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Analysis of University e-Environment in Selected European Countries – IRNet Case Study

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Abstract The chapter aims at finding out how students from selected universities in different European countries use e-environment and e-resources at their universities. Students' opinion was gathered using a survey. The questionnaire consisted of 14 questions and created the basis for the evaluation of a university e-environment. It was assumed that participants of e-environment (academic teachers, students, administration) are involved in activities with the six different benefits. Almost 900 responses from five different countries joined in the project IRNet under European Union Seventh Framework program (Poland, Czech Republic, Slovakia, Ukraine and Russian Federation) were collected. The chapter presents the analysis of the answers with the result that students require a broad Internet connection and electronic versions of study material, but do not want to publish own achievements in a university e-environment. Half of the students require printed publications and students do not widely use scientific resources when searching for learning materials.

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473

1 Introduction

Universities in Europe took a long and complicated approach to e-learning systems implementation. There can be seen that two common approaches have been implemented; bottom-up and top-down [10, 11]. Successful implementations are those who combined these two approaches. Most universities started to use commercial e-learning solutions such as Blackboard or WebCT. Now most of them have shifted to use open source Moodle. In fact, it does not matter what virtual learning environment they use. E-learning became the natural method in education, and now it is time to look at how current technologies influence the use of e-learning. Many researchers try to assess the e-learning form and its effectiveness not just as the technical solution but also from the didactic view. There are many open questions, for example, the impact of social networks and cloud computing on standard e-learning systems. After so many years, it is common, that many teachers use the virtual learning system just as a repository for educational material. Researchers and teachers try to find new ways to motivate students to use the e-learning system in the same way as they use social networks.

One of the common features of modern education in different areas of training is the presence of positions that define the ability to apply e-learning and distance learning technologies in the educational process [14]. An important aspect of a university graduate is an ability to work in a professional environment with a variety of available information resources, ICT tools, and networking opportunities. Information and communication technologies are considered today as natural tools for education and professional activities. They quickly progress and are widely used by young generations in different areas of their activities [24].

Contemporary educational standards specify the goals and results of training, including a wide range of graduate and professional competencies and objectives that a student should be ready to achieve [18].

Regardless of professional activities students are expected to implement, information and communication technologies (ICT) have a high potential to achieve educational outcomes, improve the efficiency of network forms of educational process organization [28]. To realize this potential, it is necessary to form a system of targeted information and communication educational opportunities, taking into account the benefits of a modern e-environment.

An electronic environment of a modern university should create opportunities for the development of the twenty-first-century competencies, for the implementation of a lifelong learning strategy. In this chapter, the research implemented in the Work Package 3 of the IRNet project is described and the data obtained in several universities, the participants of the IRNet project, analysed. These universities are the following: Herzen State Pedagogical University of Russia, St. Petersburg (HSPU), The University of Silesia in Katowice, Poland (US), Borys Grinchenko Kyiv University, Ukraine (BGKU) and Constantine the Philosopher University in Nitra (UKF), Slovakia. The main aim of the research was to identify the ways in which students use ICT tools in their universities' e-environments and

to outline the possible directions for improving educational interactions in network learning communities.

Among the aims of the survey was to determine if students understand the opportunities and educational benefits of e-environments: expansion of space-time coordinates, personalization of educational activities, individual requests, an increase in the degree of educational openness. The data can be not only the basis for determining the readiness of students for self-guided work and activity in an e-environment but can also help to identify ways to improve a university e-environment overall.

However, besides the analysis of individual questions, we would sometimes like to find different groups of respondents that answered the questionnaire similarly. In this case, we can apply several other knowledge-mining methods were applied, which can help to find statistically significant results.

In order to understand better the specifics of the students interviewed, universities participating in this study are briefly described in section two of this chapter. Section *Related work* offers current literature review. Main parts of the chapter are in Section 4 *The relationship between e-learning and environment* and Section 5 *Analysis of the answers*.

2   Participating Universities

Universities participating in European Union Seventh Framework Program IRNet (http://irnet.us.edu.pl/) were chosen. These Universities are similar in their size and their educational and research interests. All mentioned universities are focused on the development of a modern university e-environment and take into account different goals and requirements of its participants. In the following section, these universities are described in more detail.

2.1   *Herzen State Pedagogical University of Russia, Russia*

Herzen State Pedagogical University of Russia (HSPU) is one of the oldest teacher-training institutions in the country. Today the University comprises 5 institutes, 21 faculties, and 3 affiliations. Alongside the training of highly qualified teachers for universities and secondary schools, HSPU offers a broad range of non-teaching specializations, allowing it to fit into the category of traditional universities. The university admits students to 57 educational programs integrated into 10 groups (32 Bachelor's programs, 2 Specialist programs and 23 Master's programs). The university offers programs in Arts & Humanities, Engineering & Technology, Life Sciences, Natural Sciences, and Social Sciences. The latest achievements in the spheres of education management and economics, juvenile justice, etc. form the foundation of the training programs for psychologists, economists, lawyers,

managers, IT specialists and quality control managers. Still, the teacher-training programs remain the priority for HSPU.

The implementation of ICT in education is one of the HSPU priorities. The LMS Moodle is functioning at HSPU, and Adobe Connect has been recently introduced to support distant learning, e.g. for the university affiliations. There is a number of open electronic educational resources (e.g. open training courses, and public resources in the electronic repository). A single database accumulates information on teachers' and students' activities and research achievements. With the help of this database, an individual plan of each teacher's work is formed, which reflects the planned and the resulting performance of various types of professional activity (teaching, methodical, scientific, educational work). In addition, the data is collected and processed at the level of each division, resulting in a monthly ranking of university departments. In addition, information tools to form an individual educational student's trajectory are designed at HSPU. These tools are the electronic atlas (information about educational services), the electronic directory (individual educational routes), and the electronic guide (link to the labour market), allowing the student to navigate the available educational opportunities.

2.2 Constantine the Philosopher University in Nitra, Slovakia

Constantine the Philosopher University in Nitra (UKF) has been formed as a modern European university where the dominant role is played by science, spiritual quality, high professionalism, pedagogical mastery, open and vivid communication both within the local environment and within the world.

The university is the fourth largest university in Slovakia and consists of five faculties. The university prepares young people for a wide range of professions, such as preschool, primary, secondary and university teachers in various fields, experts in cultural institutions, political scientists, marketers, managers of tourism, interpreters, translators, catechists, journalists, anthropologists, archaeologists, historians, museologists, physicists, specialists in natural sciences, psychologists, gemologists, medical staff, social workers and many others. The teacher study programmes are a double-major combination of 27 subjects at the undergraduate and graduate level. The university offers 5 single-major teacher study programmes at the undergraduate and graduate level, 105 scientific and professional study programmes and 31 scientific doctoral programmes.

UKF is gradually developing blended as well as distance form of e-learning. The main and sole LMS at the university is Moodle since 2008. Every university building is covered by Wi-Fi signal, and every student has access to the high-speed internet. The University also offers access to scientific databases through the services of the University Library. The university e-environment offers many other e-services for students, not just the access to the study materials and e-learning platform but also the whole management of the study process.

2.3 *University of Silesia, Poland*

The University of Silesia in Katowice (US) was established in 1968 and now, with 12 faculties and several interdisciplinary schools and centres, over 35,000 students, educated at bachelor, master, and doctoral levels and over 2,000 academic staff is one of the largest in Poland. The university, within the framework of its own activity in the of area study, research, science, innovation, cooperation, national and international projects has launched various initiatives in the use of e-learning for LLL. These initiatives include Distance Learning Centre of the University of Silesia, Project 'University as a Partner of the Knowledge Economy' UPGOW, University Television.

One of the first and the most actively functioning of distance learning platforms in the University of Silesia is the platform of Faculty of Ethnology and Sciences of Education in Cieszyn. The faculty e-learning platform contains a lot of interesting courses supporting learning. Its key objectives are to:

- provide support for teaching programme courses, run in the full-time and part-time mode (hybrid learning)
- prepare future teachers to take advantage of distance learning – to use e-learning in the own profession and to perform the role of a tutor
- provide assistance with scientific research and pedagogical experiments carried out by department staff, graduate students as well as post-graduate students
- foster international cooperation, in particular, through international projects
- provide non-formal and informal distance education in ICT area, and other subjects area for future and current teachers, other [23].

2.4 *Borys Grinchenko Kyiv University, Ukraine*

The University history began in 1874 with the establishment of pedagogical courses for teacher training in Kyiv. In 1919, Borys the Grinchenko Pedagogical Institute began operating, to be later reorganised into Kyiv Pedagogical Courses named after Borys Grinchenko. In 2002, it was reorganised into Kyiv Municipal Pedagogical University named after Borys Grinchenko, and it started offering degrees in teaching. Now, there are five institutes, over 8,000 students, educated at bachelor, master, and doctoral levels.

The university is actively implementing innovative educational technology, based on e-learning. That is why in the university there is a research laboratory of information education. This laboratory works on issues of creating e-learning environment of the university and guarantees free access to its students and teachers. LMS Moodle is used to implement e-learning and for the cooperation of all members of the educational process. Also, e-learning courses are stored there. All e-learning courses are certified by the approved quality criteria [23].

2.5 *University of Ostrava, Czech Republic*

The University of Ostrava was founded in 1991, but its origins can be traced back to 1953. The University is focusing on the study and research of humanities and social sciences, helping to redress a historical imbalance in a region traditionally dominated by heavy industry and technical studies. The University of Ostrava currently has six faculties: the Faculty of Social Studies, the Faculty of Fine Arts, the Faculty of Arts, the Faculty of Medicine, the Pedagogical Faculty, and the Faculty of Science. The University offers a wide spectrum of degrees at Bachelor's, Master's and doctoral levels, in addition to lifelong learning programs. The University of Ostrava incorporates two independent research institutes.

3 Related Work

It is important to analyse and systematize the main benefits of university e-environments that can be used by students during training. Such benefits can be evaluated from different perspectives: improvement of educational services quality, formation, and development of competencies for the knowledge society, formation of graduates' competitiveness [25, 36]. At the same time, the achievements of educational outcomes are directly related to the strategic and systematic use of ICT tools by students in the university e-environment.

An e-environment of a university can be defined as a set of information and communication technologies, which can contribute to better students' educational outcomes.

As a rule, there is no flexible model for building an e-environment for the implementation of blended learning, which takes into account; on the one hand, the rapid development of information technology, and the other – especially today's students belonging to other than teachers' generation [23].

It is proposed to divide indicators for an e-environment and ICT competencies evaluation into four groups [25]:

- indicators of university electronic scientific and educational environment (internal, external),
- indicators of e-learning development level,
- indicators of student' competencies,
- indicators of teacher's competencies.

Several examples of e-environments of universities are provided in Morze et al. [23].

Comparative analysis of the relation between an e-environment of several EU and Non-EU universities and indicators of students' competencies was described in Morze et al. [25]. Other groups of indicators of an e-environment development at universities accompanied by the IRNet project are summarized by Pavlova [34] and Prudencia Gutiérrez [14].

Different aspects of the VLE implementation into the e-environment of the university are described by Drlík and Skalka [10]. Negatives and positives of using e-courses for various groups of students are described by Capay [4]. The use of the web as an effective environment for science and technology education is described by Bilek et al. [3].

Some works tried to assess the use of an e-environment from the students' point of view and focused on the perception of the VLEs and their impact on the development of ICT competencies in the environment of the university. Costa et al. [7] examined the Moodle of the University of Aveiro (UA) in Portugal through a content analysis, complemented with a non-structured interview carried out with the responsible for the platform at the UA. Moodle' tools used by students were analysed afterwards. In this survey printed questionnaires were used and assessed in three areas: participant characteristics, general use of Moodle and specific Moodle tools. Students were asked about the general purposes for which they used the Internet in the learning context. 'E-mail' and 'Search' were the most purposes mentioned by the respondents. The 'Social Networks' were not mentioned in this context. Most students use the Moodle just for downloading materials; only a few of them use Moodle for communicating with the teachers.

The tools used at the UA can be grouped considering the level of importance assigned to them. 'News' and 'Assignments' were considered the most important, followed by 'Quiz/Survey', 'Questionnaires', 'Forums' and 'Wikis UA', with an intermediate level of importance. Finally, 'Chats', 'Blogs UA' and 'Video-conference' were considered less important.

The use of an e-learning environment at the La Laguna University in Spain was evaluated by Barberan et al. [1] by combining quantitative and qualitative observa-tions. As a common quantitative method, La Laguna University supplies a yearly questionnaire to both teachers and students about the use of the virtual campus, and they monitor the growth of Moodle's resources used on campus. As a qualitative method, the direct observation of teachers and the triangle between assessors and teaching staff is considered. The number of teachers who use e-learning grows each year. However, teachers use the system mainly as a repository, then as the way to submit and receive submissions and discussion forum as the last. The main problem with the use of e-learning is the low level of teaching staff training.

The applicability of different types of resources and activity modules in the e-learning courses and the worthiness of their usage and compare outcomes of data analyses is described by Capay [5, 6].

The use of VLEs and Social Networks in the educational process of students and teachers of National Research Tomsk State University, one of the leading universities in Russia, is evaluated by Mozhaeva et al. [26]. The Google Form questionnaire with 68 various questions was used, and questions were divided into three separate groups. In the first group were participants' general information questions. The second group of questions tried to reveal the relation between stu-dents and teachers to various ways of e-learning organization and to compare it to the traditional face-to-face education. The third group of questions was directed to the definition of use frequency of eight different learning methods in LMS and

social networks. A majority of the respondents considers graphical application interface is more convenient for social networks. Moreover, the efficiency, frequency, informational content, interaction, individual approach, cooperation, and emotionality are higher in the social networks than in LMS. However, factors disturbing learning process in Moodle are less visible than in social networks. Results of the research show that the LMS does not provide comparable pedagogical conditions for communication like social networks.

Possibilities of using heuristics, interactivity and feedback in electronic learning materials are described by Klocokova [17]. Experimental evaluation of the efficiency of heuristics approach into learning is presented in this research as well as detailed analysis of the user log-on data, on which it is better to understand the rate of using of heuristics elements together with other course activities in an electronic learning environment.

Advantages of e-learning at the university are discussed by Talebian et al. [38]. Main advantages are time and place of access, equity, enhancing group collaboration, direct access to resources, enhancing the international dimension of educational services and determination of the progress. Disadvantages are the absence of a teacher, access to unsupportive information, limited feedback from students or unsuitableness in practical courses.

There are also several other works, that tried to assess the impact of some LMSs, mainly Moodle on other internet services, like e-mail [2], SecondLife [39], Facebook [9]. More of them stated that LMS and other ICT Tools significantly improve students' learning outcomes. Moreover, they emphasize the importance of the continual development of e-environment of the university using ICT tools, which should be in line with the expectations and everyday habits of the students.

Klimova and Poulova [12] in a larger survey focused on the development of students' productive language skills, asked students from the Czech Republic and Kazakhstan questions about their opinions on e-learning. It was found that students prefer face-to-face learning.

Students, being the main educational services consumers, have been the subject of study many times. With the wide development of e-learning, the active building of university e-environments, students' behaviour – motivation, expectations, and demands for the e-environment have become of special interest.

Speaking of the motivation, there is no doubt today that students' e-learning efficiency correlates with their motivation [15]. For example, among motivation factors for e-environments researchers note problem-solving approach, highlighting the goals that may be achieved [27]. Students' expectations have also become the subject of study [32].

However, if an e-environment is considered, which is not merely e-learning, a wider range of issues must be addressed – some aspects of a university e-environment that may become means of attracting students. In this particular study, these aspects are the following. Firstly, massive open online courses provided by the university attract students. Not by chance, Coursera, the international MOOC platform, became the Webby Awards (international professional Internet award) winner in 2014. Secondly, an interesting content of a university website with a user-friendly

interface and current information, together with the university social network fully correspond to the "Y" generation, or the millennials requests [16]. Thirdly, a comprehensive presentation of teachers' and students' achievements on the university website, along with the information on successful university graduates and their achievements is important, because 'in online learning faculties and tutors are symbols of the institution' [22]. Fourthly, cooperative education and experiential learning have become highly demanded. Learning in partnership, cooperative learning, are based on the constructivist approach. The leading role is played by a sense of belonging to the joint venture [13] widely used the potential of joint information activities and distributed networking. For those universities that specialise for the humanitarian sphere (e.g., teachers, psychologists, and social pedagogues), cooperation with schools, nursery schools, educational centres, and various companies forms the basis for professional practice. In addition, university cooperation in social activities and cultural life (volunteering, charity concerts, and exhibitions) may be related to extra-curricular activities of students [30].

4   The Relationship Between e-Learning and Environment

A dynamic development of ICT, as well as changes in the requirements of the educational outcomes, represent the factors, which determine the transformation of the educational environment of a modern university. Changing and improving are not only the components of the information space but also its content and the approaches to the quality of educational services. In many ways, the transformation of information processes related to the use of e-learning and distance learning technologies which potentially offer divergent ways of interaction. It can be talked about some specific benefits, which are essentially manifested in e-environment of a university.

The above mention work package was dedicated to the analyses and evaluation of the ICT level, e-learning and intercultural developments in every participating country and to the elaboration of the conceptual framework for a joint research project based on lasting collaboration with the project participants. It was assumed that participants of e-environment (academic teachers, students, administration) are involved in activities with the following benefits:

- Benefit 1: Increase of scientific and educational processes comfort, focus on lifelong learning goals, expansion of space-time coordinates.
- Benefit 2: Personalization of educational activities, individual request in e-learning.
- Benefit 3: Formation of new scientific and educational relations, cooperation, intercultural competence.
- Benefit 4: Empowerment of self-realization in educational and professional activities, support of initiatives.
- Benefit 5: Increase of the openness degree of the scientific and educational environment, expanding the influence of the university to the external cultural environment; positioning in the research and education community.

- Benefit 6: Enhancing self-organizational effects that support the sustainable development of the educational environment of the university and its participants.
- It is needed to analyse in more detail the benefits listed above. The relevance of such analysis is due to the fact that the development of a university information infrastructure requires constant material costs. Therefore, there is a need to track if students recognize these innovative benefits.

The most obvious benefits are associated with the increase of scientific and educational process comfort, focus on lifelong learning goals; the personalization of educational activities, the individual request of e-learning. It is important to emphasize that a variety of information and communication tools allow not only learning in a convenient mode but also showing to a greater extent the educational activity and independence, increasingly individualizing the educational process. The new task of education is to focus on lifelong learning, which involves the possibility for every person to fulfil own potential, in all ages, regardless of place and time, using all possible ways and means of cooperation [19]. This effect determines the expansion of educational and professional goals range. For students, these are the aspects of new competencies acquisition required for educational, and further professional tasks based on the new skills for the information environment, in accordance with the individual educational needs and requirements. For teachers, this is the focus on flexible educational support of students' independent activities in diverse media saturated space. An example of comfort indicators is an opportunity for an individual educational route [8]. These ideas are developed in the concept of a personal learning environment of a student [35].

The next benefit can be described as the formation of new scientific and educational relations, cooperation, intercultural competence. This is mainly communication benefit. Networking, distributed group work, which has become a common type of professional activities in many areas, also requires specific aspects of preparedness and qualification. Effective means of training to acquire required skills is to introduce into the educational process networking and cooperation, which are exactly the dominant technologies of e-learning [33]. It is necessary to take into account that the nature of the educational interactions should correspond to modern communication behaviour of young people in the network space [30]. Network communication is a means of self-empowerment in educational and professional activities; identifying and supporting educational initiatives. This is extremely important, both for students and for young professionals; so they get more opportunities to express themselves, to show their achievements and ideas. Network projects, competitions, scientific and educational communities are an integral part of modern educational and professional environment; an important means for formation of graduates' competitiveness.

It is important to cooperate with university social partners. For example, in Europe since 2010, a study of the effectiveness and research collaboration of countries, regions, and researchers (universities, research institutes) has been

realized. In particular, in addition to such indicators as the number of publications, citations, impact factor, also compared such indicators as a number of joint (inter-institutional) publications [20]. In Russia, network association of universities is also actively developing. This means that a number of universities join efforts in creating new educational programs, support unified scientific electronic resource databases. We can see similar effort in many universities. The focus of study and the role of the university is the cooperation with the commercial companies in research and development.

The succeeding benefit is the increase of the openness degree of the scientific and educational environment, expanding the influence of the university to the external cultural environment; positioning of the actors in the research and education community. Interaction in an open information environment ensures that students have the opportunity to act first in quasi-professional conditions, and then enter the professional community to make full use of its resources, to position their educational, professional and scientific activities. For example, the Law 'On Education in the Russian Federation' determines the information transparency and public accountability of educational institutions as the basic principles of state policy in the sphere of education [21].

Thus, a modern e-learning environment of a university is a space of multiple-choice options. However, students and teachers can use variably this environment, as well as external educational resources. It is, therefore, important to assess the level of awareness and implementation of the available opportunities for students and teachers in the learning process, to see the real effects of the degree of manifestation of the e-learning environment, transformed by the introduction of a variety of information and communication technologies [29].

Manifestation of qualitative results of e-learning and ICT in education depends on a system of conditions:

- the degree of e-learning environment development (electronic space – electronic resources and information technology; interactions while solving scientific and educational problems);
- the level of competencies for major e-learning environment participants (faculty members, students, staff responsible for e-learning management).
- An e-environment of a university requires various vectors of interactions – interactions between students and teachers within certain learning courses, interactions between colleagues while developing interdisciplinary training, exchange and transfer of experience to other educational institutions, etc. [31]. That is why an e-environment of a university can be considered at three levels:
- micro level (achieving educational objectives at the level of discipline, e-course);
- meso level (solution of scientific and educational problems in the corporate environment of the university (interdisciplinary communication, cooperation, exchange of experience);
- macro level (achieving scientific and educational objectives by integrating into the external scientific and educational environment).

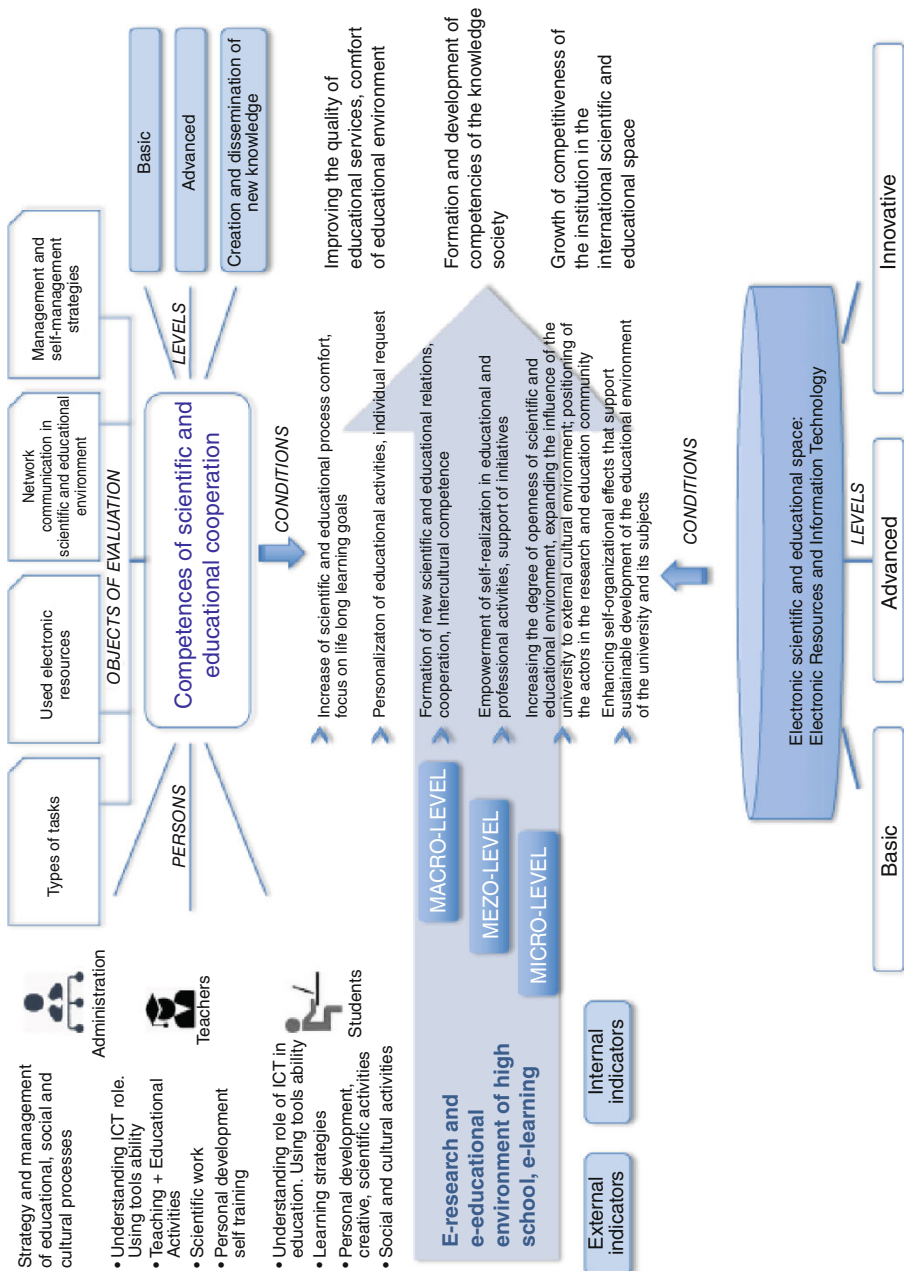The complete vision of e-environment is presented in Fig. 1.

Fig. 1 e-Environment: ICT tools, students' competencies, and learning benefits

In order to efficiently and effectively use all the opportunities of e-environment, all the environment participants should possess a certain level of e-learning and ICT competencies. That is why these competencies can be considered at three ascending levels: basic level, advanced level, and innovative level. Various activities in an e-environment make participants both form and manifest their competence, meeting the long-term requirements of training a specialist for the knowledge society.

E-learning and ICT competences can be indicated by:

- objectives of different types of activities;
- electronic scientific and educational resources;
- network communication in the scientific and educational environment;
- management strategies of scientific and educational activities in the information environment of the university.

The e-learning development and ICT contribute to the quality of educational services; the development of knowledge society competencies and the increase of the competitiveness of an institution in the world scientific and educational space. To achieve these following conditions must comply:

- an electronic space no less than advanced level should be created in an educational institution;
- a constant improvement e-learning and ICT competences should be performed; the preferred level of competencies is advanced;
- changing requirements, determining the competitiveness of an institution in the world scientific and educational space are considered at every level of the e-learning environment.
- Indicators for an e-learning environment and e-learning competencies can be divided into four sections:
- indicators of university electronic scientific and educational environment (internal, external);
- indicators of e-learning development level;
- indicators of student's competencies;
- indicators of teacher's competencies.

5   Analysis of the Answers

5.1   Research Method and Main Research Aim

In order to collect and analyse students' responses and to summarize their vision of university e-environment, a questionnaire was elaborated. The questionnaire consisted of 14 questions, which can be integrated into six groups, corresponding to the key e-environment benefits. Consequently, evaluating university e-environment, we assumed that participants of an e-environment (academic teachers, students, administration) are involved in activities with the following benefits.

Benefit 1: Increase of scientific and educational processes comfort, focus on lifelong learning goals, expansion of space-time coordinates. (Q1, Q2, Q3). The corresponding questions, firstly, invited students to select the leading purpose to use e-environment of their university (for example, such resources as electronic libraries, distance learning platform Moodle, e-courses, university website, scientific databases of university subscriptions). Among the leading purposes were suggested the following: the use only required by a teacher and the use to ease tasks performance. Simultaneously students could choose reasons for non-use of e-resources: not understanding the rules or usefulness and finding other alternative Internet resources (e.g., MOOCs). In addition, respondents were asked to choose two main reasons influencing the effectiveness of the e-environment use: getting acquainted with the possibilities and usage rules; having an opportunity to perform tasks at own pace, anytime and anywhere; finding more diverse electronic resources. Finally, in this section students were suggested to select the most important indicators of e-environment comfort: availability of Wi-Fi access points; opportunity to use own gadgets; availability of electronic educational resources in different formats; university website with the relevant information for students and comfortable navigation; availability of distance support for disciplines; availability of a prompt feedback from a teacher.

Benefit 2: Personalization of educational activities, individual request in e-learning (Q4, Q5). The section included two questions. The first one revealed students' opinion on whether or not should teachers consider students' educational requests, interests, and needs while creating electronic resources in an educational environment (presentations, websites, tests, video lectures, etc.). The second question focused on what types of additional electronic educational services would students like to receive at their university: studying foreign languages; acquiring an additional profession; learning about start-ups and own business or any other types.

Benefit 3: Formation of new scientific and educational relations, cooperation, intercultural competence (Q6, Q7, Q8, Q9). Exploring cooperation, students were firstly asked to evaluate the need for it in solving educational problems: do teachers set these objectives; do students themselves strive to cooperate and ask teachers to offer such tasks; do students need such competences for being successful. Secondly, students commented on their use of social services for collaboration and teamwork: whether or not teachers offer such activities; do students in principle recognize the use of social services for collaboration. Thirdly, respondents were asked to specify the main reason for participation in virtual communities of students: getting additional cultural knowledge; helping with studies; finding new friends; demonstrating own personal experience, knowledge, and achievements; organizing own events.

Benefit 4: Empowerment of self-realization in educational and professional activities, support of initiatives (Q10, Q11). The section studied the possible reasons motivating students to demonstrate their academic, artistic, sporting activities in the university e-environment: the opportunity to present achievements to others; the opportunity to be noticed by a potential employer; prerequisite of studying a

particular discipline; general interest; own status upgrade; the opportunity to make new friends. Students also could choose the options 'I do not want to show myself and my achievements to others because I have nothing to show' and 'I do not want to show myself and my achievements to others, because I am not interested in it'. Moreover, in this section students chose informational resources most often used when doing assignments: search engines; printed publications; electronic scientific databases from your university library subscription; digital libraries on the Internet; open storages of electronic educational resources; video channels; file sharing; webinars; podcasts.

Benefit 5: Increase of the openness degree of the scientific and educational environment, expanding the influence of the university to the external cultural environment; positioning in the research and education community (Q12). The focus of the section was on the key features of university e-environment that motivate students to choose the particular university to study. Among the features were named the following: MOOCs, provided by the university; an attractive university web site with user-friendly interface and up-to-date information; own university social network; clear presentation of the university students' and teachers' achievements on the web site; information about successful university graduates and their achievements; university social partners; university participation in social activities and cultural life.

Benefit 6: Enhancing self-organizational effects that support the sustainable development of the educational environment of the university and its participants (Q13, Q14). From students' prospective self-organization concerned selecting one of several main learning strategies: external monitoring by teachers; self-guided independent and systematic study; following peers' example. Furthermore, students estimated the possible benefits of ICT tools (electronic diaries, organizers, calendars, reminders, etc.) for planning educational and extracurricular activities – whether these tools produce any effect or not.

Each of the participating universities reviewed and accepted the questionnaire and created a version in their native language to facilitate students' answers and avoid the ambiguity of understanding. The supporting platform for this questionnaire was the Google Form tool as it offers simple and anonymous questionnaire delivery except the US, Poland that used the Lime Survey.

Some questions of the questionnaire were multiple choices, others not. For the purpose of further analysis using methods mentioned above, the transformation of all answers into true/false question was needed. For that reason, sub questions by this transformation were created, e.g. the Q3 became Q3-1, Q3-2, … Q3-6.

While preparing to conduct the survey, the possible disadvantages of this research method were taken into account, i.e., the inability to control the process of filling in the questionnaire, which can lead to the lack of independence of the respondent replies. In order to minimize all possible risks, each university had to collect at least 100 responses from different categories of students (first-year students, bachelors, and masters). This aim was accomplished, and it was collected 868 responses together (132 from Ukraine, 125 from Russia, 171 from Czech Republic, 340 from Slovakia and 100 from Poland).

Hereby, the main research aim was to identify the ways students use the ICT tools in the e-environments of their universities and to outline possible ways for improving educational interactions in students' network learning communities. In other words, of particular interest was to study how students perceive the ongoing transformations of the e-environment and are willing to participate in them.

The data provided only the basis for determining the readiness of students for self-guided learning and identifying the preferred activities in the e-environment. Moreover, it can also be helpful in identifying possible ways to improve the e-environment of the participating universities. In fact, for obtaining high-quality educational outcomes, universities need to improve both corporate strategies of e-environment development with the implementation of e-learning and educational competence of students in the extended information and communication space. For the students, these competencies are closely related with their information culture and the awareness of an individual request for the use of a variety of educational opportunities available in the electronic space.

In this chapter are some selected questions analysed using Cochran Q-test to test statistically significant differences between elements of questions. Tukey test [37] was used for multiple comparison and identification of homogenous groups. When it is talked about all answers from all universities, it is stated as 'Total' in all following tables. All questions and sub-questions are dichotomous ones, where 'zero' represent negative answer and 'one' positive one. The percentage of positive and negative answers is stated and also the 'Sum' of positive answers.

5.2 Indicators of Comfort of the Electronic Environment

The main application of this question is the use in self-development, self-realization, research and scientific activities. We assessed the availability of Wi-Fi access points (Q3-1), the opportunity to use own gadgets (Q3-2), the availability of electronic educational resources in different formats e.g. video, audio, hypertext (Q3-3), relevant information for students and comfortable navigation of the University website (Q3-4), the availability of distance support for disciplines e.g. e-tasks, e-journals, e-course (Q3-5) and the availability of a fast feedback from a teacher (Q3-6).

What can be seen from Table 1 is that answers of students from all countries form three homogenous groups. The first group contains questions with no statistical difference between questions Q3-5, Q3-3, Q3-6 and Q3-2. It means that these students put the similar weight to all these options. These students want e-courses, e-study materials, require fast feedback from the teacher and want to use own gadgets. The second group of answers creates a group where students want to have e-study materials, also require fast feedback from the

Table 1 Homogenous groups identification according to question Q3 for all universities

Total	Sum	Percent 0's	Percent 1's	1	2	3
Q3-5	181.00	79.15	20.85	****		
Q3-3	193.00	77.76	22.24	****	****	
Q3-6	199.00	77.07	22.93	****	****	
Q3-2	222.00	74.42	25.58	****	****	
Q3-4	235.00	72.93	27.07		****	
Q3-1	389.00	55.18	44.82			****

$Q = 180.57$, df = 5, p < 0.00.
Q – testing statistic, df – degree of freedom, p – significance value, 1 – the first homogenous group, … 3 – the third homogenous group, Sum – number of positive answers = 1's.

Table 2 Answers to question Q3-1 (WiFi) at each university

Q3-1	Sum	Percent 0's	Percent 1's	
UKF	71.00	79.12	20.88	$Q = 15.12941$, df = 5, p < 0.009825
OU	57.00	66.67	33.33	$Q = 54.08772$, df = 5, p < 0.000000
US	47.00	53.00	47.00	$Q = 68.84000$, df = 5, p < 0.000000
BGKU	115.00	12.88	87.12	$Q = 102.9956$, df = 5, p < 0.000000
HSPU	99.00	20.80	79.20	$Q = 60.40161$, df = 5, p < 0.000000

Q – testing statistic, df – degree of freedom, p – significance value.

teacher, also want to use own gadgets, but they also want relevant information on the University website. The third homogenous group is the also the biggest one. There is statistically significant difference between the question Q3-1 (WiFi) and all other questions.

When a closer look is taken at the results in each University (Tables 2 and 3), the Wi-Fi question creates a homogenous group in the case of HSPU (Russia), BGKU (Ukraine) and US (Poland). At these Universities students' responses to Wi-Fi question represent the strong statistically difference between Q3-1 and all other questions. They also have a higher percentage of answers to this question, e.g. at the BGKU 87% of students selected the option Q3-1, at HSPU 79% of students. In the case of US, this number was just 47% of students, at OU and UKF even worse.

When this opinion of students in EU countries (Slovakia, Czech Republic, Poland) with non-EU countries (Ukraine, Russia) is compared, it can be seen that students in non-EU countries require Wi-Fi connection more than their colleagues in EU. There can be two reasons for this opinion. The first is the broad and cheap access to the mobile internet in EU countries. For that reason, the students do not think about the Wi-Fi anymore. The second reason can be the availability of Wi-Fi everywhere.

Table 3 Homogenous groups identification according to question Q3 for US, BGKU, and HSPU

US	Percent 1's	1	2		BGKU	Percent 1's	1	2	3	4		HSPU	Percent 1's	1	2
Q3-5	8.00	***			Q3-5	31.06			***			Q3-3	31.20	***	
Q3-6	8.00	***			Q3-4	48.48	***					Q3-4	43.20	***	
Q3-2	10.00	***			Q3-6	49.24	***					Q3-5	44.80	***	
Q3-3	11.00	***			Q3-3	52.27	***	***				Q3-2	47.20	***	
Q3-4	16.00	***			Q3-2	65.15		***				Q3-6	48.80	***	
Q3-1	47.00		***		Q3-1	87.12				***		Q3-1	79.20		***

5.3   Participation in Virtual Communities

Students were asked to specify the main reason for their participation in virtual communities of students (scientific, artistic, sports ones, etc.) in social networks or other Internet services. Six reasons why students want to participate in virtual communities were selected. They can get additional cultural knowledge, learn about events, broadening outlook, and adopt cultural experience (Q9-1). Virtual communities can help with studies by sharing knowledge or by the opportunity to ask for help (Q9-2). Students can find new friends in virtual communities (Q9-3), or they want just to demonstrate own personal experience, knowledge, and achievements (Q9-4). Virtual communities are often used for organizing own events (Q9-5). It was also given the option that students do not like to participate in such communities (Q9-6).

In Table 4 can be seen four homogenous groups of answers. These groups are not overlapping, so there is a statistically significant difference between each homogenous group. The biggest group (the fourth group) consists of answers that use virtual communities in the way that help them with a study by sharing knowledge. The second largest group (the second group) consists of answers which use virtual communities to get additional cultural knowledge or learn about events. The last single question group is Q9-6 (students do not participate in virtual communities). The rest of their options in questionnaire create the first homogenous group (there is no statistically significant difference among these answers). Students put similar weight to all these options in this group, and this group is the smallest one. For example, just 72 students selected the Q9-5 option (organizing own events). Using virtual communities is worth when propagating events and to share the knowledge.

Students from Ukraine and Russia to Slovak, Czech and Poland are compared in Table 5. As most students chosen Q9-1 and Q9-2, those questions were selected for analysis.

Students tend to use virtual communities in the way that helps them with studies or as the opportunity to ask for help (Q9-2).

Table 4   Homogenous groups identification according to question Q9 for all universities

Total	Sum	Percent 0's	Percent 1's	1	2	3	4
Q9-5	72.00	91.69	8.31	****			
Q9-3	80.00	90.76	9.24	****			
Q9-4	94.00	89.15	10.85	****			
Q9-6	153.00	82.33	17.67		****		
Q9-1	300.00	65.36	34.64			****	
Q9-2	402.00	53.58	46.42				****

$Q = 592.51$, df = 5, $p < 0.00$.
Q – test, df – degree of freedom, p – significance value, 1 – the first homogenous group, …
4 – the fourth homogenous group.

Table 5 Answers to Q9-1 and Q9-2 from all universities

	Q9-1			Q9-2		
	Sum	Percent 0's	Percent 1's	Sum	Percent 0's	Percent 1's
UKF	92.00	72.94	27.06	175.00	48.53	51.47
OU	60.00	64.50	35.50	105.00	37.87	62.13
US	31.00	69.00	31.00	18.00	82.00	18.00
BGKU	64.00	51.52	48.48	62.00	53.03	46.97
HSPU	53.00	57.60	42.40	42.00	66.40	33.60

5.4   Reasons Motivating to Demonstrate Own Achievements in the University e-Environment

Students were asked about their motivation to publish in the university e-environment (website, social networks, etc.⎮ their results of academic, artistic or sporting activities. The main application is the use in self-development, self-realization, and research. Following reasons motivating students were selected:

- opportunity to present me and my achievements to others (Q10-1),
- opportunity to be noticed by a potential employer (Q10-2),
- prerequisite for studying a particular discipline (Q10-3),
- general interest (Q10-4),
- own status upgrade (Q10-5),
- opportunity to make new friends (Q10-6).

Some students do not want to show themselves and their achievements to others, because they have nothing to show (Q10-7) or because they are not interested in it (Q10-8).

It can be seen that the presentation of own achievements in the university e-environment is not a very popular theme for students (Table 6). The highest percentage for question Q10-1 is just 25%. All other questions have a lower percentage of answers. Despite this fact, students' answers form three separate homogenous groups. The largest group consists of answers to Q10-1, Q10-2 and Q10-3. There is no statistically significant difference between 'opportunity to present myself and my achievements to others', 'opportunity to be noticed by a potential employer' and 'general interest'. A group of those three answers does not overlap with questions Q10-8 and Q10-7, which are negative for us (students do not show anything). Students use social networks, but it seems that only in their private life. They do not want to put status upgrades into their university e-environment. University environment should focus on motivating students not to hesitate to present own achievements. They should know that information in a university e-environment is valuable and trustworthy for a potential employer.

Table 6 Homogenous groups identification according to question Q10 for all universities

Total	Sum	Percent 0's	Percent 1's	1	2	3
Q10-5	49.00	94.34	5.66	****		
Q10-7	58.00	93.30	6.70	****		
Q10-3	69.00	92.03	7.97	****		
Q10-6	78.00	90.99	9.01	****		
Q10-8	170.00	80.37	19.63		****	
Q10-4	203.00	76.56	23.44		****	****
Q10-2	207.00	76.10	23.90		****	****
Q10-1	220.00	74.60	25.40			****

$Q = 323.17$, df $= 7$, $p < 0.00$.

Q – test, df – degree of freedom, p – significance value, 1 – the first homogenous group, …
3 – the third homogenous group.

5.5 *Informational Resources During Study*

Students were also asked what resources they use most often when doing assignments, doing research, preparing reports, etc. Students were able to choose from the following items:

- Q11-1: Search engines (Google, Yandex, etc.) - Search by keywords
- Q11-2: Printed publications (books, journals, guidelines, etc.)
- Q11-3: Electronic scientific databases from your university library subscription (databases of electronic journals, full-text electronic resources, etc.)
- Q11-4: Digital libraries in the Internet
- Q11-5: Open storages of electronic educational resources (institutional repository, WIKI)
- Q11-6: Video channels (YouTube)
- Q11-7: File sharing, torrents
- Q11-8: Webinars, podcasts

Informational resources are most valuable for studying any discipline. Knowing the source where students search for these resources is valuable for the teacher. As seen in Table 7 most students (nearly 86%) use search engines when looking for informational resources. This is strange because all universities offer access to scientific databases for all students. There is no statistical difference between questions Q11-3 (scientific e-databases), Q11-6 (YouTube) and Q11-5 (e-resources) and less than 30% of students use these resources. Students more often try to search relevant information using a search engine and often find not relevant one instead of using highly relevant source, e.g. a scientific database. It is surprising that more than half of students use printed publication (Q11-2). Even when students are well equipped with e-gadgets, when it comes to learning, they prefer paper copies of the books. What students do not discover yet are podcasts

Table 7 Homogenous groups identification according to question Q11 for all universities

Total	Sum	Percent 0's	Percent 1's	1	2	3	4	5	6
Q11-8	48.00	94.47	5.53		****				
Q11-7	138.00	84.10	15.90			****			
Q11-3	241.00	72.24	27.76	****					
Q11-6	255.00	70.62	29.38	****					
Q11-5	261.00	69.93	30.07	****					
Q11-4	345.00	60.25	39.75				****		
Q11-2	446.00	48.62	51.38					****	
Q11-1	745.00	14.17	85.83						****

$Q = 1685.37$, $df = 7$, $p < 0.00$.

Q – test, df – degree of freedom, p – significance value, 1 – the first homogenous group, … 6 – the sixth homogenous group.

and webinars. Just 6% of students know about this form of education. Many students do not want to widen their horizon beyond what is needed by the teacher.

5.6 Elements of E-environment Which Imply Student Decision to Study

Question 12 focuses on elements of an e-environment of a university, which imply student decision to study the selected field. Responses to this question can show the importance of some factors for the recruitments of new students, which factors most influence student decision to study some field at the university. The elements in this question were as follows:

- Massive open online courses provided by the university (Q12-1)
- The interesting content of the university website with a user-friendly interface and current information (Q12-2)
- An own social network of the university (Q12-3)
- A comprehensive presentation of the achievements of university teachers on the university website (personal pages, awards, publications, etc.). (Q12-4)
- A comprehensive presentation of the university students on the university website (awards, publications, etc.). (Q12-5)
- Information on successful university graduates and their achievements. (Q12-6)
- University cooperation with schools, nursery schools, educational centres, companies, etc.). (Q12-7)
- University cooperation in social activities and cultural life (volunteering, charity concerts, exhibitions, etc.). (Q12-8)

In Table 8 can be seen statistically significant differences for non-overlapping groups of columns. Respondents for the twelfth question form five groups

Table 8 Homogenous groups identification according to question Q12 for all universities

Total	Sum	Percent 1's	Percent 0's	1	2	3	4	5
Q12-3	181.00	21.37	78.63	****				
Q12-5	197.00	23.26	76.74	****				
Q12-4	225.00	26.56	73.44	****	****			
Q12-6	253.00	29.87	70.13		****	****		
Q12-1	262.00	30.93	69.07		****	****		
Q12-8	305.00	36.01	63.99			****	****	
Q12-7	350.00	41.32	58.68				****	****
Q12-2	393.00	46.40	53.60					****

$Q = 221.84$, df $= 7$, $p = 0.00$.

Q – test, df – degree of freedom, p – significance value, 1 – the first homogenous group, … 5 – the fifth homogenous group.

based on their answers. The lowest weight for choosing the field of study has the group of elements Q12-3, Q12-4, Q12-5 (social network of the university and presentation of achievements of teachers and students). The highest weight has a group of elements Q12-2 and Q12-7 (content of university website and cooperation with other subjects). There is also a statistically significant difference between these two groups. The results for each university were also analysed. The results showed different views about the importance of elements in each country.

The UKF had the highest number of answers among other universities. Student responses form four groups of answers. These answers for question Q12-3, Q12-4, Q12-5 and Q12-8 form the group with the lowest impact on choosing the study at the university. The answers for Q12-7 and Q12-2 form the group with the highest impact for choosing the study at the university. Results at UKF almost copy the overall results. What is interesting, that students from the Czech Republic (Table 9) form very similar groups. Students from the University of Ostrava put the highest weight on the cooperation with schools, nursery schools, educational centres, companies (Q12-7). There are statistically significant differences between the Q12-7 question and all other questions.

When a closer look at results from Ukraine (Table 10) is taken, the highest weight is on the answers for Q12-2 (attractive university website) together with Q12-8 (university cooperation in social activities and cultural life). Answers for question Q12 form just two homogenous groups. The second group consists of the rest of Q12 subquestions, but the weight is lower. The highest weight is on Q12-8 also in Russia. In both countries, the students put a high focus on university cooperation in social activities and cultural life. In Russia, Q12-6 (successful university graduates) and Q12-8 (university cooperation in social activities and cultural life) form one homogenous group and the rest of question another group with the mean value similar to Ukraine.

Table 9 Homogenous groups identification according to question Q12 for Slovak and Czech university

UKF	Percent 1's	1	2	3	4
Q12-3	26.76	****			
Q12-4	30.59	****	****		
Q12-5	31.76	****	****		
Q12-8	32.35	****	****		
Q12-6	37.94		****	****	
Q12-1	43.24			****	
Q12-7	47.06			****	****
Q12-2	54.12				****

OU	Percent 1's	1	2	3	4
Q12-3	16.05	****			
Q12-5	17.90	****			
Q12-4	19.14	****	****		
Q12-6	21.60	****	****		
Q12-1	24.69	****	****		
Q12-8	32.10		****	****	
Q12-2	45.68			****	
Q12-7	67.90				****

Table 10 Homogenous groups identification according to question Q12 for all Ukraine and Russia university

BGKU	Percent 1's	1	2	HSPU	Percent 1's	1	2
Q12-6	19.17	****		Q12-1	16.00	****	
Q12-5	20.83	****		Q12-5	18.40	****	
Q12-3	23.33	****		Q12-3	23.20	****	
Q12-1	27.50	****		Q12-7	28.80	****	
Q12-7	29.17	****		Q12-4	32.80	****	
Q12-4	33.33	****		Q12-2	38.40	****	
Q12-8	50.83		****	Q12-6	40.00		****
Q12-2	61.67		****	Q12-8	55.20		****

6   Discussion and New Significance

The questionnaire on five similar Universities in five different countries was taken with nearly 900 responses from students who provided their opinion about a university e-environment. When processing the data, not only exploratory techniques were used, but based on selected items of the questionnaire, profiles of universities were created. The Cochrane Q test was used to test differences between dichotomous variables of selected questionnaire items with distinguishing each university. Cochrane Q test is an extension of the McNemar test for dependent samples that provides a method for testing for differences between three or more dichotomous variables.

After the rejection of the global null hypothesis using multiple comparisons, significant differences, and homogeneous groups were identified. For this purpose, parametric (Tukey HSD test) and nonparametric methods were used. As the results were equally, they were considered to be robust. The use of advanced method of analysis gave this research new significance and it was possible to create a profile for all participating universities and find groups of respondents that answered the questionnaire similarly.

It is obvious that all universities participating in the described research realize their e-environment development strategies. However, the new significance of the survey lies in the student-centered approach. It means that students are considered as the main consumers of educational services, so their request to an e-environment is of a high value. On one hand, the obtained data can be helpful to critically analyse and find the answer to the question, does the existing e-environment and provided facilities match students' vision of an 'ideal' university. On the other hand, the results help to reveal weak points in students' understanding of all e-environment benefits that are already available for them.

One of the main research limitations can be related with the sample of respondents taken only from the Eastern European universities and Non-EU universities. However, this aspect can be one of the future research directions, because IRNet

consortium includes also several Western and Southern European universities as well as one Australian university. In the future, data from Portugal, Spain, Netherland and Australia will be collected and analysed so it will be possible to better understand differences in e-environment strategies, implementation and opinion of students.

7   Conclusion

Following statements about a university e-environment can be concluded based on the answers of students.

Students require a Wi-Fi connection, but it seems that not for study purposes. Students from Ukraine and Russia require a Wi-Fi connection more than their colleagues from Slovakia, Czech Republic, and Poland, which more often use mobile technologies for internet access (mobile providers offer a cheap mobile internet access for students). Students want to e-study, but they do not require e-materials from the university enough. Even when the university offers access to e-documents, through access to digital libraries or scientific databases students do not use them and try to find relevant information using web search engines. It is surprising that more than half of students require printed publications for their studies.

There is a question that is difficult to answer unequivocally: to what extent teachers should take into account the information and educational needs of students, their interests, while creating electronic educational resources (presentations, websites, tests, videos, lectures, etc.). On the one hand, students can use the proposed resources in accordance with their needs. On the other hand, teachers have to take into account the information and educational needs of students, their interests, and provide resources adapted to individual request, especially when it comes to inclusive education. It is important to note that a modern e-learning environment allows variation of electronic resources. Furthermore, additional electronic educational services can be provided in such environment. For example, the study of foreign languages, additional profession, business start-ups, etc. Obtaining additional educational services ensures the readiness of the graduates for professional careers in the dynamically changing conditions.

Students actively use external information resources and less actively are turning to university resources. This allows to specifically recommend to acquaint students with these opportunities offered by each university participating in the IRNet project.

E-learning environment ICT tools allow to enrich the educational process with visual representation of educational results, scientific, university artistic and sports activities and achievements of particular students. Thus, students have the opportunity to show themselves and their achievements to others: potential employers, teachers, students, prospective students, social partners of the educational institution. But students do not want really much to publish their achievements in a university e-environment. Students use social networks, but it seems that only in

their private life. Students are not willing to put status upgrades into a university e-environment. University environment should focus on motivating students not to hesitate to present own achievements. Students should know that information in a university e-environment is valuable and trustworthy for a potential employer. Because the presentation of achievements improves students' status, the circles of acquaintances and interactions are expanding. Possession of means and methods of professional activity results presentation today is an important competence for a representative of any professional field. Offering students at the initial stages assignments aimed at presentation of educational activity results in an e-learning environment, the preconditions for the formation of such competence are created.

It can be seen what students want to find at a university website when they are at the phase of choosing where to study. Students are looking for interesting content of the university website with a user-friendly interface and current information. Students also want to see cooperation with schools, nursery schools, educational centres, companies, etc.

Students can effectively use the benefits of ICT tools and an e-learning environment, thereby achieving the purpose of improving the quality of education, formation and development of professional competencies, formation of competitiveness in the labour market. These benefits are fully compliant with the emerging knowledge society and the ideas of lifelong learning.

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