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Designing a Modern Cloud-Oriented Virtual Personalized Educational Environment

Abstract

This paper focuses on students' research ability to use information and communication technologies to carry out information activities in their professional field. The results of studies on personalized and adaptive learning, based on the consideration of learning styles were analyzed. Based on the statistical analysis of the pedagogical experiments some recommendations were formulated for technology training for teachers and students, to improve efficiency training.

Keywords: *personal e-learning environment, cloud computing, network services, distance courses, formal, informal and non-formal learning*

Introduction

Today's realities and the tendencies of the modern labor market development create new requirements for education systems and upgrade the level of e-learning in today's world that results in the higher percentage of unformal learning for self-development and competitiveness (What do employees of Y generation want? 2011, West 2011).

Research Problem

The virtual learning environment of a modern educational institution does not always take into account its students' learning needs, or the content and technology that they use in creating and maintaining their own personal educational environments.

Research Focus

The modern university has to take into account new educational tendencies of percentage growth of unformal education and become interested in their students and understand their wishes of personification in the global network and individual-oriented learning that, under normal conditions, is the basis for the formation of informational-communicative and key competencies of the students and professors by the creation and implementation of a personal e-learning environment, the usage of new social services during the educational process and establishment of corporate standards

Research Methodology

Research question 1: Does the quality of the virtual learning environment of a modern educational institution need to be based on its students' learning needs, on content and technology? Does the quality of the virtual learning environment of a modern educational institution depend on the level of ICT competence?

Hypothesis 1: The quality of the virtual learning environment of a modern educational institution must be based on the learning needs of its students, on the content and technology that they use in creating and maintaining their own personal educational environments, and it depends on the level of ICT competence. **Independent variables:** students' own personal educational environments. **Dependent variables:** the level of ICT competence; the quality of the virtual learning environment of a modern educational institution.

Research question 2: Are contemporary students active Internet users, and if yes on what scale?

Hypothesis 2: Contemporary students are active Internet users, on a large scale. **Independent variables:** The level of the Internet use by students. **Dependent variables:** Scale of the implementation of remote and blended forms of teaching and learning; use of the university and faculty Internet services by students.

Research question 3: Is the university creating an e-learning platform as well as developing distance courses, on what scale?

Hypothesis 3: Management and use of an e-learning platform as well as developing courses determines the scale of the implementation of remote and blended forms of teaching and learning. **Independent variables:** The level of the management and use of the e-learning platform and developing courses. **Dependent variables:** Scale of the implementation of remote and blended forms of teaching and learning.

Methods of pedagogical research:

During research several quantitative as well as qualitative **methods were used**, such as: quantitative methods: 1) pedagogical monograph (research papers), 2) method of individual cases, 3) method of diagnostic survey. Qualitative methods: 1) in-depth interview, 2) qualitative analysis of the text (documents), 3) observation. **Techniques of educational research:** 1) observation, 2) interview, 3) questionnaire, 4) study and analysis of documents, 5) content analysis. **Main research tools:** 1) interview questionnaire, 2) questionnaire, 3) survey, 4) observation tools, 5) development of the subject dictionary, 6) research trip and visiting a partner university, 7) meeting, (video)conference, seminar, workshop, etc.

Research tools

In order to consider a wide range of modern information and communication needs of a future professional in the context of personal-oriented learning, and the objectives of the competency-based approach in formal and informal learning, and to clarify the peculiarities of vision and building of content-structural model of cloud-oriented learning environment, a study involving students of Borys Grinchenko Kyiv University, specialty "Informatics," was conducted, using the following empirical methods:

- respondents (students of 1–4 courses with a specialty in "Informatics") were interviewed on the following topics:
  - use of modern cloud and web technologies and open educational resources;
  - formation of a personal electronic space based on the portfolio method;
  - use of formal, unformal and informal training to increase the competitiveness of the modern student in the labour market;
  - support of communication and collaboration among students and teachers to improve the quality and effectiveness of teaching and research activities.
- after conducting the survey, the primary data were collected to create an expanded questionnaire for further study;
- by direct and indirect survey the necessary information was collected;
- after processing and analysis of the obtained statistical data, the content-structural models of cloud-oriented learning environment in the context of personal-oriented learning and competency-based approaches to training students in the system of preparation of the future teachers of "Informatics" were created.

Study participants and procedure

According to the scenario of the pedagogical experiment, during the first phase the students with a specialty in "Informatics" were presented with more than 40 positions of various contemporary Web services and applications, on which individual electronic educational platforms of content management and electronic communication, cooperation and solution of educational and scientific problems that enable students to set learning goals and manage their personal process of academic progress monitoring were based and, on the basis of a portfolio to form their personal e-learning space, conduct and publish educational and scientific project activities, etc. From this list, the respondents had to choose forms of learning, frequency of use and type of activity among which they distributed the proposed web services and applications.

Research Results

In the following graphs (Figures 2–5) the detailed results of the statistical processing of the experiment are presented. According to the requirements, the students independently marked the type of activity on which they distributed the proposed web services and applications, frequency of their use.

During the second phase of the pedagogical experiment the students were asked to answer questions about what cloud storage services are used by the future teachers of information sciences. As in the first part of the survey, the respondents had to choose forms of learning, frequency of use and type of activity among which they distributed the proposed cloud web services and applications.

After analyzing the data, it appeared that most of the students in their work hardly used cloud storage services (Figure 6).

As a result of statistical processing of the data obtained after the pedagogical experiment it appeared that the students of the 4th year of study regularly use only a small number of software and web applications:

- 75% of the respondents use YouTube for unformal education for research and search for information;
- 76% regularly use the social network VKontakte in informal education and for communications;
- 80% use Wikipedia regularly in formal education;
- 76% of students regularly use Google search in all types of learning in most cases for research and search for information;
- 99% of the respondents regularly use different translators and mail.

Figure 1. PLE instruments and frequency of their use in communication according to a survey of 4th year students
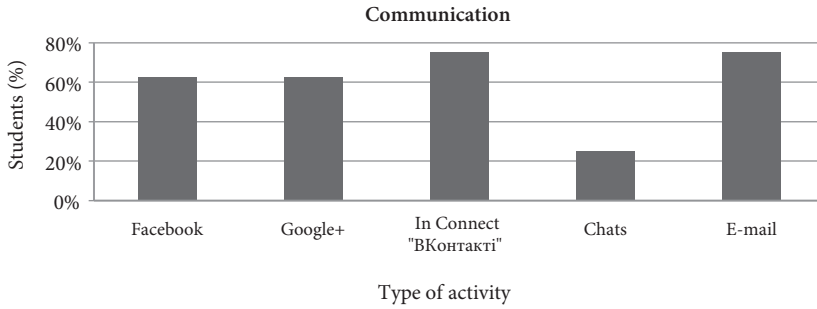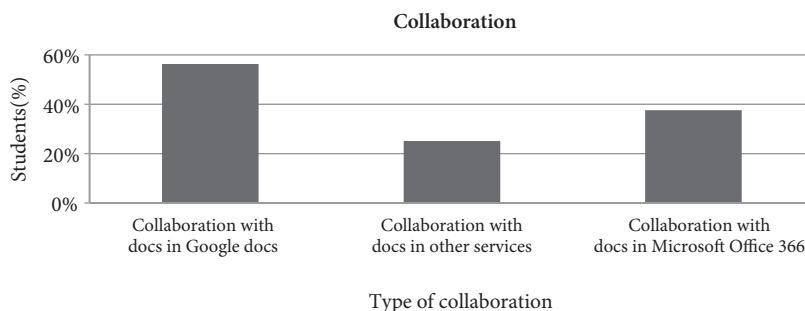

Source: Own work

Figure 2. PLE instruments and frequency of their use in research and search for information according to a survey of 4th year students.
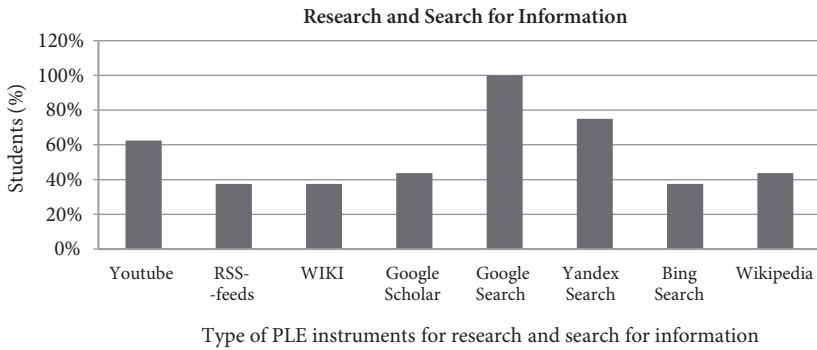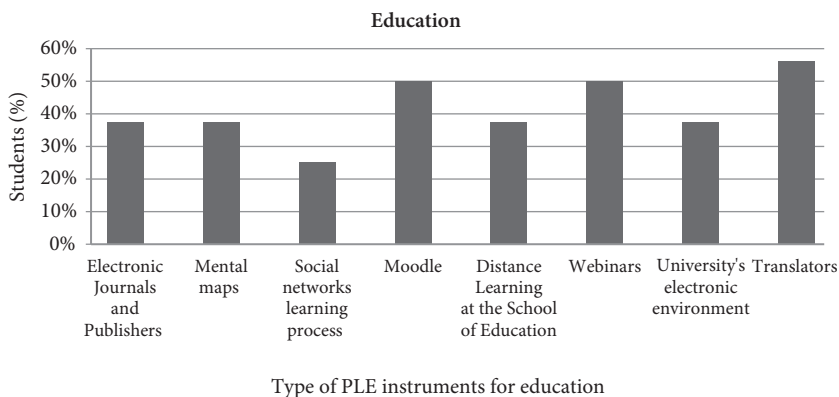

Source: Own work

Figure 3. PLE instruments and frequency of their use for communication according to a survey of 4th year students
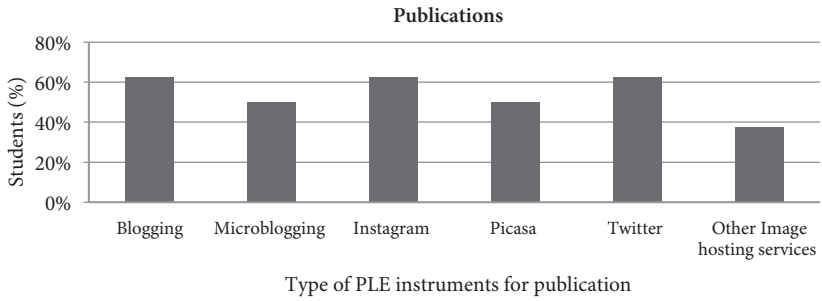
Collaboration

Source: Own work

Figure 4. PLE instruments and frequency of their use in education according to a survey of 4th year students.
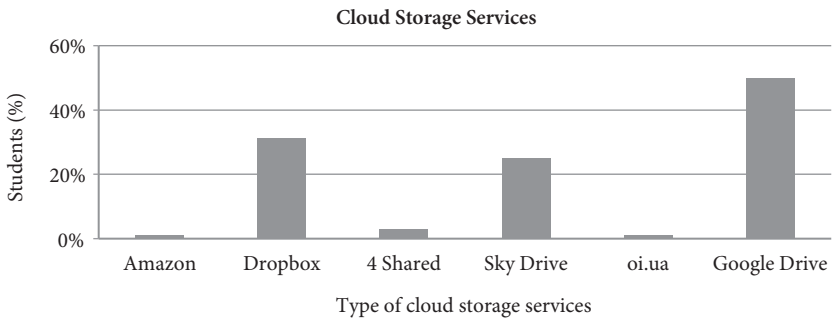
Education

Source: Own work

Figure 5. PLE instruments and frequency of their use in publications according to a survey of 4th year students

Publications

Source: Own work

Figure 6. Frequency of use of cloud storage services according to a survey of 4th year students.

Cloud Storage Services

Source: Own work

Other web applications and software either are not used or not in high or medium demand. This must be taken into consideration as most of the tools are very useful and according to recent research are in the 'Top 100' of the best web applications and software (Hart 2013) used in remote, formal and unformal learning.

Consequently, the quality of a virtual learning environment of a modern educational institution must be based on the learning needs of its students, content and technology that they use in creating and maintaining their own personal educational development. What also needs to be considered is the content of a virtual learning environment, its quality and effectiveness of use by students to achieve the objectives of education and training of the future competitive specialists on which the modern labor market depends. Meanwhile, as proved by the results of the conducted pedagogical experiment, the quality of a virtual learning environment also depends on the level of teachers' ICT competence and matching the services that they use in the creation of their personal learning environment, with services used by students.

Additionally, the research was conducted within the framework of the international IRNet project (www.us.edu.pl) as well as the PhD study of one of the authors. During our research study, one of the most popular and priority tools and techniques used in the framework of WP2 was a diagnostic survey and questionnaires. This paper describes only a part of the research conducted at the University of Silesia in Katowice and in Borys Grinchenko Kyiv University. More than 190 students from different faculties and specializations participated in this research. BGKU students from the Faculty of Information Technology took part in the survey; 104 students in total. The University of Silesia conducted the survey at the Faculty of Ethnology and Sciences of Education among students of the humanistic specialization: Integrated Primary Education and Kindergarten Education, Kindergarten Education with Child Development Early Support, Social-Cultural Animation with Cultural tourism, Integrated Primary Education and Pedagogical Therapy; in total 105 students participated. Generally, within the IRNet Project, nearly a thousand students from partner universities are scheduled to take part using LimeSurvey services as well as Google Drive. The questionnaire covered several groups of topics concerning the aim of the research. The research instruments were described in more detail in the authors' other publications (Kommers et al. 2014, Smyrnova-Trybulska et al. 2014)

Table 1, Table 2 and Table 3 present percentage distribution of the answers of the students from US and BGKU in the group of questions reflecting the students'

educational strategies and their opinions about the most effective ways of submitting their final work for checking to the instructor.

Table 1. Percentage distribution of the answers of the students from US and BGKU in the group of questions reflecting the students' educational strategies.

Question	US	BGKU
If you have access to the Internet, with what aim do you use it most frequently?		
To search for course materials, to advance your own knowledge	79.5%	87.2%
To participate in the e-learning course(s)	41.9%	27.4%
To contact friends (e-mail, social network, messenger)	72.4%	90.3%
For entertainment (on-line games, free surfing, watching movies)	45.7%	44.4%
For file sharing (P2P)	15.2%	42.1%
To develop your interests, hobbies	42.9%	72.2%
Looking for interesting materials on the Internet, do you use most frequently:		
Search systems, e.g., Google	84.8%	85.1%
Wikipedia	53.3%	81.5%
Electronic catalogues (bibliographical references and data bases)	21.9%	37.3%
References to other web sites, placed on the pages	27.6%	28.1%
Social networks	21.9%	31.3%
Reliable and well-tested portals	33.3%	37.2%
Blogs	6.8%	7.1%

Source: own research, 2014

After analyzing the results, we can conclude that the percentage distribution of the responses of the BGKU students, almost in respect of all the positions, though to a small extent, is higher than the distribution of the answers provided by the students of US. Thus, items such as search for learning materials, entertainment resources, using search engines, social networking sites, blogs, etc. differ by only a small percentage ± 10%, serve to express the similarity and typicality of the psychological development of the US and BGKU students.

However, one should focus on the points where the gap between the percentages of the students' responses is significant (20%–30%). Thus, the students of BGKU showed less tendency to use e-learning than the students of US, suggesting the need for greater involvement in, or improvement of the existing e-learning systems in the educational process. However, at the same time, the students of BGKU show almost twice as much regularity using the services of file sharing and finding interesting and scientific materials in electronic catalogs and on the pages

of the free Wikipedia encyclopedia. The biggest difference between the percentage of the students' responses, almost 30%, is found in the issue of the development of interests and hobbies: for 72.2% of the students of BGKU to use the Internet is self-development, and thus it can be concluded that the share of informal learning increases significantly and cannot be taken into account in educational activities of the university.

Table 2. Students' opinions about rating of the substantive value of the materials mentioned in the (1–5)

Type of materials	(1–5) point									
	1		2		3		4		5	
	US	BGKU	US	BGKU	US	BGKU	US	BGKU	US	BGKU
Wikipedia	8.6%	0%	4.8%	0%	3.8%	1.5%	1.0%	9.5%	2.7%	38.5%
file-sharing sites	4.8%	1%	17.1%	2.5%	12.4%	10.5%	8.6%	20.5%	12.4%	15.5%
found with the help of search systems	3.8%	0%	34.3%	1.5%	43.8%	5.5%	33.3%	19.5%	29.5%	24%
contained in public PDF files	1.0%	1%	34.3%	3%	30.5%	7%	46.7%	18%	44.8%	21.5%
papers, presentations, multimedia, scenarios of classes published on the website, published by other users	2.9%	3%	9.5%	4.5%	9.5%	7%	10.5%	18%	10.5%	18%

Source: own research, 2014

After analyzing the data, we can conclude that, when searching for necessary information on the Internet, all Internet services, the students of BGKU often use search engines (85.1%) as well as the students of US (84.8%) and resources of the free Wikipedia encyclopedia (81.5%) (among the Polish students, 53.3% admit looking for interesting materials on the Internet most frequently).

The table above shows that the students of BGKU appreciate most materials of informative value and meaningful level published on Wikipedia (38.5%), while their US counterparts trust more materials placed in the popular PDF file (44.8% of the respondents) and materials found using search engines (29.5% (US students) and 24% (BGKU students)). Simultaneously, the Polish respondents prefer participating in the e-learning course(s) (41.9%) in comparison to the BGKU students (27.4%).

Generally, the Ukrainian as well as the Polish respondents rate the cognitive level of significance and contents of different types of materials published on the

pages of the Internet as more than satisfactory. However, the Polish students are a little more critical in relation to the information submitted in the network and trust the e-learning courses with verified information more.

Table 3. Students' opinions about the most effective transfer of final work for checking to the instructor as well as the methods actually used

Questions	US	BGKU
What methods of submitting final work for checking to the instructor do you consider the most effective?		
By e-mail	**71.4%**	**76%**
By portable (external) means of information storage (e.g. a flash-memory stick)	23.8%	26%
By means of distance learning platform, e.g. the Moodle system or similar ones (Forum, Tasks, etc.)	31.4%	18%
Cloud services	9.5%	6%
Social networking sites	**83.8%**	**19%**
Traditional paper forms (press, photo-copying)	**27.6%**	**59%**
Orally during classes	5.7%	47%
Which method do you in fact use most often to forward your assignments to the teacher for correction?		
By e-mail	**66.7%**	**30%**
By portable (external) means of information storage (e.g. a flash-memory stick)	31.4%	10%
By means of distance learning platform, e.g. the Moodle system or similar ones (Forum, Tasks, etc.)	20.9%	7%
Cloud services	4.7%	3%
Social networks	**5.7%**	**7%**
Traditional paper forms (press, photo-copying)	**43.8%**	**24%**
Orally during classes	9.5%	19%

Source: own research, 2014

The results of BGKU show that the students are less involved in e-learning and prefer traditional debugging sessions with a "real" relationship, visual communication and the use of traditional paper check of forms of knowledge, and believe that such training is most effective for them. This can be explained using non-system e-learning systems in various disciplines.

The students of BGKU are quite familiar with the Moodle platform. What was surprising was the fact that almost half of the students prefer the traditional system of learning in groups and only one third chose the distance form of classes. This is an important signal for the further improvement of the information environment.

At the same time nearly 60% of the students of the University of Silesia prefer and choose the distance form of classes.

Two questions concerned methods of submitting final work for checking to the instructor that is considered the most **effective.** The answers were as follows: by email – 71.43% (US), 76% (BGKU), social networking sites – 83.81% (US),19% (BGKU) traditional paper forms (press, photo-copying) – 27.62% (US), 59% (BGKU) , orally during classes – only 5.71% (US) and 47% (BGKU). The answers to the second question "Which method do you in fact use most **often** to submit your assignments to the teacher for correction?", not covered by the answers to the previous question, show the following results – 66.67%, traditional paper forms (press, photo-copying) – 43.81% (US), 24% (BGKU), orally during classes – 9.52% (US), 19% (BGKU). The Polish students prefer, and consider as the most effective, submitting final work by email and social networking sites, however in fact use email and traditional paper forms (press, photo-copying); on the other hand, the Ukrainian students prefer using email and traditional paper forms (press, photo-copying), and in fact use the same form of submitting tasks for assessment.

Discussion

Analysis of the data obtained at US shows that the **contemporary students** are **active Internet users**.

Thus, we can conclude that the analysis of the student's information behaviour in the university's virtual environment is an effective tool to verify the correctness of the existing decisions and findings. These data are also important for further virtual environment development in accordance with the informational and communicational requirements of its main users - students. At the same time, these data help to understand how we can help students to correctly apply and understand existing open resourses and learning opportunities.

As a result of a number of interviews, questionnaires, surveys and statistical data processing, our pedagogical experiment gave us the opportunity to make a content-based structural model of a cloud educational environment for training future teachers of information sciences, with the vision of the students of the fourth year of study and make clarification of a personal electronic environment model under the influence of individual factors. The research instruments were described in more detail in the authors' other publications (Morze et al. 2014).

Conclusions

In modern society, a clear trend is visible of increasing the share of informal learning that should be considered as an indicator of quality self-development and competitiveness of the employee in the labor market under current conditions. After all, unlike traditional formal learning, it is able to fully take into account the personal needs of people and promotes certain knowledge quickly and conveniently, the quality of which depends on the student's ICT literacy and creating a comfortable environment for personal fulfillment of their own activities.

Analysis of typical university e-learning environments demonstrates quite a high level of qualitative and quantitative indicators of the implementation of electronic resources for educational purposes, but cannot ignore the fact that the university portals cover only scientific and educational aspects of students' lives, and stay out of sight of their individual needs. In order to really consider how wide the spectrum is of modern information and communication needs of the future in the context of professional student-centered learning and the objectives of the competency approach to formal and informal learning, and to clarify the characteristics vision and building a content-structural model of a cloud-oriented learning environment with the students of Borys Grinchenko Kyiv University, the specialty of «Informatics,» a study was conducted using empirical methods. According to the scenario of the pedagogical experiment, the respondents reported learning, frequency of use and type of activity to which they attributed the proposed cloud web services and applications. Analysis of the data revealed that most students in their activities hardly use cloud storage services and regularly use only a small number of software and web applications. It should be noted because most of the proposed recognition tools are useful, and these are the best web applications and software used in remote, formal and informal learning.

The modern student's ICT competency plays a key role in the shaping of the electronic learning environment of educational institutions and a cloud-oriented personalized learning environment. It allows students to set learning goals and manage their own process monitoring academic progress and, based on its own electronic portfolio form educational space, create their own e-libraries, make and publish educational and scientific project activity, etc.

Studies on students' ability to use information and communication technologies to carry out information activities in their professional field have shown that the quality of a virtual learning environment of a modern educational institution must be based on students' needs, the content and the technology they use in creating

and maintaining their own personal educational environments and the content of the virtual learning environment.

Analysis of student information behavior in a university's virtual environment is an effective tool for building and continuous refinement of the model of a personal learning environment, so in the context of student-centered learning universities can produce valuable competitive professionals, and students are able to acquire modern and up-to-date knowledge and constantly improve themselves.

Acknowledgments

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