students practice testing the usability of their web applications. It has been noticed that there are clear differences, but also similarities in the computer literacy of students from technical faculties in the region. It has been noticed that computer literacy influences the choice of method for testing web applications. It is necessary to make changes in the curricula at informatics faculties, and to point out web usability terms, as well as to introduce subjects that will deal with testing web applications within virtual learning environments.

REFERENCES

[1] Guasch,T., Alvarez,I., Espasa, A. (2010). University teacher competencies in a virtual teaching/learning environment: Analysis of a teacher training experience. Teaching and Teacher Education, Elsevier 26, 199–206.

[2] Hiary, H., & Abu Shawar, B. (2009). The Impact of JU Computerized Systems on E-Learning Process. European Journal of Scientific Research, 38 (2), 328-336.

[3] Butcher, C., Davies, C., & Highton, M. (2006). Designing Learning: From Module Outline to Effective Teaching. Routledge.

[4] Nielsen, J. (1994). Heuristic evaluation. In: Nielsen, J., Mack, R.L. (eds) Usability Inspection Methods. Wiley &Sons, New York.

[5] Polson, P., Lewis, C., Riemann, J., & Wharton, C. (1992). Cognitive Walkthrough: A Method for Theory-based Evaluation of User Interfaces. International Journal of Man-Machine Studies, Vol. 36, 741-773.

[6] Vukovac, Plantak, D., & Orehovački, T. (2010). Web Usability Evaluation Methods. CASE 22 Methods and tools for the development of business and information systems. 171-182.

[7] Williams, P. E. (2003). Roles and competences for distance education programs in higher institutions. *American Journal Education*, 17, 45–57.

[8] Herrera Mosquera, Leonardo. (2017). Impact of Implementing a Virtual Learning Environment (VLE) in the EFL Classroom. *Íkala, Revista de Lenguaje y Cultura*, *22*(3), 479-498. https://dx.doi.org/10.17533/udea.ikala.v22n03a07

[9] M. Pejić Bach, I. Miloloža, J. Zoroja. (2018) Internet Use for Online Learning among Youth: Differences across European Countries and Educational Levels, MIPRO 2018, International Convention, ISBN 978-953-233-096-0 , 616-621