Students and Teachers' Usage of E-Learning Artifacts in Tertiary Education in Croatia

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Abstract - E-learning is perceived as an important aspect of current educational processes and has been receiving an increasing interest from Croatian educational institutions. In spite of a plethora of studies on that topic in Croatia, empirical research on the actual usage of different e-learning artifacts is still missing.

This paper presents the findings of an exploratory survey conducted as part of a large-scale study on e-learning systems usability. The survey was conducted among students from three tertiary educational institutions and teachers from four universities and two polytechnics. The research results provide insights into the profiles of e-learning users and identify experiences and usage preferences/patterns concerning different e-learning artifacts such as e-learning tools and technologies.

I. INTRODUCTION

E-learning research has experienced an intense expansion of different aspects to be considered in exploring this area. In numerous studies strategies have been proposed for implementation and integration of e-learning into the educational process in both educational institutions and the business sector. The existing research has so far addressed the facilitation of technologies and methods for teaching and learning in virtual environments as well as the issues of e-content development and management. Furthermore, a lot of researchers have examined communication and collaboration in e-learning or the teacher's role in the e-learning environment. Studies that are specifically oriented toward the effects of e-learning on knowledge acquisition on one side, and the quality and evaluation of e-learning resources on the other represent another rich avenue of research. Finally, perceptions and acceptance of online teaching/learning are also among widely explored topics.

Croatian educational institutions, particularly in higher education, are increasing their interest in e-learning. The advantages of e-learning, including the accessibility of knowledge, flexibility of learning, lifelong learning etc., have been acknowledged by many researchers [3], while e-learning itself has been characterized as one of factors that improve the quality of university education [15]. However, the application of different information and communication technologies in education is not perceived as important as several years ago [5]. Regarding legal prerequisites for e-learning implementation, the number of universities (e.g. [14], [15]) and faculties (e.g. 8 out of 33 faculties at the University of Zagreb [5]) that have developed their e-learning strategy is relatively small. Strategies prescribe issues such as the formal/legal and organizational environment that enables e-learning; development of human resources like technical staff or instructional designers; support to teachers in developing e-learning materials and providing additional training; support to students by assuring conditions to participate in e-learning; development of educational content by prescribing standards, criteria, procedures and providing funds for its development; and development of basic and specific infrastructure (ICT infrastructure, virtual learning environment etc.) [15]. It is only through a strategic approach, where resources that support e-learning are planned and ensured, that sustainability of e-learning in the educational process can be enabled [4].

Nevertheless, it seems that the implementation of e-learning at universities is still not at a satisfactory level. The majority of faculties at the University of Zagreb belong to the group where e-learning is not systematically implemented, support is declarative and implementation of e-courses relies on the initiative, enthusiasm and efforts of individual teachers [5]. On the other hand, a few studies (e.g. [8] and [16]) that explored some issues concerning the actual usage of different e-learning artifacts have indicated the students' tendency to use low-level e-learning materials.

II. E-LEARNING ARTIFACTS

As defined by Koper [11], e-learning artifacts/artefacts are "all the physical products produced before, during or after learning, like courses, programmes, learning designs, activity descriptions, books, reports, tests, remarks and comments". This definition of e-learning artifacts, where they are viewed from the teacher's (and partially the student's) aspect, presents a standpoint for the research in this paper as well.

One of the challenges facing the teacher is developing high quality digital learning materials that are in line with the pedagogical objectives of the course, motivating for students and assure knowledge acquisition. Some of the activities needed for such learning materials to be implemented are facilitated by learning management systems (LMSs), which are dominant Internet communication systems for e-learning [10]. Such systems provide teachers with the tools for presenting multimedia learning materials; the tools for creating lessons and

learning paths; the tools for knowledge assessment; the tools for student/student and student/teacher communication and collaboration; and the tools for the efficient administration of students and the entire e-course. However, the information about the usage of those e-learning artifacts in e-courses that the existing studies provide is scarce.

Although the e-learning artifacts have not been widely explored, in reality students access different e-learning artifacts during their e-course: they access learning materials created by the teacher, learn from those materials, test their knowledge in LMS-based tests and communicate and collaborate whenever they need to, regardless of the delivery mode of the course (i.e. blended learning or full online learning). Students can participate in the creation of different e-learning artifacts in LMS (e.g. wiki web pages) to support the social constructivist model of e-learning. In addition to the teacher's or self-created digital learning materials, students can also use a whole range of other e-learning artifacts to learn from: third-party multimedia educational CDs/DVDs, e-books or e-magazines, online encyclopedias and dictionaries, free educational portals, webinars, etc.

Several studies have been conducted that explore how e-learning in general and different e-learning artifacts in particular are perceived and accepted among students and teachers in Croatia, e.g. [1], [2], [6], [7], [8], [13] and [16]. However, there is still a significant lack of research into the actual usage of e-learning in education, although some insights into that specific issue can be found in [5], [8] and [16]. In order to contribute to the existing body of research, this paper sheds additional light onto the usage of different e-learning artifacts used by students and teachers in several Croatian higher educational institutions.

III. Review of Previous Research on E-Learning Usage

Starting from the year 2007, the E-Learning Centre at the University of Zagreb has been conducting a survey among e-learning representatives at the University's 33 faculties and academies. The aim of the study has been to identify the institutional state of the art as well as the constituents' expectations and plans concerning e-learning implementation. In 2010, the usage of e-learning in general at the University of Zagreb was high, with 29 institutions (88%) that had implemented one or more e-learning systems, mostly LMS Moodle [5]. At present, there are more than 1500 blended learning courses offered to students. However, the students' perception of the fulfillment of preconditions for e-learning, like having access to computer equipment and Internet, is fairly low – 'not too good' (30%) and 'good' (34%). From the teachers' perspective, the preconditions for e-learning are perceived more favorably, as 'good' (46%) and 'very good' (21%).

In the research conducted at the Josip Juraj Strossmayer University of Osijek students' attitudes about e-learning and forms of e-learning that students had been exposed to during their tertiary education were investigated [8]. The research sample comprised 215 students from different faculties. Research results showed that some e-learning artifacts were used to a great extent: 96.74% of students had downloaded course materials from the teachers' web sites, while 81.4% of students had submitted homework or a paper to the teacher's e-mail. Advanced forms of e-learning, like attending videoconference lectures (19.07% of all respondents) or using LMS (21.86% of all respondents), were mostly found among students enrolled in information and computer science programs.

Another study was conducted at the University of Rijeka to assess students' perception of the quality of delivered e-courses and the importance of different e-learning artifacts as well as their attitude towards e-learning [16]. The questionnaires completed by 313 respondents (16% of all students enrolled into MudRi, the Moodle LMS implemented at the University of Rijeka) were analyzed. The study does not provide much information on the usage of concrete e-learning artifacts but rather indicates the respondents' opinions and satisfaction with e-learning artifacts. The research showed that engineering, social sciences and ICT students participated in a significantly higher number of e-courses than the students of social sciences and humanities, while ICT students had more extensive e-learning experience than others. The students assessed advanced e-learning artifacts as 'good' in only 16% of the cases (self-assessment tests) and 14% of the cases (implementation of the multimedia), but they also characterized these e-learning artifacts as 'less important' or 'the least important', respectively. Forum discussions and communication with the colleagues throughout the e-course were also identified as 'the least important'.

In spite of valuable insights into e-learning usage at particular universities that the aforementioned studies provide, they are mostly restricted to the students' perspective (e.g. [8] and [16]). This paper therefore aims to make an additional contribution by presenting the current practice in e-learning usage from the perspective of both students and teachers.

IV. Research Method

The research presented in this paper was conducted in June and July 2011 as part of a large-scale study on usability of university hybrid courses implemented in learning management systems (LMS). Usability of e-courses was evaluated by three groups of stakeholders: usability experts, student users and teacher users. For the purpose of this paper, only the evaluation obtained by the users is described.

Users were involved in usability testing of two e-courses. Testing sessions included a brief inspection of the user interface followed by a completion of a variety of tasks that users usually do in an LMS-based e-course. As a part of usability testing, users' profiles needed to be determined. Thus, before the actual testing, every user completed a survey with questions about their personal information and prior experiences with e-learning, the results of which are presented in this paper. After testing, the users gave their feedback in a survey about their satisfaction with technical and pedagogical aspects of a

particular e-course. Some users also participated in the qualitative part of the research (interview and co-participant testing method) to give additional information about users' interaction with e-courses.

Considering the users' sample, the entire research plan was aligned to the requirements of usability testing settings (e.g. a small number of participants needed to achieve valid results [12]), while also taking into account that the usage of questionnaires requires at least 30 participants [9]. Since test users "should be as representative as possible of the intended users of the system" [12], two main groups of users were selected: higher education students and teachers. In order to obtain a heterogeneous sample, while having in mind the accessibility of the users included in the qualitative part of the research, the student population invited to participate in the research comprised two faculties (University of Zagreb, Faculty of Organization and Informatics, and University of Split, Faculty of Economics), and one polytechnic (Polytechnic of Varazdin). The teacher population invited to participate in the research was obtained from four universities (University of Zagreb, University of Split, University of Rijeka and University of Osijek), and two polytechnics (Polytechnic of Varazdin and Polytechnic of Rijeka). The participation in the study was voluntary and the research sample consisted of users who were willing to allocate up to two hours for testing and completing the questionnaires.

The results from the first questionnaire are presented in this paper. By means of the questionnaire the following data were collected: 1) demographic data about the user, 2) user's computer literacy, and 3) user's experience with e-learning artifacts. The questionnaire mostly consisted of closed-response questions. Two versions of the questionnaire were distributed as an online survey – one adapted for the students and the other for the teachers.

V. RESEARCH FINDINGS

A. Students

A total of 150 students, 91 of them male (60.7%) and 59 female (39.3%), completed the entire questionnaire. The average age of respondents was 21.5 years (median=20). The majority of the students were in their first year of study (68.7%), with a smaller number of students in the third (27.3%) or second year of study (4.0%). The students were enrolled in three different higher education institutions: University of Zagreb, Faculty of Organization and Informatics: Information and Business Systems (52.0%) or Economics of Entrepreneurship (15.3%) study programmes; the Polytechnic of Varazdin, Construction Engineering (14.0%) or Multimedia (11.3%) study programmes; and the University of Split, Faculty of Economics, Business Studies/IT Management (8.00%) study programme.

The respondents self-assessed their computer literacy as very high, since 61.3% of students described their ICT skills as advanced and 18.7% students declared themselves as experts in using ICT. Such a high percentage of ICT experts among students is accounted for by the particular field of study but also by the fact that a vast majority of students have been using the computer from elementary school age (78.7%) or even preschool age (9.3%). They also reported to spend a lot of time in front of the computer on a daily basis: more than 4 hours (68.7%), up to 3 hours (22.2%) or up to 2 hours (9.3%), and use the Internet every day (94.0%) or almost every day (6.0%).

Students self-assessed their e-learning usage skills as fairly high, since 93 of them (62.0%) reported they were somewhat experienced or very experienced (36 students, or 24.0%). As shown in Fig. 1, 21 students (14.0%) declared to have very little or no e-learning experience.

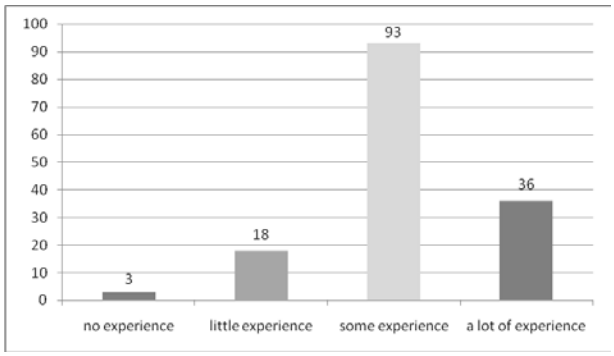

Figure 1. Students' e-learning experience

It is interesting, however, to consider the reasons that motivate the students to use e-learning. More than half of the students (52.0%, or 78 students) declared they used e-learning only because it is obligatory in courses, and less than half of the students used e-learning to acquire new knowledge (the first and the third columns in Fig. 2).

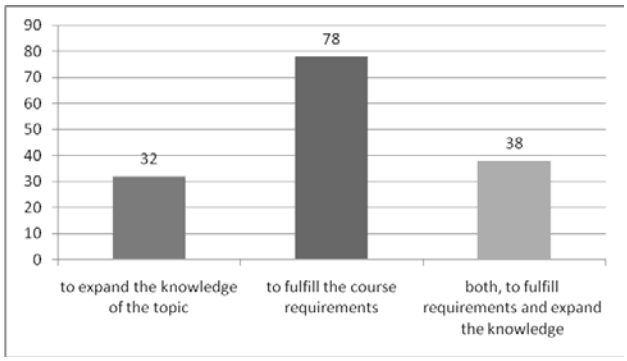

Figure 2. Reasons for students' usage of e-learning

More than half of the students in the research sample (56.0%) had been using e-learning systems for less than a year. Another 36.0% of students had been using them for between 1 to 3 years, and 6.7% of them for more than 3 years. One student stated that she had never used any e-learning system, although she later named two LMSs she had used.

Most of the students had used only one LMS (82.7%), while the rest of the students had experience with up to three LMSs. Altogether, every student had had some experience with Moodle e-courses, either faculty-based (98.7%) and/or Moodle e-courses at SRCE (3.3%).

Several students had used both Moodle and Claroline e-courses (11.3%). Two students had had experience with Blackboard e-courses. Three students had accessed some other LMSs (a proprietary LMS of the faculty or the LMS of one e-learning academy). One student also reported that he had been working on adapting his own idea of an e-learning system based on a file sharing system.

Besides using e-courses provided through the faculty's e-learning system, which constituted the most utilized e-learning artifacts (92.7%), to a great extent because it is obligatory, students had also used other e-learning artifacts (technologies or digital learning materials, LM), as shown in Fig. 3.

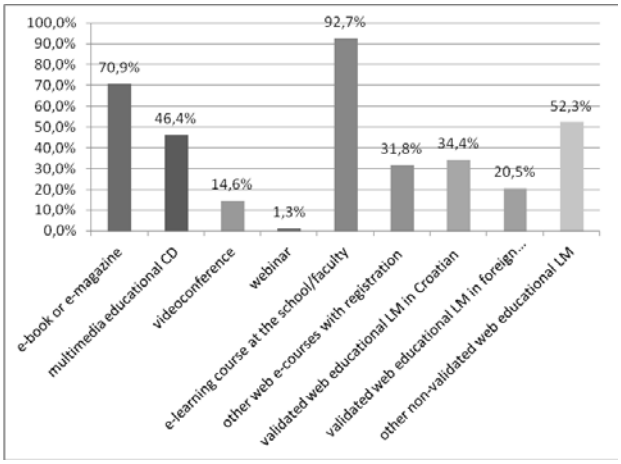

Figure 3. Students' usage of e-learning artifacts

The majority of students had also used an e-book or an e-magazine (70.9%), which may indicate that students like to learn from e-books/magazines or that e-books/magazines are more accessible or more convenient to use (e.g. they can be printed out). Multimedia educational content on a CD-ROM is also highly evaluated since 46.4% of the students reported its usage.

A minority of students reported to expand their knowledge by using different validated e-learning artifacts: web educational learning material in Croatian (e.g. the Croatian linguistic portal and similar, 34.4%), validated web educational learning material in a foreign language (e.g. Britannica Online Encyclopedia, Merriam-Webster Dictionary and similar, 20.5%) and web e-courses that require registration (e.g. edukacija.net, e-learning portal "Nikola Tesla" and similar, 31.8%). Only a small number of students had had experience with advanced methods of delivering educational content like videoconferences or webinars (14.6% and 1.3%, respectively). As expected, a great percentage of students (52.3%) reported to rely on non-validated educational learning materials they found on the web, which also raises a question of credibility of students' knowledge and the importance of teachers' efforts to provide valid additional learning materials.

B. Teachers

A total of 86 university teachers completed the questionnaire, 47 of whom were female (54.7%) and 39 male (45.3%). The average age of respondents was 34.5 years (mean=34.7, median=33, std=7.86), with the age ranging from 25 to 64. The average length of their teaching experience was about 8.5 years (mean=8.6, median= 6, std=6.99).

By their scientific title, the respondents comprised teaching assistants (30.2%), assistant professors (18.6%) and research novices (16.3%). Two full professors also participated in the research. Teachers in the research sample were from all scientific fields, with the majority of them from the social sciences backgrounds (46.5%). They were based at the University of Zagreb (57.0% of all the teachers in the survey, including those from the Faculty of Organization and Informatics, Faculty of Electrical Engineering and Computing, Faculty of Teacher Education, Faculty of Economics, Faculty of Science, Faculty of Food Technology and Biotechnology, Faculty of Philosophy, etc.); University of Split (12.8%, with all the respondents from the Faculty of Natural Science); University of Rijeka (10.5%, with respondents from the Faculty of Philosophy, the Faculty of Engineering and the Faculty of Civil Engineering); University of Osijek (4.7%, with respondents from the Faculty of Teacher Education and the Faculty of Food Technology); the Polytechnic of Varazdin (9.3%) and the Polytechnic of Rijeka (5.8%).

The teachers' self-assessment of their computer literacy was higher than that obtained by the students: 45.3% reported to be experts in using ICT and 40.7% described their ICT skills as advanced. Only 9.3% of the teachers perceived their computer literacy as average. Not surprisingly, 84.9% of university teachers reported to use the computer more than 4 hours a day and a vast majority of them used the Internet every day (94.2%). Many of them had started using a computer in elementary school (37.2%) or high school (31.4%). Some participants had become computer literate at the faculty (14.0%) or after they had got employed (9.3%). Only three teachers had started using the computer at the preschool age.

Most of the teachers from the research sample had been using e-learning systems for between 2 and 5 years (60.5%), and 18.6% for more than five years. 15.5% of the teachers had reported up to two years' experience with e-learning systems. Five teachers (5.8%) had never used any kind of e-learning system before this research.

As expected, a high percentage of teachers had been using Moodle (91.4%) implemented at the faculty/ polytechnic (e.g. MudRi), or at SRCE (e.g. Merlin or MuS). Moodle is the only LMS that the majority of teachers (61.9%) had experience with in their e-courses delivery. Besides Moodle, a quarter of the teachers had tried other well-known LMSs, like WebCT, Claroline, Blackboard or ATutor. Three teachers had experience with three LMSs, e.g. with Moodle, WebCT and Claroline. Two teachers reported the usage of intelligent tutoring systems TEx-Sys and CoLaB Tutor, or an e-learning system based on autopoietic information system architecture.

Teachers' self-assessment of their knowledge of e-course design in LMS is shown in Fig. 4. The majority of teachers perceive themselves as average users of LMS functionalities (41.9% , or 36 teachers).

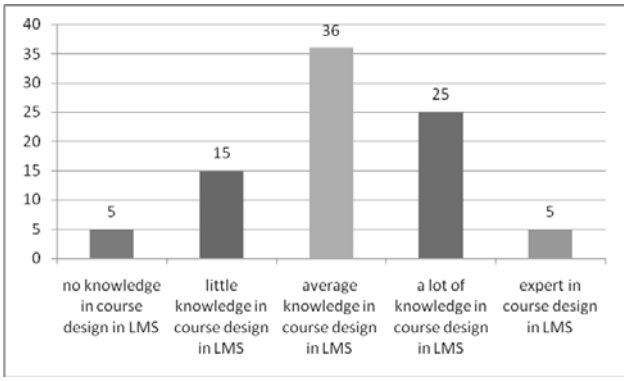

Figure 4. Teachers' level of knowledge about e-course design

LMS primarily serves as a repository for digital learning materials (e.g. presentations, .pdf documents etc.), since 96.3% of teachers upload different documents to make them accessible to students (Fig. 5). The second most frequently used activity in LMS is a forum, which is used by 77.8% of teachers to communicate with students.

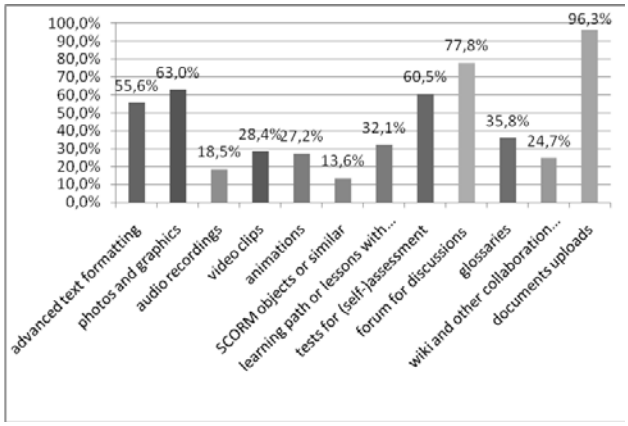

Figure 5. Usage of e-learning artifacts in LMS by teachers

Assessment presents a very important activity in an e-course and a high percentage of teachers (60.5%) therefore provide students with quizzes and tests. Unfortunately, the percentage of teachers who create tests only for self-assessment and those who do so for the final exam as well was not obtained.

Teachers also indicated they spent their time creating web pages within the e-course to provide a *web-like feel* of the learning materials, since advanced text formatting as well as photos and graphics were reported to be frequently used (55.6% and 63.0%, respectively).

There are some e-learning artifacts that teachers tend to create/use less, like glossaries (35.8%), learning paths or lessons with branching structure (32.1%), video clips (28.4%), animations (27.2%), wiki and other collaboration tools (24.7%), and audio recordings (18.5%). SCORM objects are very rarely used (13.6% of all respondents reported their use). This might indicate the following: that teachers are not very well acquainted with the advantages of such objects or that they may not know how to create them, where to find them and, finally, how to implement them within e-courses. One teacher reported his use of the workshop activity in LMS.

Considering the administration of an e-course in LMS (Fig. 6), the majority of teachers reported to use LMS to inform the students about course activities (87.7.%) and to collect their work (82.7.%). Most LMSs facilitate keeping students' records with grades and a high percentage of teachers use those facilities (63.0% teachers use LMS to grade students and 58.0% to keep students' records). Grouping of students for easier administration within an e-course is slightly less used (46.9%), whereas the analysis of the e-course log is the most rarely used activity by teachers (33.3%). Two teachers also reported they used LMS to enable students to sign up for the exam.

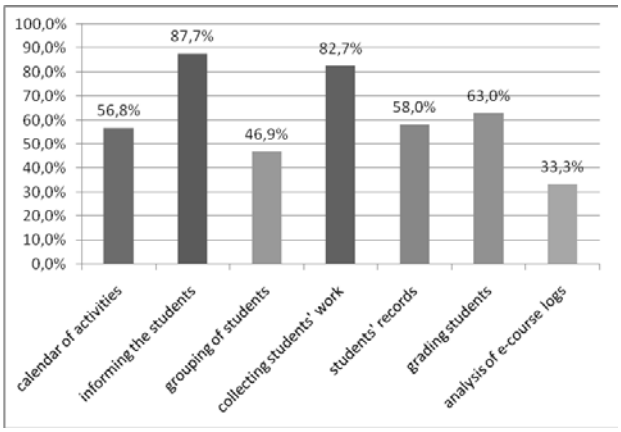

Figure 6. Administration of e-courses

VI. CONLUSION

This paper presents research results of an online survey on e-learning usage in Croatian higher education institutions. Although the survey was not conducted within a standalone study, but as part of a large-scale usability study of e-learning systems, the collected data offer revealing insights into the current e-learning practice.

The presented study explored two groups of e-learning users: students and teachers. A hundred and fifty student respondents, mostly in their first year of the study, were gathered from two universities and one polytechnic. Eighty-six teacher respondents formed a more heterogeneous group, coming from four universities and two polytechnics, with a different scientific background. Since both students and teachers volunteered to participate in the study, research results have to be interpreted with that limitation in mind.

The survey respondents revealed their demographic information, experience with using computers in general and e-learning in particular. Both students and teachers see themselves as very experienced computer users, since they started to use the computer at an early age and use it on a daily basis. Teachers assessed their e-learning usage skills slightly higher than students, which was to be expected since many faculties encourage or even prescribe creation of e-courses within the blended learning model. Teachers thus have to familiarize themselves with different e-learning artifacts, e.g. tools and methods offered by learning management systems and adapt their way of teaching accordingly.

On the whole, the analysis of e-learning artifacts usage by students and teachers indicate that both stakeholders' groups use a wide range of artifacts. All the students and a vast majority of teachers from the research sample use Moodle LMS as a platform for e-learning activities. Other reported LMSs were WebCT, Claroline, Blackboard and ATutor. Students were asked to indicate which other e-learning resources they had used using for learning besides the faculty e-courses. Furthermore, the analysis revealed their preference for e-books or e-magazines, multimedia educational CDs and, to some extent, validated educational web sites. Only a few students had an opportunity to participate in a videoconference or to watch a webinar. Unfortunately, more than half of the students rely on non-validated web educational learning materials, which might contain skewed or incorrect information. This fact emphasizes the importance of teachers' efforts to provide enough learning materials, tests, additional interesting learning sources, accompanied by a wide range of communication and collaboration activities etc., to facilitate enjoyable and efficient e-learning experience to their students, which can also result in knowledge acquisition. In this sense, teachers should not use LMSs merely as the e-course repositories for document downloads or as bulletin boards to inform students, which are the two most widely used activities by teachers. Instead, teachers should primarily utilize LMS's functionalities that are built on social constructivist pedagogy and include students into knowledge building by using glossaries, wikis or similar e-learning artifacts. Resources that are time-consuming to build, like animations or videos, or those that require additional technology, like videoconferences or webinars, should be used moderately, when efforts justify learning effects. Third-party SCORM objects, which are the least frequently used e-learning artifacts among Croatian university teachers, also present a good alternative to self-created learning materials.

The findings of this study suggest several avenues of research for future studies: further analysis of the data to reveal correlations among different parameters; broader study involving a more representative research sample; or exploration of the relationship between the proposed e-learning strategies and practice. The findings also reveal a need for further education of teachers concerning building and implementing advanced e-learning artifacts into their e-courses and teaching practice.

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