Barriers to using E-Learning in an Advanced Way

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***Abstract*— E-Learning has become a common way to teach and learn. The number of technologies for a variety of educational purposes is already quite high and constantly rising. Scientific experiments and studies increasingly confirm the usefulness of various technologies for teaching purposes. Nevertheless, there is still a lack of formal training and support of digital skills within faculty training. Studies that report the potential of E-Learning are matched by those reporting the barriers. Universities throughout Europe have now established Learning Management Systems (LMS); instead of using these to their full potential, lecturers often just upload their syllabus and some reading material. At the same time, higher education institutions all over Europe are expected to implement innovative technologies and scenarios such as Open Educational Resources (OER) or Massive Open Online Courses (MOOCs), but only a small number of universities actually do so. What are the reasons for not utilizing the pedagogic potentials of E-Learning? What findings does the current research provide on this topic? Which barriers can be derived from studies and what can be done to avoid them? What are the individual barriers of one institution or university? This contribution summarizes barriers that were identified in recent studies and discusses possible solutions to finding connections between barriers to mitigate the negative effects. It also describes a data collection method (group concept mapping) suitable for identifying the individual barriers at an institution or university using a study in the European ERASMUS+ project AduLeT (Advanced Use of Technologies in Higher Education) as an example.**

***Index Terms*— E-Learning, Group Concept Mapping, Higher Education, Barriers.**

I. INTRODUCTION

Most universities in Europe have been using Learning Management Systems (LMS) to enrich their face-to-face teaching [1], [2] and have specific departments for E-Learning [2], [3]. Nevertheless, for most higher education lecturers in Europe, E-Learning means uploading documents on the LMS [4], or generating content [5]. Only few lecturers use the pedagogic potentials of E-Learning [6]. While cooperative and collaborative scenarios are rarely used, higher education institutions, in particular, should be at the forefront of innovative teaching and learning scenarios with digital media. There are several barriers preventing the establishment of new ways of teaching in higher education [7], leading to a discrepancy between expectations and reality. Several studies investigate the use of E-Learning [8], [9] or sustainability [10]. Only little research can be found concerning barriers to using E-Learning. Mahmodi and Ebrahimzade [11] have investigated barriers for students using E-Learning. Knowing the barriers to using E-Learning can help to understand the situation at the individual university or workplace better. Therefore, this article summarizes barriers identified in recent studies, and subsequently discusses possible approaches to overcoming these barriers. Due to the diversity of universities and institutions, this article also describes a method of collecting the barriers at different institutions with the group concept mapping (GCM) method. This article presents results from a literature review and a GCM study carried out within the framework of the European ERASMUS+ project AduLeT (Advanced Use of Technologies in Higher Education).

II. METHODS

In order to identify barriers to using E-Learning from the perspective of a lecturer, a literature review was conducted. The keywords used for the research within common educational databases were “barriers, barriers, pitfalls” as well as “E-Learning, online-teaching, and learning management system”. Moreover, the studies had to fulfill the following criteria: the studies had to be conducted in the field of higher education, the studies had to have a focus on barriers to using E-Learning for lecturers, as well as being empirical studies, and published in the year 2010 or later. Most of the studies are from the United States, such as the studies by Allen and Seaman [12], Bacow, Bowen, Guthrie, Lack, and Long [13], Baran [14], Dahlstrom, Brooks, and Bichsel [6], as well as Lloyd, Byrne, and McCoy [15]. There are only a few studies from Europe, such as Cabral, Pedro, and Gonçalves [16] from Portugal or Moscinska and Rutkowski [17] from Poland, and Sanchez, Hueros, and Ordaz [18] from Spain. These studies focus on finding barriers to the use of E-Learning at one specific university. A review of literature from the United Kingdom can be found in Islam [19]. Three studies are from Africa, like the studies by Mutisya and Makokha [20] and Tarus, Gichoya, and Muumbo [21] from Kenya, as well as the study of Mwakyusa and Mwalyagile [22] from Tanzania. Studies investigating barriers to using E-Learning in the Middle East can be found for Iraq in Al-Azawei, Parslow, and Lundqvist [23] for Iran in Farzaneh, Mousavi, and Maghabl [24], as well as Al-Shboul [25] from Jordan. Results from Australia can be found in the study of Anderson [26] and from Asia in Arinto for the Philippines [27].

The collection of barriers from the literature review can be compared with the results of the GCM study.

The AduLeT project used the group concept mapping (GCM) method in the study. GCM [28] (see also [29], [30]), is a participative research methodology that facilitates a group of people arriving at a shared vision about a particular issue (e.g. problems with the use of ICT in teaching). The participants are asked to participate in a few commonly used activities such as generating ideas, sorting ideas into groups and rating ideas on some values (e.g. importance of problems with the use of ICT in teaching and difficulties in solving these problems). While the participants generate, sort and rate ideas individually, two advanced multivariate statistical techniques - multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) - aggregate the individual contributions to identify patterns in the data. Visualizations of the results such as concept maps and pattern matches help to interpret the findings. GCM shows how ideas are related, how they are grouped in more general categories, and how much emphasis is given to each idea and cluster.

The procedure included the following steps:

(1) Idea generation. The participants were asked to brainstorm as many ideas as possible, completing the following focus prompt: "A barrier for the use of ICT in my teaching is ..."

(2) Sorting the ideas. The participants were asked to group the ideas on similarity of meaning giving each group a name.

(3) Rating the ideas. The participants were asked to rate the ideas on (a) the relative importance of each statement about problems with using ICT in teaching, using a scale ranging from 1 (relatively unimportant) to 5 (very important); and (b) rate each statement on how difficult /easy it is to solve the problem with using ICT in teaching, applying a 1-to-5 scale where 1 = very difficult and 5 = very easy.

(4) Analysis of the data applying MDS, HCA, correlation and significant tests.

Within this article the results of step one and step two will be described. The analysis of step three and step four is still ongoing and will be part of future publications.

III. RESULTS

A. Barriers identified in the literature

The identified barriers were divided into three different areas: personal factors, institutional and cultural factors, and technical factors. Personal factors include all barriers that are dependent on the person. Institutional and cultural factors contain barriers that are shaped by the institution and which lecturers cannot control. Technical barriers refer to the use of technologies and infrastructure [4].

Personal factors: Time was mentioned in several studies (e.g. [14], [15], [19], [20], [26]). Specifically, the additional time needed for the preparation of E-Learning, is a major barrier for lecturers, since there is generally more time needed than in face-to-face teaching [14], [15], [20]. Anderson [26] found in his study at a large Australian university that the flexible use of time in an online environment is also an advantage for lecturers experienced in E-Learning. For lecturers with less E-Learning experience, the lack of time is often a problem. The academic status might also have an impact. In a study with 386 lecturers from 36 colleges at a large state university system in the United States, Shea [31] found out that assistant, associate and full professors were more demotivated by the additional time needed for online teaching than part-time or non-traditional faculty such as instructors or teaching assistants. Lecturers with less experience with E-Learning seem to be less self-confident and have more doubts about their skills to teach online. Some respondents of the study by Anderson [26] were of the opinion that E-Learning is more time consuming, even if they had not yet tried it out themselves. Other respondents report a need for additional support. Lloyd, Byrne and McCoy [15] found that lecturers with less E-Learning experience generally rate barriers higher in comparison to experienced users. Individual motivation is another personal factor in the use of E-Learning. The lack of motivation was mentioned as a barrier in several of the studies (e.g. [14], [26]). Furthermore, support has an impact on the motivation of lecturers [14]. Anderson [26] found out that self-efficacy has a high impact on motivation. Self-efficacy again depends on previous experiences. Moreover, older studies show that age and employment status might have an impact on motivation. In the study by Shea [31], younger faculty (<45 years), in particular, had more doubts concerning the use of E-Learning due to lack of recognition of online teaching in their institution. By contrast, the flexibility of time by using E-Learning has the largest impact on the motivation of lecturers.

Institutional and cultural factors: From a lecturer's point of view, two barriers concerning institutional and cultural factors were identified: support and recognition. At most higher education institutions, a variety of approaches are available for lecturers to support the use of E-Learning. Training courses are an essential part of the support. A wide range of topics should be offered in training courses, from using specific tools to pedagogical issues, in order to enable lecturers make advanced use of E-Learning [4], [23], [26]. The number of training courses attended seems to be a key factor in the degree of utilization of learning management systems [16]. Empty courses are much more likely to be found by lecturers that have not attended any training course. Lecturers that have taken part in three or even more training courses use the learning management system at a much higher level, technically as well as pedagogically. The lack of recognition of online teaching is a barrier to using E-Learning (e.g. [13], [26]). Hence, Bacow et al., [13] suggest providing incentives for faculty, such as a stipend or reducing responsibilities in other areas. Since faculty time is the scarcest resource for lecturers, a financial incentive could be less appealing than having more time for developing E-Learning courses. In the study by Shea [31] the lack of recognition was even the biggest barrier to using E-Learning at all.

Technical factors: Technical factors include skills in using E-Learning tools, usability, and infrastructure. There is wide agreement in the various studies that lecturers' existing competences influence the use of E-Learning (e.g. [6], [23]). The range of computer literacy required for the use of E-Learning tools in teaching is very wide. The basic level would be tasks such as uploading or storing files. However, the ways to use learning management systems are endless and an exhaustive use of all available

options would not be expected [26]. Competent use however, requires knowledge of the learning management system, computer literacy [6], basic legal knowledge and pedagogical skills [4]. Therefore, it comes as no surprise that many teachers believe their teaching would be more effective if they had more skills in using the learning management system [6]. Inexperienced users are more likely to be afraid of the technology itself, of failure, or being embarrassed in front of the students [26]. A common technical barrier is the lack of user-friendliness of learning management systems (e.g. [17], [26], [31]). Nowadays, many users are accustomed to the comfortable operation of social networks, such as writing comments or liking something. The handling of learning management systems is therefore often perceived as cumbersome [32]. The existing technical infrastructure has a significant impact on the use of E-Learning. This includes not only the reliability of the tools used and the IT support offered [13], [26], but also a stable Internet connection [23].

The literature review showed that technical factors represent an barrier that should not be underestimated [6], [26]. Especially in the case of developing countries, the equipment at the universities is mentioned as an barrier that hinders or prevents the use of E-Learning. In addition to the lack of equipment (e.g. computers, tablets, laptops), a lack of infrastructure (e.g. no stable WiFi connection) is an additional factor (e.g. [20], [21], [24]). This is important because technical factors also play an important role in the sustainability of E-Learning projects. McGill, Klobas, and Renzi [35] have analyzed 64 empirical studies about E-Learning projects and found out that the technologies in use must be updated early enough and always be up to date. In addition, the technologies must be reliable in order to facilitate sustainable use. A reliable infrastructure and skills in using the tools are necessary factors, while user-friendliness is a sufficient factor for the use of E-Learning. According to Lloyd, Byrne, and McCoy [15], lecturers' existing experience could be the key to removing barriers . This aspect was previously neglected in the literature and would need to be examined more closely.

B. Barriers identified in the Group Concept Mapping Study

A customized web-based environment was created specifically for the AduLeT project to facilitate data collection and analysis (Concept System Global Max) [33].

Forty-nine experienced teachers across Europe contributed to the brainstorming phase of the study. Of them, twenty-eight participated in the second stage – sorting and rating. They were experienced teachers (mean = 20; median = 20 and mode = 20), representing Finland (3.6%), Germany (14.3%), Hungary (25%), The Netherlands (17.9%), Portugal (17.9%) and Spain (21.4%). Face-to-face was the dominant teaching mode (67.9%), followed by online (17.9%) and blended way of teaching (14.2%). The perceived level of expertise of using ICT in teaching was defined as 'beginner' (14.3%), 'advanced' (57.1%) and 'expert' (28.6%). The participants had diverse educational background: educational science (47.1%), computer science (17.6%), social science (14.7%), other (20.6%; health sciences, music education, special needs education, English, applied science, and mathematics).

Figure 1. Point map

Figure 1. visualizes the first result of the MDS analysis. It shows all the 87 reported barriers and how they are related by locating similar terms close to each other in the two-dimensional space (a point map). MDS scaling also assigns each idea a bridging value (between 0 and 1) after computation of the map. A lower bridging value means more participants have grouped the statements with ideas around it. A higher bridging value indicates that the idea has been sorted together with statements further apart. MDS scaling also produces a statistic, called stress index (a value between 0 and 1) to indicate the goodness-of-fit between the mathematical model as represented by the point map and the raw sorting of the participants aggregated by a binary similarity matrix. In this project the stress value is 0.26, which is not only in the accepted range but it is also considered quite good in terms of the study's internal validity [34]. The next steps in the interpretation of the data was identifying thematic areas on the map by applying agglomerative hierarchical cluster analysis (HCA). Typically the procedure starts with 16 cluster solutions until reaching 5 (a practical heuristic based on research and practice with GCM [28], [34]. Figure 2 indicates suggestions made by HCA for merging clusters following the 16-to-5 guideline.

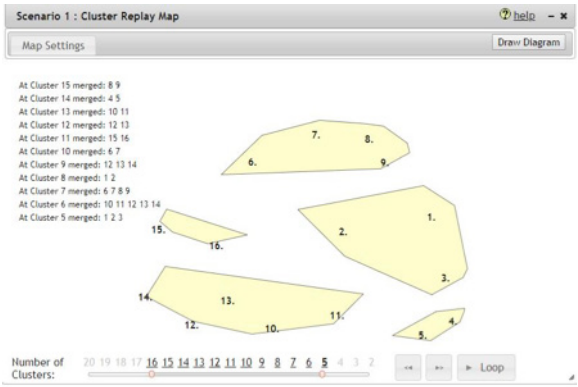

Figure 2. Checking and deciding on number of clusters

Two researchers checked individually whether each of these suggestions makes sense by examining in detail the content of any pair of clusters.

The researchers came to the conclusion that a six-cluster solution reflects the data and purpose of the study in the best possible way.

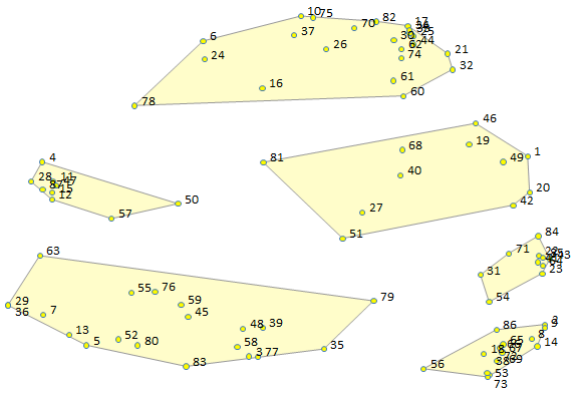

Figure 3. Six-cluster solution

The next step in giving sense of the data was to name the clusters. In general there are three ways for that:

(1) by simply reading through the content of a particular cluster and deciding upon what meaning the majority of the ideas in the cluster depicts;

(2) by looking at the bridging values of the ideas in a cluster as the ideas with lowest bridging values express the meaning of a cluster best; and

(3) by checking suggestions given by the Concept System software.

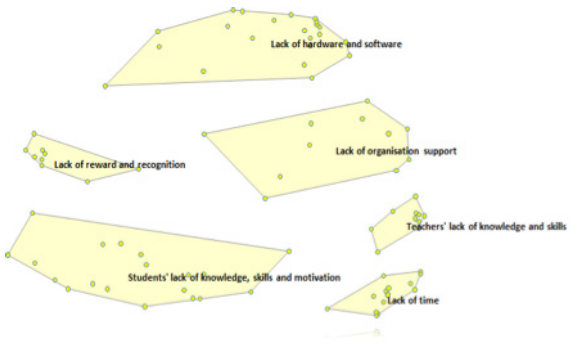

Figure 4. Clusters named

The following issues regarding the use of ICT in teaching were identified: lack of organization support; teachers' lack of knowledge and skills; lack of time; lack of hardware and software; students' lack of knowledge, skills and motivation; and lack of reward and recognition (see Figure 4).

Some examples of statements in the clusters are: *lack of organizational support* ("40. Small amount of support available and/or you need to be very active yourself in order to get the needed support for planning, organizing and completing online courses", "51. Support is needed to overcome difficulties to achieve excellence in the use of information for learning and research", and "68. I have no or too little support with ICT problems that occur suddenly"); *teachers' lack of knowledge and skills* ("31. I am afraid of making mistakes in front of the class", "41. I do not know well the methodology of using ICT in a language classroom", and "64. Not knowing the most appropriate educational technology); *lack of time* ("2. Lack of time to know how tools work in real-life (classroom)", "65. The time needed to get to know the tools available with the pressing needs to teach now and not after I have mastered the tool", and "67. The lack of time for preparation"); *lack of hardware and software* ("10. I have to buy licenses to all my students to teach", "25. The lack of proper equipment or software", and "74. Teachers and students have different devices: teachers have Macbooks and students have Chromebooks"; *students' lack of knowledge, skills and motivation* ("45. I am afraid of unsatisfied students that will complain if things fail by ICT", "77. Heterogeneous learners: I have to modify every content for new groups even if the subject (topic, content) is the same", and "83. Some students do not yet have the competencies to use ICT in an educational setting, they have to learn them first"); and *lack of reward and recognition* ("12. There are no rewards for better teaching, so why go through the trouble of creating something new?", "28. Quality of ICT is not part of the internal teacher evaluation", and "87. I do not get rewarded for my efforts but it will take me more hours").

The analysis of the rating data provides some additional information about issues teachers face when use ICT in their practice. Figure 4 shows the relative position of clusters when compared to each other on the two rating values importance and easy/difficult to solve the issue. As can be seen some of the clusters score high on one value but relatively low on the other (r =-0.66). For example, 'Lack of time' scores very high on importance and very low on easy/difficult to solve. In contrast, the issues 'Teachers' lack of knowledge and skills', 'Lack of organization support' and 'Students' lack of knowledge, skills' are considered relatively easy to dealt with, but not so important.

The following issues regarding the use of E-Learning were identified: lack of organization support; teachers' lack of knowledge and skills; students' lack of knowledge, skills and motivation; lack of time; lack of hardware and software; and lack of reward and recognition (see Figure 2).

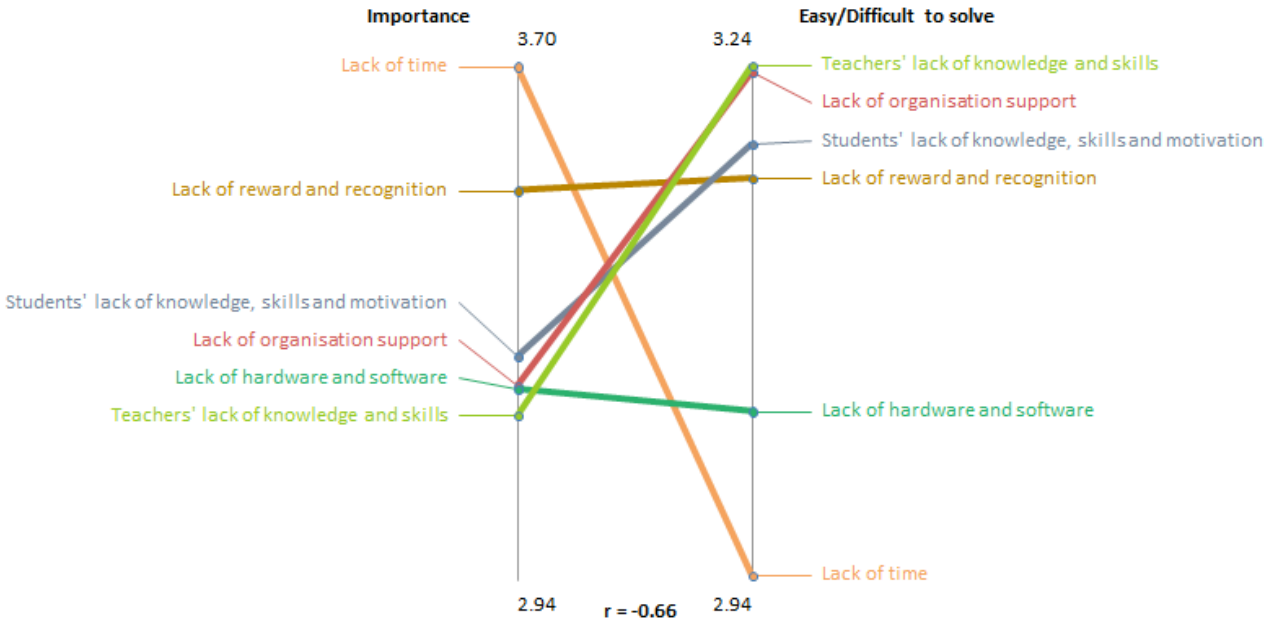

Figure 5. Clusters' comparison on importance and easy/difficult to solve the issue

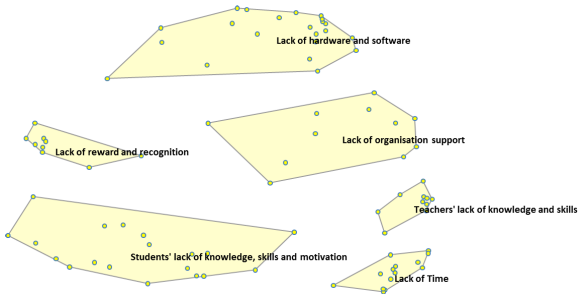

Figure 6. Barriers categorized

IV. CONCLUSIONS

Although the literature review and GCM identified different categories of barriers by name to adopting E-Learning, their findings are similar. Both methods have revealed issues related to availability of E-Learning tools, the need for technical and pedagogical support by organizations, insufficient time to learn E-Learning tools and implement them into teaching practice, teachers' low self-efficacy in educational technology knowledge and skills, and lack of recognition for the efforts teachers have made. A specific issue that the GCM has highlighted is shortage of knowledge, skills and motivation among students. Some more specific issues in this category are the need to adapt to learners' different levels of knowledge and skills, efforts to combine technology with effective teaching methods, and lack of appreciation from students. Teachers' low level of motivation as identified in the literature review, did not appear as a separate cluster in the GCM study but all other barriers depicted in the study negatively affect the motivation of teachers to apply E-Learning applications.

In the future we are going to analyse how the participants rate the barriers on importance and easy/difficult to be overcome. In addition, we compare ratings of different groups of participants and identify long- and short-term measures.

The participants in this study identified lack of time as the most significant issue to dealt with. It was defined as the most important but very difficult problem to solve. The participants in this study seem to have a high efficacy believe that issues related to teachers' and students' lack of knowledge and skills could be relatively easy resolved.

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