UDC 378.147:004.7

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RECOMMENDATIONS FOR THE USE OF OPEN SYSTEMS NETWORK TECHNOLOGIES IN THE STUDY OF FUTURE BACHELORS OF INFORMATICS

The article presents recommendations for the use of open systems network technologies (OSNT). It determines the priority directions of the use of OSNT and the circumstances of their implementation at higher educational institutions (HEI). While modeling the process of specialist training, all its aspects (educational, scientific, organizational, managerial, educational etc.) should be analysed. It is important to use open systems network technologies in the educational process at HEI. The transition to the system of organization of educational process with the use of OSNT is theoretically grounded. Such transition requires that a university present an information package about the institution and a student coordinator for the educational process. The article focuses on the process of training of Bachelors of Informatics. It is determined that informing of future Bachelors of Informatics about the organization of their study program, peculiarities of training quality control and managerial activity is carried out at all levels of management: chair, dean's office, university administration. The peculiarities of the use of OSNT by all the participants of the educational process of the HEI are described. It is substantiated that OSNT fully accompany the process of students training. The academic staff forms the educational load and elaborates the educational and methodical complex of subjects. The administration of HEI and educational and administrative staff of HEI (enrollment committee, the formation of lessons schedule, library, personnel department) also have important functions in the process of students training. OSNT selection for the higher educational institutions should be performed according to the following characteristics: (i) management supporting; (ii) commitment to the end-user; (iii) establishment of three-dimensional interaction; (iv) user service.

Keywords: open systems network technologies, Bachelor of Informatics, academic staff, administration of HEI, educational and auxiliary staff.

Introduction. The main aim of the development of a higher educational institution is improving the quality of specialists` training to the level which will enable them to work successfully in a specialty to develop society and education. It will be realized faster and more effectively if open systems network technologies (OSNT) are implemented into the educational process of the university.

The learning process with the use of OSNT is interactive and available to everyone. The use of OSNT at HEI will promote the formation of a single information educational space, the improvement of the interaction between teachers and students and it allows to design this space in accordance with different needs of social groups. OSNT improve the cooperation of all the participants of the educational process.

Application of abilities to use OSNT for continuous personal development is especially relevant for future Bachelors of Informatics. These abilities are applicated for the development of professional skills and the formation of students' moral and ethical bases of network communication in the modern informative environment.

Aspects of the use of open education technologies for the educational aims are revealed in the works of M.P. Leshchenko, A.V. Yatsyshyn [2], O.V. Ovcharuk, L.A. Vynohradova, O.Ye. Vysotska, O.A. Zakharova, A.Yu. Ishchenko, M.M. Karpenko, I.A. Kolesnikova, M.V. Hramova, Zh.M. Chupahina and others. V.Yu. Bykov [5] made a significant contribution to the study of the problem of using open systems network technologies. He analyzed the characteristics, principles and technologies of open education.

The studies of the leading specialists working in the field of open education in the United States and Europe are very actual. They are Tory Iiyosi, Vijay Kumar, Stuart D. Lee, Trent Batson, Andy Lane, Marcher S. Smith, Sheryl R. Richardson etc.

Problems of training of future teachers of Informatics were investigated by M.I. Zhaldak [1], N.V. Morze [3], O.M. Spirin [4] and others. This problem is highlighted in the works of foreign scientists, in particular, from Poland (Ye. Mazinska, H. Kiedrovich, etc), USA (A. Thompson, R. Bradley, etc), France (G. Arsak), Russia (V.V. Davydov, A.P. Yershov, K.K. Kolin, N.P. Lapchick, etc.).

The relevance of the study. When forming the conceptual provisions and tasks of the university development by the means of OSNT the following principles should be followed: (i) the continuity of education, its systemic and systematic nature; (ii) innovativeness of education content; (iii) the unity of fundamentality and professionalism of education content; (iv) corporate identity, partnership of all the participants of educational activity at the university; (v) flexible and open character of the educational process; (vi) consideration of the effect of co-education; (vii) activity principle of studying.

As a result, it is necessary to determine the priority directions of the OSNT use in the universities, in particular:

- to bring the content of pedagogical education closer to the modern requirements of school, society and the state to increase the professional competence of university graduates with the help of OSNT;
- to conduct seminars devoted to the problem of OSNT introduction into the organization of the educational process;
- to conduct training seminars for the academic staff for making them acquainted with the OSNT;
- to use OSNT when training university students.
   The use of OSNT in the educational process must meet the following requirements:
- being appropriated with the normative and legal acts of the current legislation;
- creation of equal conditions for all the participants of the educational process maximally excluding subjective assessments;
- taking into account all the aspects of the educational process;
- analysys of the results obtained;
- creation of a positive emotional microclimate.

Favourable conditions for the implementation of OSNT into the educational process are the next ones:

- activity of higher educational institution in solving organizational and methodological tasks concerning the use of OSNT;
- consideration of psychological and pedagogical factors of teaching students of HEE in the conditions of the application of OSNT;
- improvement of teacher's professional and pedagogical activity in the process of the use of OSNT;
- strengthening the role of student self-government;
- formation and control of the professional competence of the university graduate.

The purpose of the study is substantiating the recommendatory measures for the use of open systems network technologies in the training of future Bachelors of Informatics.

Organization of the education of the future Bachelors of Informatics with the use of OSNT will allow to increase the effectiveness of the learning process at HEI.

Method. To achieve the goal and realize the tasks of the study a complex of methods was used. They are: (i) the analysis of pedagogical experience of implementation of OSNT at HEI; (ii) observation – to identify features of the education of future Bachelors of Informatics in open educational space; (iii) self-evaluation – to study personal beliefs of the participants of the educational process on OSNT use.

Research site and background on the case. The inculcation of the OSNT changes the organization of the educational process in the universities. The transition to the system of organization of the educational process with the use of OSNT requires the university to present:

‒ an information package about the institution, namely: data on enrollment rules, curricula, subject programs, academic staff, tuition, living conditions, etc. All this information should be posted on the website of the university;

‒ a coordinator, who (i) informs students about the educational process, (ii) helps to make an individual curriculum and correct it while studying, (iii) communicates with foreign universities in the process of student exchange, (iv) informs about international programs which the student can participate in, etc. The coordinator must give all the necessary data for students through the Internet, using special services or technologies (for example, e-mail, Skype, Viber, social network);

‒ information (i) about forms of student assessment, (ii) about the rules of liquidation of failure to take examination, (iii) about the ways of getting the additional assessment for students' active scientific and extracurricular work, (iv) about the methods of determining the student rating by the results of term and year's evaluation of students' knowledge. This information should be in the open access to the student (for example, Google Calendar, blog, conversation, etc.).

Informing future Bachelors of Informatics about the organization of study, features of the evaluation of students' knowledge, order of transfer, expelling, awarding the scholarship is carried out at all the levels of management: chair, dean's office, university administration.

Control over informing students about the structure of subjects, the content and the list of tasks included in the term control, the topic of individual educational and research tasks, the content of control tests and appeals should be carried out at the level of *chair*.

They should acquaint students with the possibilities of forming an individual curriculum, the organization of term control, the peculiarities of students transfer, exeption, continuation and termination of their studies at the level of *dean's office*.

The university administration should make the university applicants and students acquainted with the information package about the higher educational establishment, the order of name scholarships appointment, information about tours for health improving during the vacation period by the results of term and annual rating; they should place the main normative and legal documents regulating the activity of HEI on the university website [8].

The use of OSNT in the process of studies and its organization are also carried out at the level of chair, dean's office, university administration. They (i) provide openness, transperance and democracy in the organization of university activity, (ii) provide control of the educational process. The use of OSNT promote the increase of educational establishments' autonomy, their competitiveness. The use of OSNT intensifies the participation of patrons, public organizations, funds, mass media in the educational, scientific and methodic, financial and economic activity of the educational institution.

System of control including joint coordinated actions of all structural departments and officials in carrying out control measures is an important element in managing the quality of future Bachelors of Informatics training. The goal of the system of control over the use of OSNT in the university is (i) thorough improvement of scientific and research work by notice, identification and elimination the deficiencies, (ii) giving organized and methodic assistance, (iii) strengthening the responsibility of teachers and students for the results of their activity.

Using OSNT in the process of training of future Bachelors of Informatics the procedure of control will fulfil such **basic functions**:

1) educational (systematic observation of students' learning and scientific activity with the use of OSNT);
2) diagnostic (determination the gaps of the application of OSNT, elucidation of causes and taking measures to eliminate defects);
3) educative (systematic control of the use of OSNT furthers (i) training of positive features, (ii) formation of organization, discipline, responsibility, integrity, perseverance, etc.);
4) stimulating and motivational (impartial valuation is an important stimulus, which grows into a stable motive);
5) managerial (correction of the university activity).

The main tasks of the system of control over the establishment of OSNT are the next ones:

i.   study of the level of the university activity;
ii. improvement of the organization and content of the educational process;
iii. analysis of the level of educational and methodological content;
iv. analysis of the quality of lectures, seminars, practical and laboratory studies, students' independent work, practice, etc.;
v.   finding out the gaps in the material and technical base.

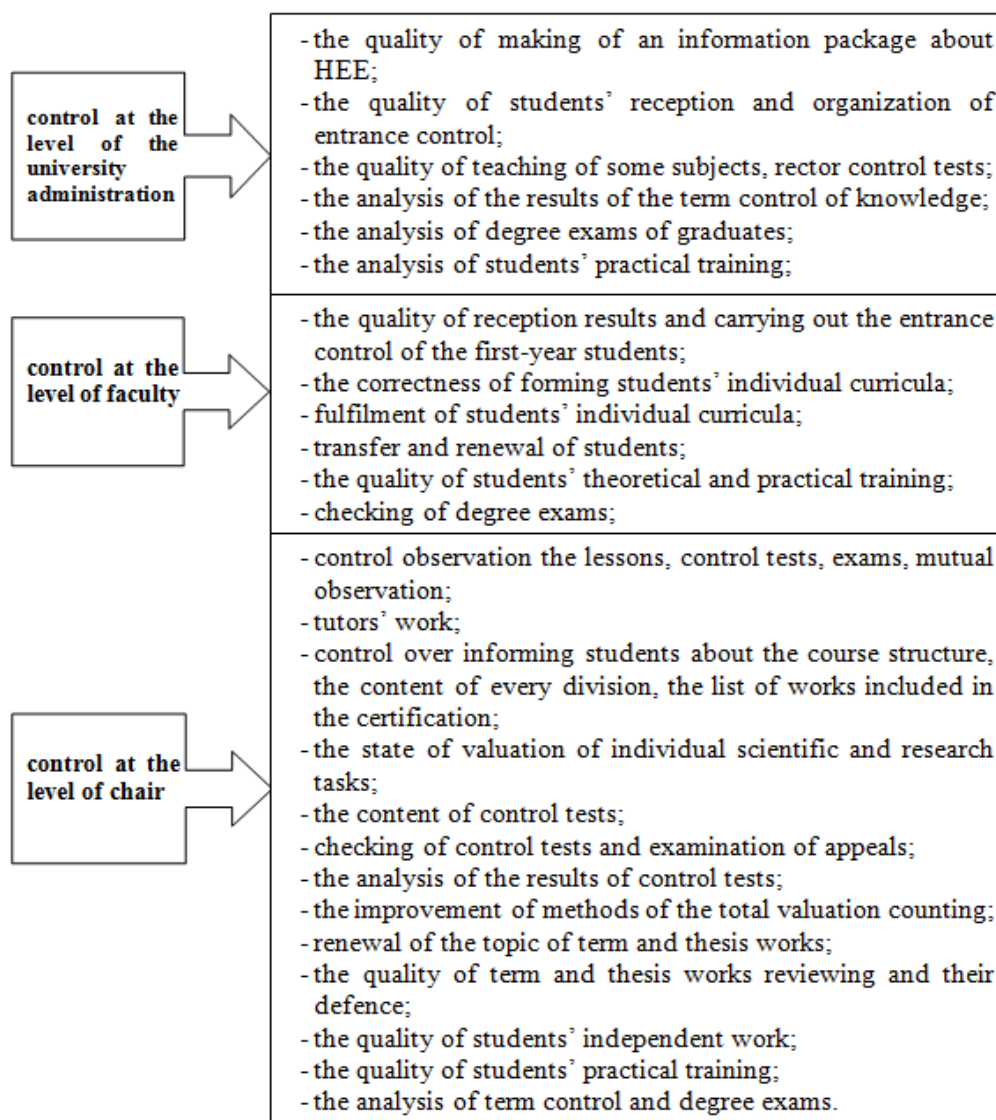| control at the level of the university administration	- the quality of making of an information package about HEE; - the quality of students' reception and organization of entrance control; - the quality of teaching of some subjects, rector control tests; - the analysis of the results of the term control of knowledge; - the analysis of degree exams of graduates; - the analysis of students' practical training;
control at the level of faculty	- the quality of reception results and carrying out the entrance control of the first-year students; - the correctness of forming students' individual curricula; - fulfilment of students' individual curricula; - transfer and renewal of students; - the quality of students' theoretical and practical training; - checking of degree exams;
control at the level of chair	- control observation the lessons, control tests, exams, mutual observation; - tutors' work; - control over informing students about the course structure, the content of every division, the list of works included in the certification; - the state of valuation of individual scientific and research tasks; - the content of control tests; - checking of control tests and examination of appeals; - the analysis of the results of control tests; - the improvement of methods of the total valuation counting; - renewal of the topic of term and thesis works; - the quality of term and thesis works reviewing and their defence; - the quality of students' independent work; - the quality of students' practical training; - the analysis of term control and degree exams.

Fig. 1. Structure of the system of internal control over the quality of specialists training

Carrying out the control over the use of OSNT in HEI such principles should be followed:

– planning – to predetermine the interval of the use of OSNT because frequency, sequence and forms of their application increase their effectiveness;

– systematic – to continue the use of OSNT in everyday activity of the participants of the educational process;

– diagnostic – to determine defects of OSNT functioning in the educational process, the gaps in students' knowledge;

– diversity – to improve forms and methods of control using the OSNT;

– universality and thoroughness – all subjects and all the aspects of the educational process should be controlled when use the OSNT;

– effectiveness – eliminating the revealed defects;

– democracy, adhering to ethical standards and benevolence.

It is advisable to consider university control over the inculcation of OSNT internally at two levels: control over the quality of specialists training (fig. 1) and control over managerial activity (fig. 2).
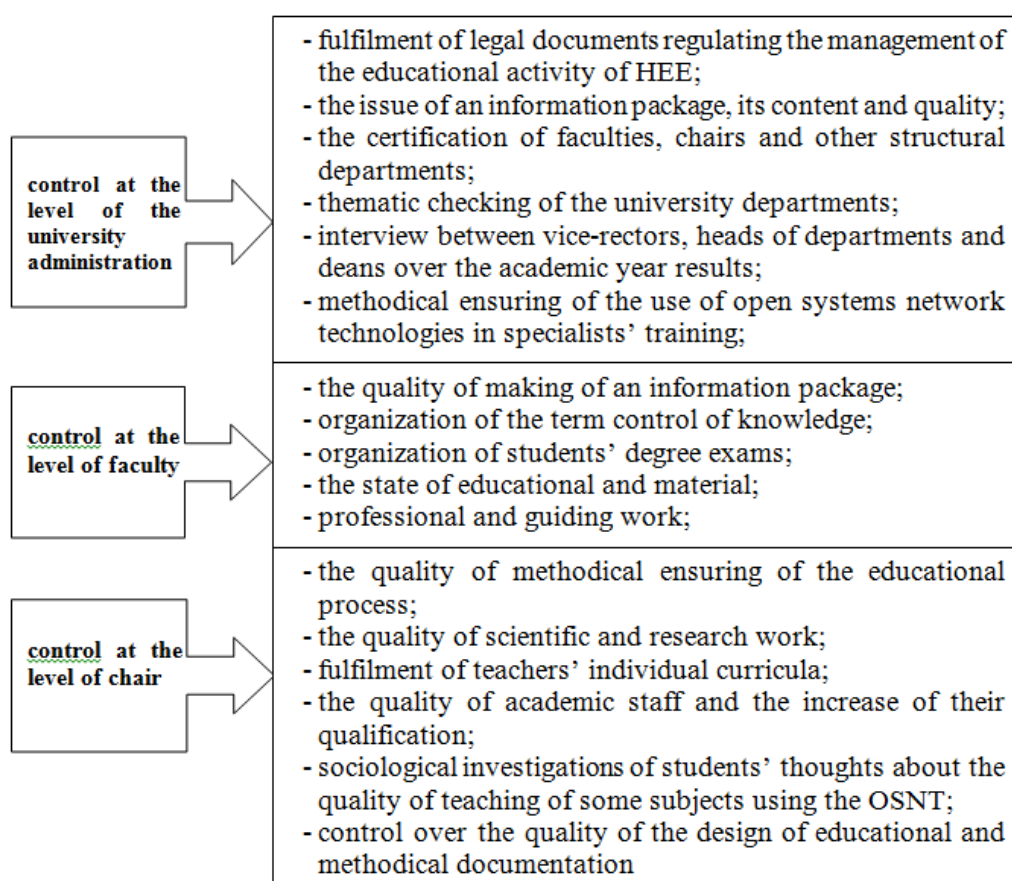

Fig. 2. Structure of the system of internal control over managerial activity

Features of the use of OSNT by future Bachelors of Informatics

It is necessary for the university entrants to have pedagogical abilities. It is a set of personality's psychological features necessary for successful mastery of pedagogical activity, its effective implementation. The use of OSNT furthers the demonstration of pedagogical abilities.

OSNT should be used in all forms of the educational process of future Bachelors of Informatics: lectures, seminars, laboratories, individual lessons, independent work and other types of students' educational and scientific and research activity. It is important to increase the level of coursework with the use of OSNT.

The use of OSNT is an integral part of educational work. They (i) enable to save time, (ii) further individualization and differentiation of the educational process, (iii) increase students' activity, (iv) simplify the organization of interdisciplinary connections, (v) help to form a complete theoretical basis, (vi) facilitate the process of knowledge self-control, (vii) impel to use practical computer skills to solve professional problems.

The most accessible way to get professionally meaningful information is the use of Internet. To realize independent work in the educational activity successfully students must be able:

i. to use search systems, electronic libraries,
ii. to find the necessary study material and apply it in independent work,
iii. to use electronic textbooks.

To our mind, it is effective to use educational and control programs in the process of training of future Bachelors of Informatics. They act as a "virtual teacher" connecting an electronic textbook and a system of progress control.

Electronic lectures will also increase the level of educational work, as they:

i. will combine audio and video information, graphic images,
ii. will enable to read additional literature through the hyperlink.

The computerization of libraries is an important aspect. The electronic fund simplifies the process of searching for the necessary literature, enables a quick analysis of different approaches to a particular topic and simultaneous use of literature by several readers.

Features of the use of OSNT by the academic staff

To develop the university using the OSNT the academic staff should follow such conceptual principles:

– professional and guiding work with comprehensive school graduates and emphasis on the openness of all the necessary information for the entrant;
– specialists' training with the use of OSNT;
– orientation onto the competent Bachelor of Informatics as the final result of the learning process;
– the priority of the scientific work of the teacher over the teaching one;
– educational work of the university teacher considering moral and ethical norms of behaviour in the network.

An important factor of the quality increase of the educational process with the use of OSNT is formation of:

– educational and methodical complex of a subject consisting of regulatory documentation;
– educational and methodical ensuring of a subject: work program; lesson plans; lecture notes; methodical recommendations for carrying out laboratory, practical and seminar lessons; methodical recommendations for independent work; methodical instructions for the course and thesis project.

Teacher of each subject or a group of teachers should work out a package of necessary educational and methodical literature for teaching certain subjects and place it on the chair's or university's website.

Features of the use of OSNT by the administration of HEI and educational and auxiliary staff

University administration should take into account the rational use of computer equipment and ensure it to be used as efficiently as possible for students' learning and independent work.

University administration should follow development of the OSNT and enlist academic, educational and auxiliary staff and students.

The dean's offices should pay particular attention to the introduction of the OSNT at the places, controlling the chairs and announcing the process of their application at the scientific and methodical, academic councils, meetings, etc.

Chairs should prepare electronic versions of those original sources and textbooks which are uncommon but they are used by a course or even by several faculties.

The realization of OSNT can be demonstrated on the example of consideration of the concept of the organization and structure of the chair database. The chair database sometimes is called "a virtual chair" or "an electronic chair". The goal of creating an electronic (virtual) chair is organization and ensuring of network educational process with the use of open pedagogical systems. It is necessary to solve the following tasks:

- to consider the technology of creating the database of the electronic chair;
- to analyze the means of creating electronic educational and methodical materials;
- to create patterns for typical training lessons, practical works, summaries;
- to organize an educational process based on objective knowledge control (computer testing, polls, etc.)
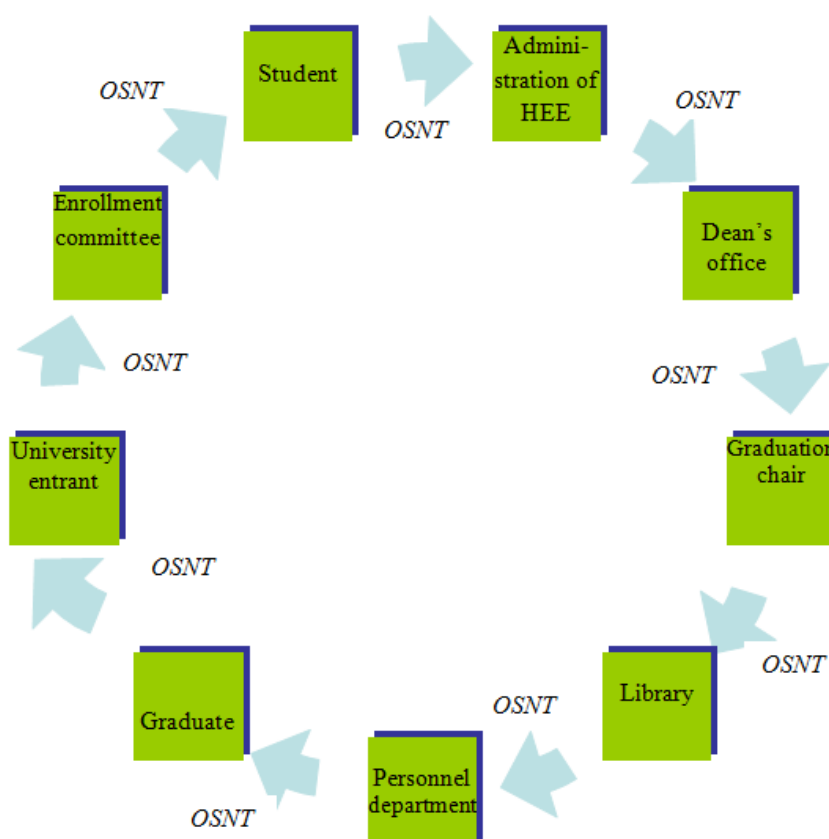

Fig. 3. Scheme of the use of OSNT in the learning process of Bachelors of Informatics

Open systems network technologies completely accompany the process of students studying: from an entrant – to a graduate of the university (fig. 3). Both academic staff forming educational load and working out the educational and methodical complex of subjects and the administration of HEI and educational and auxiliary staff of HEI (enrollment committee, the compilation of lessons schedule, library, personnel department) perform their functions in this circular process.

If you look in more detail, the OSNT ensures:

For a university entrant: electronic application for admission to a university, observation the application of an entrant; presentable information site of HEI.

For an enrollment committee: an automated system of admission to HEI.

For a student: access to the university's website to acquaint with topical information, lessons schedule, educational and methodical complex of subjects, electronic library.

For the administration of HEI: support of the automated system, which divides studying subjects for the courses and terms; distribution of the educational load for the chairs; access of the student to observe studying subjects.

For a dean's office: access to the lessons schedule using modern technologies (mobile and cloud technologies).

For a graduation chair: access to the work program of the subject, lecture notes, methodical recommendations for carrying out laboratory or practical lessons, methodical recommendations for independent work.

For a library: access to the materials of the electronic library of this university and other ones.

For the personnel department: access to materials of students' personal files: admission to university, scholarship appointment, information about tuition, transfer from the course to the course, notes about special student success etc.

For a graduate: a competent specialist.

In summary, the use of OSNT has special features for students, academic staff, university administration, educational and auxiliary staff (table 1).

Table 1.

Features of the use of OSNT for the participants
of the educational process of the university

Student	Academic staff	University administration and educational and auxiliary staff
electronic application for admission to a university	qualitative professional and guiding work	presentable site
observation the application of an entrant	an automated system of the formation of teacher's educational load, filling in his individual curriculum	an automated system of admission to HEI
access to the university's website to acquaint with topical information	presentation of educational material using modern technologies, namely the Internet (electronic lectures, webinars, conferences, technologies of distance learning etc.)	an automated system of the distribution of the educational load for faculties and chairs
access of the student to observe studying subjects a certain level of higher education	transition from a "traditional" teacher to a "virtual" one	an automated system of the distribution of the educational load for the teachers of a certain chair
electronic form of lessons schedule	formation of educational and methodical complex of subjects with open access for the student	access to materials of students' personal files: admission to university, scholarship appointment (for state orders), information about tuition (for fee-paying form), transfer from the course to the course, notes about special student success etc.

Student	Academic staff	University administration and educational and auxiliary staff
an electronic calendar with the possibility to view the events by other students, groupmates, graduation chair, faculty (institute) or university	downloading methodical textbooks into the electronic library of the HEI	experience exchange between universities at the national and international level
educational and methodical complex of subjects with open access	flexible working schedule using modern mobile devices, cloud services, social networks, video conferences	international exchange of students
access to the university's electronic library	constant increase of qualification, trainings, seminars	maintaining the image of the university

Recommended organizational measures for the introduction of OSNT in the universities

The introduction of OSNT in the process of training students, namely *the future Bachelors of Informatics* should correspond to such objectives:

- − creating favorable conditions for innovative activity;
- − participation in the formation and ensuring of state policy in the field of educational activity;
- − formation of strategic priority directions and checking of their realization;
- − organization and methodological ensuring of modern educational activities;
- − coordination of the activity of the relevant institutions on issues of educational activity;
- − using the achievements of fundamental sciences and acquaintance students with them;
- − learning new in the field of future professional activity.

Academic staff should more actively use the OSNT in the educational process. Nowadays, the university teacher must be able to motivate the student and guide his activity so that he has a desire to learn and discover something new. The teacher must not only be able to model and solve pedagogical situations, furthering (i) the improvement of the personality's emotional and volitional spheres, (ii) his pedagogical technique, (iii) pedagogical skills and personal qualities. A teacher must also (i) use various forms of open learning, which consider the specifics of professional activity, (ii) impel students to work actively and independently to acquire new knowledge and methods of subject teaching. Teacher functions are changing. He acts more as an assistant, preceptor, counsellor.

The university administration and the educational and auxiliary staff of HEI should realize such conditions:

- − ensuring with modern material and technical base;
- − purchase of licensed software;
- − accordance of the training classrooms to modern norms and requirements;
- − placing educational and methodical ensuring of subjects, normative documents, general information about the university activity in the open access;
- − creation of favorable conditions for the teachers on approaches to teaching subjects;
- − ensuring teachers' and students' knowledge about the possibilities of using the OSNT through the organization of corresponding seminars, trainings, conferences, workshops and other training and educational events.

Conclusions. To inculcate the OSNT into the educational activity of the pedagogical university, they should consider the development measures for the university informatization using the OSNT (table 2).

Table 2.

Recommended measures for the universities inculcating the OSNT

№	Task	Deadline	Responsible
1.	Direction of using the OSNT (i) to adapt the ideas of openness; (ii) to strengthen the role of students' independent work; (iii) to ensure the flexibility of curricula and students' opportunities to study on the basis of individual curricula; (iv) to achieve the high quality of preparation for needs and requirements of the labour-market	constantly	university administration, faculty deans (institute directors), heads of chairs
2.	Giving students an open information about subject studying, which contains (i) the subject structure, (ii) the list of works included in the certification, (iii) methods and criteria for valuation of student's current work, (iv) examination variants	at the beginning of the term	course lecturers
3.	Giving student the opportunity to form an individual curriculum in accordance with interests, abilities and future work being observed by the tutor of the corresponding specialty	at the beginning of the term	faculty deans (institute directors), educational and methodical department
4.	Formation of the educational process schedule in accordance with the individual curricula and its presentation in the open access	at the beginning of the term	faculty deans (institute directors)
5.	Giving students the opportunity to get the second higher education in another specialty without violation the schedule of the educational process of the main specialty	at the beginning of the term	faculty deans (institute directors)
6.	Creating conditions for students' independent work (library work, elaborating of methodical ensuring, revision of the schedules of computer classes work, etc.)	at the beginning of the term	director of the library, heads of chairs
7.	Moral and material encouragement of group tutors	constantly	educational and methodical department
8.	Consideration of the need of higher education openness in the structure and the content of curriculum of Bachelors' training	constantly	faculty deans (institute directors), heads of chairs

№	Task	Deadline	Responsible
9.	Coordination of the topic of scientific and research works and the structure of training of candidates (doctors) of sciences to the requirement of higher education fundamentalization	constantly	head of postgraduate studies and doctoral studies department, heads of chairs
10.	Work out electronic textbooks for professional subjects, creation of author's teams for writing electronic textbooks on specialty	constantly	all the chairs
11.	Participation in Ukrainian and international competitions on the training of future teachers for the effective use of OSNT in the educational process	constantly	all the chairs
12.	Work out educational and methodical materials for the use of OSNT and their approbation	constantly	all the chairs
13.	Strengthening the role of fundamental training in the learning process, namely the professional and methodical training for the use of OSNT	constantly	heads of chairs
14.	Making corrections to the experimental materials for the application of OSNT in the educational process and their approbation	constantly	all the chairs

Moreover, a plan for the introduction of OSNT into the work of the university should be formed. It should be based on the principles: (i) of purposefulness (purpose, task, content of the use of OSNT in the educational process); (ii) of science (implementation of the achievements of psychological and pedagogical science, optimal correlation of theoretical and practical material concerning the OSNT); (iii) of a complex approach (content and time combination of all components of the learning process with the use of OSNT); (iv) of expediency (concrete measures for the inculcation of OSNT for students, academic staff, university administration, educational and auxiliary staff); (v) of consideration of specific features (educational and material base, personnel); (vi) of the control over the plan fulfilment.

To realize these measures, a positive attitude, competence and motivation of all the participants of the educational process are necessary. Teachers' readiness for innovations and their desire for the professional self-improvement will contribute the introduction of innovative technologies and the organization of the educational environment at a qualitatively new level.

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РЕКОМЕНДАЦІЇ З ВИКОРИСТАННЯ МЕТОДІВ ВІДКРИТИХ СИСТЕМ У ДОСЛІДЖЕННІ МАЙБУТНІХ БАКАЛАВРІВ ІНФОРМАТИКИ

У статті представлено рекомендації щодо використання мережевих технологій відкритих систем (OSNT). Визначено пріоритетні напрями використання ОСНТ та обставини їх впровадження у закладах вищої освіти (ЗВО). Моделюючи процес підготовки фахівців, слід проаналізувати всі його аспекти (навчальні, наукові, організаційні, управлінські, навчальні тощо). Важливо використовувати мережеві технології відкритих систем в освітньому процесі ЗВО. Теоретично обґрунтовано перехід до системи організації освітнього процесу із застосуванням ОСНТ. Такий перехід вимагає, щоб університет представив інформаційний пакет про заклад та студентського координатора навчального процесу. Стаття присвячена процесу підготовки бакалаврів інформатики. Визначено, що інформування майбутніх бакалаврів інформатики про організацію їхньої навчальної програми, особливостях контролю якості навчання та управлінської діяльності здійснюється на всіх рівнях управління: кафедра, деканат, адміністрація університету. Описано особливості використання ОСНТ усіма учасниками освітнього процесу ЗВО. Обґрунтовано, що ОСНТ повністю супроводжує процес навчання студентів. Вчений колектив формує навчальне навантаження та розробляє навчально-методичний комплекс предметів. Адміністрація ЗВО та навчально-допоміжний персонал ЗВО (комісія з зарахування, формування розкладу уроків, бібліотека, відділ кадрів) також виконують важливі функції в процесі навчання студентів. Відбір ОСНТ для закладів вищої освіти повинен здійснюватися за такими характеристиками: (i) підтримка управління; (ii) прихильність до кінцевого споживача; (iii) встановлення тривимірної взаємодії; (iv) обслуговування користувачів.

Ключові слова: мережеві технології відкритих систем, бакалавр інформатики, викладачі, адміністрація ЗВО, навчальний та допоміжний персонал.