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E-learning Specialists Training for IT Infrastructure of an Educational Institution Management

Abstract

The article discloses the possibility of training e-learning specialists to manage the IT infrastructure of educational institutions. The contents and results of lifelong learning competencies formation and professional competencies, skills, and soft skills in the course of "Managing the IT infrastructure of an educational institutions" are studied. Content training for specialists in e-learning is defined by such topics as "ICT policy and IT infrastructure of educational institutions," "Program and technical solutions for building IT infrastructure of educational institutions," "Using cloud technologies for IT infrastructure of educational institutions," and presented as an e-course that includes educational materials and competence tasks that form a competence for lifelong learning (communication in mother tongue, communication in foreign languages, knowledge of mathematics and general knowledge in the field of science and technology, skills in digital media, training for gaining knowledge, social and civic skills, proactive position and practical approach, awareness and self-expression in culture) and professional competence (in educational, technical, managerial, and project activities). The feasibility of using competency tasks to prepare specialists in e-learning is confirmed by educational achievements of 94 full-time and part-time students. What is analysed are the students' acquired soft skills (flexibility, teamwork, leadership, outgoingness, social skills, creativity).

K e y w o r d s: competence education, management of IT infrastructure, professional competence of e-learning manager, soft skills

Introduction

Research Issue

The development of information and communication technologies, and thus informatisation of education, contributes to the need to introduce the course "Managing the IT infrastructure of educational institutions" as an element of training not only managers of state and regional education bodies, but also students of pedagogical departments. Each teacher is the manager of learning, and within the knowledge society one is also an e-learning manager, able to design how to use or build the IT infrastructure of an educational institution and its information and educational environment to guide the learning activities of those one teaches.

De la Fuente and Vives (1995) determined that the IT infrastructure is a tool of regional educational policy. Most researchers of e-learning implementation pay attention to training students to use IT. For example, Keengwe and Kidd (2010) summarise the best practices of e-learning, while Baumgartner, Häfele, and Maier-Häfele (2004) examine the content management system of education in accordance with the development of ICT. Information Technology Infrastructure Library describes best practices worldwide in the organisation of the enterprise or unit that provides services in IT.

The use of ITIL library is implemented in higher education to train project managers and service managers for business.

Research Focus

Training a specialist in e-learning is considered for the most part as training an expert who has to pick up the tools for e-learning and is able to design an e-environment, but the manager needs an active stance, a holistic perception of ICT in the educational institution, and should define IT policy and its consequences, pick, design, and build an IT infrastructure depending on the educational process objectives. These requirements necessitated the study of the "Managing the IT infrastructure of educational institutions" course by pedagogy students in preparing them to be managers of e-learning.

The objective of the study is determined by the acquisition of lifelong learning and professional competencies, as well as soft skills in the course of "Managing the IT infrastructure of educational institutions" by managers of e-learning.

The hypothesis of the study is: training specialists in e-learning is of appropriate quality with the introduction of a training course on IT infrastructure management of an educational institution that forms competencies of lifelong learning, professional competencies, and soft skills of future teachers. The objectives of the study are:
• the design of a course on IT infrastructure of educational institutions for the formation of competencies of lifelong learning, professional competencies, and soft skills;

- the use of competence tasks as a tool for forming lifelong learning competencies, professional competencies, and soft skills;
- the analysis of the "Managing the IT infrastructure of educational institutions" course introduction results in the preparation of students as managers of e-learning.

Methodology and General Background of Research

Let us define the study methods. Theoretical methods are: systematisation and comparison of scientific propositions, experiences in training specialists in e-learning to the management of educational institutions IT infrastructure; modelling to create competency problems for verification of the students' readiness for management of IT infrastructure of educational institutions. Empirical methods are: observation; questionnaires to determine the competence of lifelong learning, professional competencies, and soft skills of the students; content analysis of students' guidelines to the design and management of educational institutions IT infrastructure.

Soft Skills Formation in Specialists in E-learning Training

Lifelong Learning Competencies and Professional Competencies

The introduction of a competence approach in education contributed to a large number of studies on the subject in pedagogy and to the identification of general requirements for key competencies, competencies for lifelong learning, and students' professional competencies. For example, Winterton, Delamare – Le Deist, and Stringfellow (2006) defined conceptual approaches to competence training according to the experience of France and Germany. Jones and Voorhees (2002) disclose the models of competence formation in universities and other institutions, and define and sort the experiences of different types of educational institutions on the possibilities and methodology of competencies formation. The European Parliament and the EU Council recommended "Key competences for lifelong learning." Jochems, Koper, and Van Merriënboer (2004) summarised the trends of competencies development in connection with the introduction of e-learning, and identified the peculiarities of e-learning and the way to prepare for it.

Lifelong learning competencies

The recommendation of the European Parliament and of the EU Council "On the core competence for lifelong learning" of 18 December 2006 contains a list of eight core competencies: communication in the mother tongue, communication in foreign languages, knowledge of mathematics and general knowledge in science and technology, skills in digital media, training for gaining knowledge, social and

civic skills, initiative and practicality, awareness and self-expression in culture. They should be reflected in preparing students for professional life (Europeo, 2006). Let us consider the appropriatness of the "Managing the IT infrastructure of educational institutions" course for their formation through the preparation of e-learning managers.

Table 1.
Competencies formation through the "Managing the IT infrastructure of educational institutions" course

Core competencies	"Managing the IT infrastructure of educational institutions"
Communication in the mother tongue	The ability to study, compile, and implement domestic and foreign management experience in information technology and systems, IT infrastructure, etc.
Skills in digital media; knowledge of mathematics and general knowledge in science and technology	Competencies in IT infrastructure design, deep knowledge and content understanding, principles of organisation, teaching, hardware and software of educational process with the use of ICT; the ability to design the IT infrastructure of the educational institution; the ability to ensure interoperability in solving urgent problems of introducing ICT in school; competence in diagnostic, analytical, and advisory activities for the implementation of IT solutions; the ability to design and implement ICT in education process of different educational institutions (universities, secondary schools, primary schools) as well as the corporate sector
Training for gaining knowledge	Skills in organisation of individual educational, applied, and research activities
Social and civic skills	The ability to use the interaction skills in work, interpersonal skills, skills of productive communication as a parcel of professional activity
Initiative and practicality	The ability to utilise the theoretical and conceptual expertise in practice, teaching, and research work
Awareness and self-expression in culture	The ability to study and systematise achievements of national and foreign scholars in the field of ICT, pedagogy, psychology, and related areas

S o u r c e: Own work.

"Managing the IT Infrastructure of Educational Institutions" Course Description as a Content Groundwork for Professional Competencies Formation

The course "Managing the IT infrastructure of educational institutions" provides the students with competencies in the development and management of IT infrastructure of educational institutions. The objectives of the course are to provide students with theoretical knowledge about the peculiarities of IT infrastructure elaboration, and to form their categorical concepts for the design of the IT infrastructure and skills to create, update, and maintain IT infrastructure of educational institutions; students are encouraged to do active analytical and research work aimed at identifying effective ways of development and management of IT infrastructure of educational institutions.

The main topics of the course "Managing the IT infrastructure of educational institutions" are: "ICT policy and IT infrastructure of educational institutions," "Software and hardware solutions for building IT infrastructure of educational institutions," and "Using cloud technologies for IT infrastructure of educational institutions."

In the study of the "Managing the IT infrastructure of educational institutions" course the students should know:
- the essence of the IT infrastructure concept, its requirements, IT infrastructure objects typology;
- methods for identifying the information needs of the organisation, sources, and channels of information;
- principles and strategy for creation and development of information infrastructure;
- regulatory and scientific methods of management processes in information technology (IT) in school;
- structure, composition, objectives, and importance of IT infrastructure of educational institutions;
- key processes of IT infrastructure; methodology of construction and management of IT infrastructure of the edcational institution;
- classification and characteristics of hardware and software;
- recommendations of international standards for IT service management and ICT competencies of teachers; the main factors that determine the reliability and efficiency of information systems; and
- concepts and terminology in research, content, and basic forms of research activity.

The students should be able to:
- determine the ICT policy of educational institutions;

- build models of IT infrastructure and identify peculiarities of IT infrastructure models for different types of educational institutions;
- identify technology, environment, and equipment for the implementation of ICT policies in educational institutions;
- define and improve the IT infrastructure of an educational institution, or-ganise and manage the processes of formation, renewal, and development of information technology, information systems, information resources, model the information flow, and customise electronic document management system in an educational institution;
- perform formalisation of requirements for IT infrastructure of educational institutions; justify the choice of hardware and software IT infrastructure development of the institution; optimise IT processes; and
- identify the resources needed to ensure the reliability of information systems, use cloud technologies in education (software as a service (SaaS), platform as a service (PaaS), Infrastructure as a Service (IaaS)).
  Students' key professional competencies can be identified:
- in pedagogical activity (the ability to manage IT infrastructure at different levels of education in various educational institutions, including taking it into account when forming educational policy on the use of ICT, to provide a choice of effective ICT tools to create the conditions for individualisation of learning, including e-learning);
- in methodology (the ability to develop, implement, and summarise the expe-rience and results of teaching models, methods, technologies, and training methods implementation with the help of different types of IT infrastructures);
- in management (the ability to study the state of the art and potential of ICT and to use a cluster of management methods of analysis and prediction of the results of IT solutions implementation using personnel, logistical, regulatory support in educational institutions of various types); and
- in project management (the ability to develop a pedagogical project of an educational institution IT infrastructure).

Soft Skills Formation

Gewertz (2007), John (2009), and others define the necessity of forming soft skills for the successful achievement of self-realisation and creativity in professional activities. Research of Robles (2012) determined top 10 soft skills that are most important to business leaders: integrity, communication, courtesy, responsibility, social skills, positive attitude, professionalism, flexibility, teamwork, and work ethic.

The course is aimed at developing both "hard" and "soft" skills and requires mandatory consolidation of students' behavioural models for daily use.

The degree of mastering soft skills is difficult to track, verify, and demonstrate. Therefore, in the course, soft skills formation is facilitated through the establish-

ment of educational tasks that make it possible for students to use a variety of behaviours, to holistically understand their own and common interests, to set priorities, and to make choices. Let us consider how soft skills can be cultivated through training managers of e-learning.

Table 2.
Soft skills examples, formation, and assessment methods

Soft skills	Formation methods	Assessment
Flexibility (adaptivity, ability to change)	Teaching practice in different types of educational institutions	Educational tasks fulfilment under different conditions
Team work	Project methods	The implementation of educational and research projects; participation in the creation of a common vision of IT policies for various types of educational institutions; the ability to perform various team roles; self-evaluation and evaluation of others
Leadership	Personal leadership – presentation of results, defending one's own point of view, creation of one's own electronic resources; social leadership – development of social projects, development of IT policies and IT infrastructure of educational institutions	Research projects development, development of IT solutions; development of guidelines for implementation of IT infrastructure in educational institutions, training of teachers during practice; workshops for teachers
Communication	Project methods	Online forums, blogs
Social skills	Problem solving through teaching practice	Seminars and workshops for teachers
Creativity	IT infrastructure development for different types of educational institutions according to their needs and capacity	Implementation of different resources, forms, and tools for creating new models of IT infrastructure

S o u r c e: Own work.

Competence Tasks Description

Morze, Barna, Vember, and Kuzminska (2015) determined that competence tasks combine knowledge and activity components, and ought to include the following stages: description of the problem situation content based on previously acquired knowledge or personal experience of students; formulation of

requirements set for initial and boundary conditions for the process of learning activities; development of implementation criteria for phases of the assignment and the resulting product; development of assistance in the form of questions, tasks, or exercises aimed at the content specification described in a situation, specification of requirements, updating of basic knowledge, and activation of the association and causation needed to find ways to solve it; and development of guidelines for quality performance of certain tasks.

Hereby follow several examples of tasks to prepare students for IT infrastructure management of educational institutions.

Problem 1. Create guidelines for the implementation of software in the educational process and for the management of various types of educational institutions according to their ICT policy.
- Answer the following questions:
  - ◦ What educational software can be used in an educational institution?
  - ◦ What processes can be automated using ICT?
  - ◦ Is there a standard of software implementation in educational institutions?
  - ◦ What tools are necessary to automate the management of the institution, for educational use?
  - ◦ What is the difference and what is common in software to be used in the educational process and for the management at a university, a secondary school, and a primary school?
- Fill out the chart (identify the software on your own, using hot links and personal experience):

Capacity	Software 1	Software 2	Software 3 etc.
Information flow			
Website design			
Communities			
Library repositories			
E-learning			
E-government			
Etc.			

- Basing on the table, develop guidelines for software implementation in different types of educational institutions (universities, secondary schools, primary schools). Upload the result as a file in the LMS platform.
- Evaluation criteria: "Software Capacity" table – 4 points; guidelines – 4 points; teamwork, communication, project presentation – 2 points. Total grade – 10 points.

Problem 2. You are a manager of e-learning at an educational institution that can spend 100 thousand UAH for the construction or improvement of its IT infrastructure. Provide IT solutions to build or improve the IT infrastructure and justify its feasibility, organisational and pedagogical conditions for its implementation. For example, if you decide to purchase multimedia systems, you have to find the manufacturers and compare prices and functionality. In the project describe goals and projected outcomes of IT solutions, and justify feasibility of certain assets. All offers need to be backed by links to the manufacturers' sites and evaluations of experts.

- Answer the following questions:
  - What results are to be obtained when implementing your solution?
  - What criteria did you follow to choose the tools? Have you considered the trends of ICT in their selection?
  - What should be included in expenses (repair, maintenance, software installation, payment for teachers, outsourcing, etc.)?
  - What are the organisational and pedagogical requirements for implementing your IT solutions?
  - What are the negative consequences of the implementation of your IT solution?
  - Describe the project and estimate the implementation of IT solutions.
- Examples: multimedia equipment of classrooms, introduction of e-learning (in distant form), introduction of e-learning (in blended form), organisation of a school newspaper issue, introduction of electronic journals and Web conferencing, creation of a remote school, purchase of office equipment, Wi-Fi connection to the assembly hall, etc.
- Evaluation criteria: project description (justification of relevance, objective, projected results, tools, organisational and pedagogical conditions of implementation) – 4 points; the budget estimate (taking into account all costs of purchase, service, maintenance, including the necessary staff, links to manufacturers, expert evaluation) – 4 points; team work, communication, project presentation – 2 points. Total grade – 10 points.

Data Collection and Analysis

The course of "IT infrastructure of an educational institution management" was within the framework of the "Manager of e-learning" curriculum Master degree programme. 92 students of the Borys Grinchenko Kyiv University students passed the course in the 2016-2017 academic year. 48 (52%) of those students were enrolled in a full-time course, and 44 (48%) – in an extra-mural course. For full-time students, the course comprised of 2 credits, for extra-mural studies – 4 credits due to the volume of time scheduled for individual learning.

Of the overall number of students, 32 (35%) passed the exam and took part in the survey. Two distance courses were created for different forms of study.

All students had the opportunity to take advantage of distance learning courses for more in-depth understanding of the course. For individual consultation and discussion topics of the course, a forum was implemented; 156 posts and 903 student tasks and projects were uploaded for full-time students, and 269 posts and 730 student tasks and projects were uploaded for extra-mural studies.

Results of Research

The analysis of practical works and projects showed that the tasks offered in the form of competence tasks were practice-oriented, and the students got the highest score. Extramural students needed more individual counseling with the course tutor.
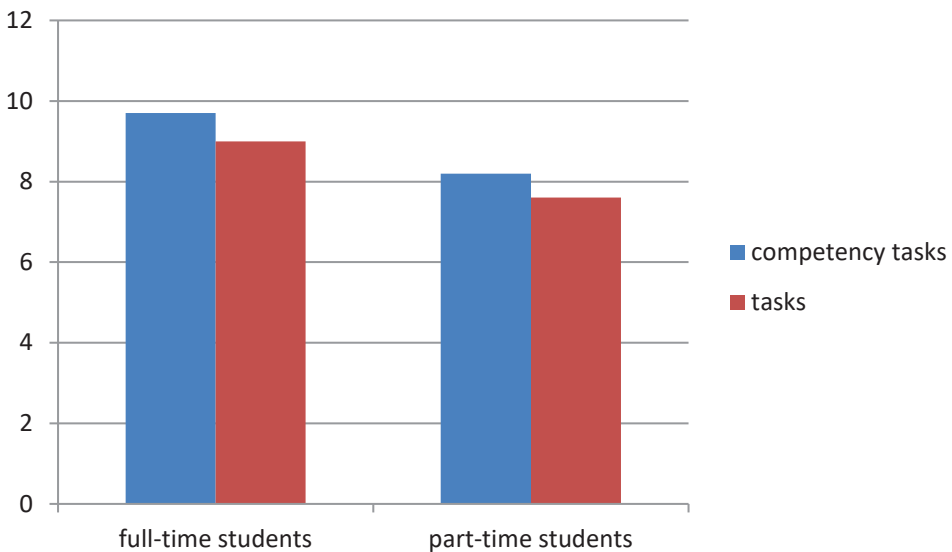

Figure 1. Grade point average for different types of tasks (max. 10 points).

S o u r c e : Own work.

The meaning of figures compared in the selections exceeds 10, which is why the nonparametric method Mann-Whitney has been employed. The experiment encompasses two selections of students – the full-time and the distance learning formats, N=48 and M=44 accordingly.

Having calculated the Mann-Whitney criterion for the reproductive problems results, we get U = 373. According to the calculations *Wemp* = 0.0338 < 1.96. The hypothesis of the selections coincidence is estimated at 0.05 of significance. Having calculated the Mann-Whitney criterion for the competence problems, we get *Wemp* = 2.1987 > 1.96. The efficiency of learning acquisition for full-time and distance form students coincide, while the competence tasks efficiency is different. Hence the conclusion may be derived that the full-time learning format is more suitable for the competence tasks training.

32 full-time students to have completed the course and passed the exam took part in a survey as to the course influence on skills formation. For the distance learning students, a credit pass was proposed based on the laboratory and applied tasks completion.
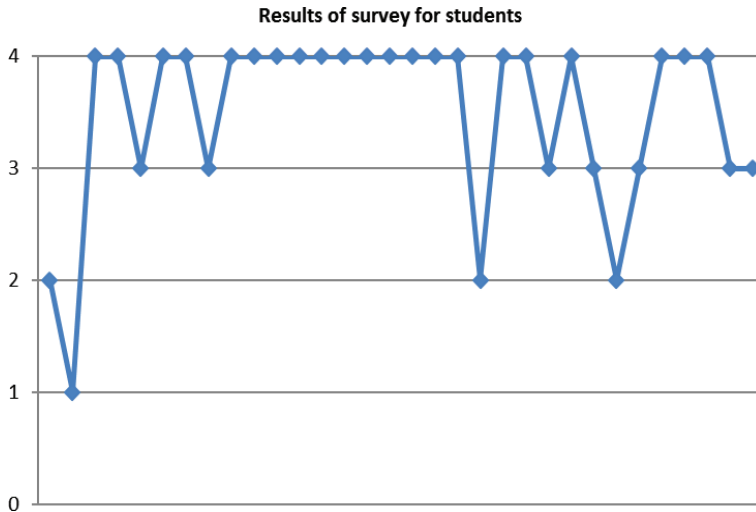

Figure 2. Students' assessment of the course impact on professional competencies and soft skills formation.
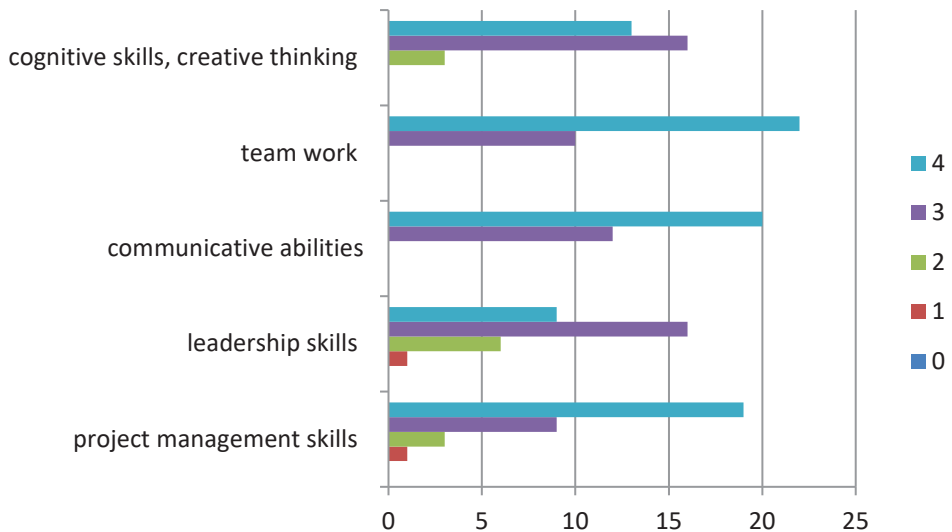
S o u r c e : Own work.

Figure 3. Frequencies of students' assessment of the course impact on soft skills formation (max. 4 points).

S o u r c e : Own work.

Discussion

Soft skills formation is possible if exercises and practical simulations are used, constantly enticing students to make independent decisions (to solve the competence tasks, develop and implement projects, to perform self-evaluation of their activities, and so on).

The feasibility of using competence tasks to prepare specialists in e-learning is corroborated by educational achievements of 94 full-time and extramural students. The extramural students demonstrated lower GPA (8.2) than students of full-time education (9.7), but interviews indicated greater interest in this form of knowledge assessment, based on their experience in educational institutions.

Conclusion

To perform the research tasks, we developed the structure of the "Managing the IT infrastructure of educational institutions" course and determined how it provided for the formation of competencies for lifelong learning (communication in the mother tongue, communication in foreign languages, knowledge of mathematics and general knowledge in the field of science and technology, skills of digital media, training for gaining knowledge, social and civic skills, initiative and practicality, awareness and self-expression in culture) and professional competencies (in educational, technical, managerial, and project activities); we also analysed the acquisition of soft skills by students (flexibility, team work, leadership, communication, social skills, creativity).

Students indicated the following most useful competencies acquisition activities:
- consultations with teachers (among others in the form of blogs and forums) (34.6%),
- educational technology project (33.2%),
- competence tasks solution (31.5), and
- independent research (0.7%).

The study results demonstrated that the tasks presented in a competence form enticed the students' interest for being practical and for presenting an opportunity to be creative and apply leadership skills, and provided for the overall successful study results.

The study does not cover all aspects of the abovementioned academic problem. The system of students competencies, and soft skills evaluation and self-assessment need further development and elaboration of appropriate diagnostics. The possibility of using the acquired competencies by specialists in e-learning in educational institutions of different types needs in-depth exploration to adjust the training programme for the management of an infrastructure of educational institutions.

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Szkolenia z zarządzania infrastrukturą IT w instytucji edukacyjnej skierowane do specjalistów w zakresie e-learningu

S t r e s z c z e n i e

Artykuł omawia możliwość zorganizowania szkolenia specjalistów w zakresie e-learningu, którzy mogliby zarządzać infrastrukturą IT w instytucji edukacyjnej. Porusza zagadnienia związane z rozwijaniem umiejętności uczenia się przez całe życie, kompetencji zawodowych oraz umiejęt-

ności miękkich i innych. Kurs taki powinien obejmować następującą tematykę: polityka związana z wprowadzaniem technologii informacyjno-komunikacyjnych w instytucjach edukacyjnych i infrastrukturach IT, program budowania infrastruktury IT i jej rozwiązania techniczne w instytucjach edukacyjnych, usługi w chmurze dla instytucji edukacyjnych. Mógłby to być kurs online zawierający materiały i zadania kształcące umiejętność uczenia się przez całe życie (dot. komunikacji w języku ojczystym, komunikacji w językach obcych, wiedzy matematycznej, wiedzy ogólnej w zakresie nauk ścisłych, umiejętności używania mediów cyfrowych, szkolenia na temat sposobów zdobywania wiedzy, kompetencji społecznych i obywatelskich, podejścia praktycznego i zachowania aktywnego, świadomości kulturowej i wyrażania siebie) oraz umiejętności zawodowych (edukacyjnych, technicznych, menadżerskich i projektowych). W artykule została pokazana możliwość stworzenia zadań kształcących różne kompetencje, jakimi muszą wykazywać się specjaliści w zakresie e-learningu, potwierdzona przez osiągnięcia edukacyjne 94 studentów uczących się w pełnym i niepełnym wymiarze. Zostały przeanalizowane umiejętności miękkie zdobyte przez studentów (elastyczność, praca zespołowa, zdolności przywódcze, kompetencje społeczne i towarzyskie, kreatywność).

S ł o w a k l u c z o w e: kształcenie kompetencji, zarządzanie infrastrukturą IT, kompetencje zawodowe menadżera e-learningu, umiejętności miękkie

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Подготовка менеджеров e-обучение в управление ИТ-инфраструктурой образовательных учреждений

А н н о т а ц и я

В статье раскрыты возможности подготовки менеджеров e-обучения для управления ИТ-инфраструктурой образовательного учреждения. Исследовано содержание и результаты формирования компетенций обучения в течение жизни и профессиональных компетенций, навыков soft skills в курсе «Управление ИТ-инфраструктурой образовательного учреждения». Содержание подготовки менеджеров электронного обучения определены темам «ИКТ политика и ИТ инфраструктура образовательного учреждения», «Программно-технические решения для построения ИТ инфраструктуры образовательного учреждения», «Использование облачных технологий для построения ИТ-инфраструктуры образовательных учреждений» представлен в виде дистанционного курса, содержащий учебный материал и компетентностного задачи, которые формируют компетенции для обучения в течение всей жизни (общение на родном языке; общение на иностранных языках, знание математики и общие знания в области науки и техники; навыки работы с цифровыми носителями, обучение ради получения знаний, социальные и гражданские навыки; инициативность и практичность, осведомленность и самовыражения в сфере культуры) и профессиональные компетентности (в области педагогической, методической, управленческой и проектной деятельности). Целесообразность использования компетентностных задач для подготовки менеджеров электронного обучения подтверждено результатами учебных достижений 94 студентов очной и заочной формы обучения. проанализировали получения soft skills студентами (гибкость, работа в команде, лидерство, комуникабильнисть, социальные навыки, креативность).

К л ю ч е в ы е с л о в а: компетентность образование, управление ИТ-инфраструктура, профессиональные компетентности менеджера электронного обучения, мягкие навыки

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Formación de especialistas en e-learning para infraestructuras de IT para la gestión de instituciones educativas

R e s u m e n

El artículo expone la posibilidad de formar especialistas en e-learning para gestionar las infraestructuras de TI en las instituciones educativas. Se estudiaron los contenidos y resultados de la formación de competencias de aprendizaje permanente y las competencias profesionales, habilidades, habilidades blandas durante la «Gestión de la infraestructura de TI de una institución educativa». La formación de contenidos para especialistas en e-learning está definida por temas como «La política de TICs y la infraestructura de TI de las instituciones educativas», «El programa y las soluciones técnicas para la construcción de infraestructuras de TI de las instituciones educativas» y se presenta como un e-curso que incluye materiales educativos y tareas de competencia que constituyen una competencia para el aprendizaje permanente (comunicación en idioma materno, comunicación en lenguas extranjeras, conocimiento de matemáticas y conocimientos generales en el campo de la ciencia y la tecnología, habilidades en medios digitales, capacitación para adquirir conocimientos, habilidades sociales y cívicas; posición proactiva y enfoque práctico, conciencia y autoexpresión en la cultura) y para la competencia profesional (en actividades educativas, técnicas, de gestión y para proyectos). La viabilidad de utilizar las tareas de competencia para preparar a los especialistas en e-learning se confirma a través de los logros educativos de 94 estudiantes a tiempo completo y a tiempo parcial. Se analizaron las destrezas transversales adquiridas por los estudiantes (flexibilidad, trabajo en equipo, liderazgo, sociabilidad, habilidades sociales, creatividad).

P a l a b r a s   c l a v e: Educación en competencias, gestión de infraestructuras IT, competencia profesional de gestión en e-learning, habilidades transversales