РОЗДІЛ VII. ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНІ ТЕХНОЛОГІЇ В ОСВІТІ

OPEN WEB RESOURCE "MODERN OPERATING SYSTEMS"

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One of the priorities of the higher education modernization program is the introduction of open training courses into the educational process. The advantages of an open training course are the ability to provide access for all subjects of training to independent work and all those who do not have the opportunity to study in higher education institutions in person. The authors of the article created the Open Web-resource "Modern operating systems" (http://surl.li/bicy) for the field of knowledge: 01 Education / Pedagogy, specialty 014 Secondary education and introduced it in the educational process. During the creation of the open web resource, the scientists defined the purpose and objectives of the course, divided the educational information into separate blocks; consistently provided information according to a certain logic; made up questions to secure the content of the open course. The purpose of the course is to form students' perceptions of the requirements for operating systems, a history of development, and classification. Provide them with knowledge related to operating systems and their development. Using the operating systems of the MS Win2K (Windows 7 or Windows 10) and GNU Linux (Ubuntu Linux) families as an example, study process control systems, memory management, file system operation, and input-output control systems.

Creating of own open web resources requires more flexibility, detailed content development, and careful planning. The teacher should be able to: determine the goals and objectives of the course, divide the educational information into separate blocks; consistently submit information according to a certain logic. The open resource "Modern operating systems" activates students' cognitive, creative activity, is a necessary resource for students' distance learning due to the epidemiological situation (COVID-19 coronavirus spread), which occurred in spring 2020 not only in Ukraine, but throughout the world.

ВІДКРИТИЙ ВЕБ-РЕСУРС «СУЧАСНІ ОПЕРАЦІЙНІ СИСТЕМИ»

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Ключові слова: веб-ресурс, сучасні інформаційні технології, операційні системи, GNU Linux, електронний навчальний продукт.

Одним із пріоритетних напрямів програми модернізації вищої школи є розширення освітнього інформаційного простору, реалізація принципу неперервної освіти, впровадження в освітній процес відкритих електронних навчальних курсів. Стаття присвячена перевагам відкритого навчального курсу – можливість реалізувати доступ всіх суб'єктів навчання до самостійної роботи та всіх тих, хто немає змоги навчатися у закладах вищої освіти очно. У статті розглядається власний відкритий веб-ресурс «Сучасні операційні системи» (http://surl.li/bicy), який створений авторами статті для галузі знань: 01 Освіта / Педагогіка, спеціальності 014 Середня освіта та впроваджений в освітній процес. Під час створення власного відкритого веб-ресурсу науковці визначили мету і завдання курсу, поділили навчальну інформацію на окремі блоки; послідовно подали інформацію за певною логікою; склали запитання для закріплення змісту відкритого курсу. Мета курсу полягала у формуванні

уявлення студентів про вимоги до операційних систем, історію розвитку, класифікації, забезпеченні їх знаннями, які пов'язані з операційними системами та їх розвитком. На прикладі операційних систем сімейств MS Win2K (Windows 7 чи Windows 10) та GNU Linux (Ubuntu Linux) вивчаються системи керування процесами, керування пам'яттю, робота файлових систем, системи керування вводом-виводом. Створення власних відкритих веб-ресурсів вимагає більшої гнучкості, детальнішої розробки змісту, ретельнішого планування. Викладач повинен уміти: визначити мету і завдання курсу, поділити навчальну інформацію на окремі блоки; послідовно подати інформацію за певною логікою. Відкритий веб-ресурс «Сучасні операційні системи» реалізує філософію «педагогіки соціального конструкціонізму» й орієнтований на взаємодію викладача та студентів у процесі навчання. Цей курс активізує пізнавальну, творчу діяльності студентів, є необхідним ресурсом для дистанційного навчання студентів у зв'язку із епідеміологічною ситуацією (розповсюдження коронавірусу COVID-19), яка склалася навесні 2020 року не лише в Україні, а й в усьому світі.

Statement and substantiation of the urgency of the problem. The rapid development of modern information technologies improves the educational process, the quality of education, effectively integrates it into the global and European educational space [19; 21, pp. 427–440].

Development of open educational courses, pedagogical software, creation of distance education systems is an important condition for modernization of education [2, pp. 1403–1419; 4, pp. 16–20; 5; 8, pp. 988–1013; 13, pp. 52–60; 14, pp. 678–685; 18]. The main task of informatization of modern education is active interaction of the user with the e-learning product [3; 17, pp. 407–410; 16, pp. 57–72; 20, pp. 349–360].

Literature Review. The most systematic materials of implementation and use of information and communication technologies, open learning, blended learning, distance learning in higher education are reflected in the works of the following scientists: A. Babii, A. Bollin, O. Burov, O. Cherednichenko, A. Chernodub, M. Davidovsky, H. Dobrovolskyi, V. Domkin, A. Doroshenko, S. Dyadun, V. Ermolayev, R. Gamzayev, A. Hlybovets, I. Ivanov, V. Janev, V. Kharchenko, V. Kobets, H. Kravtsov, S. Kryukov, V. Kukharenko, V. Kuklin, V. Liubchenko, E. Malakhov, O. Molchanovskyi, M. Nikitchenko, Y. Nosenko, G. Semanisin, S. Shmatkov, V. Starko, M. Tkachuk, M. Vinnik, M. Vladymyrova, A. Yerokhin, I. Zaretska, G. Zholtkevych. Foreign scientists M. Melda, H. Maksum, E. Indrawan and D. Yuvenda [12, pp. 387–399] emphasize the importance of implementation and use of information and communication technologies and prove experimentally the impact on student motivation. Scientists H. Bao and X. Zhao [1] also point out the improvement of students' learning interests, positive impact on their self-study and analytical abilities.

A study by L. Sawsen and Kh. Hager [9, pp. 3347–3373] is very important to test whether technological factors affect the preservation of online courses. As a result, a theoretical model was tested that covers seven variables: performance expectancy, effort expectancy, social influence, facilitating conditions, attitude, anxiety and persistence in online courses. Three moderation variables (gender, age, and previous course experience) were also considered in the analysis. Also, important are data from a study by M.A. Griffiths, V.A. Goodyear and K.M. Armour [6] that describe how professional students respond to massive open online courses to inform their practice.

The purpose of the article is to describe the use of open e-learning course "Modern operating systems" at the Faculty of Physics and Mathematics of Volodymyr Vynnychenko Central Ukrainian State Pedagogical University for students of specialty 014 Secondary education (mathematics, computer science) (http://surl.li/bicy).

Presentation of the main material with justification of the obtained results. One of the priorities of the higher education modernization program is the introduction of open training courses into the educational process [15]. Open source web-based learning is seen as a modern educational technology, as a kind of distance learning that makes it possible to place educational information on Internet sites, making it accessible to everyone [3; 7; 10, pp. 175–188; 16, pp. 57–72; 11].

In modern conditions, there is a need to obtain higher education remotely [4]. The advantages of an open training course are the ability to provide access for all subjects of training to independent work and all those who do not have the opportunity to study in higher education institutions in person:

1. Students who lack time.
2. Professionally employed.
3. Territorial distance from the educational establishment.

4. People with disabilities.

5. Epidemiological situation, quarantine.

Open electronic training courses are created by highly qualified teachers, practitioners from different fields in a special educational environment through the use of modern ICT.

Open learning enables students to improve the quality of education, has a positive impact on personal development, increasing level of self-organization and responsibility.

Students receive full electronic lecture notes, guidelines for laboratory work, practical tasks, and knowledge control tasks.

Characteristic features of open source:

– flexibility – learning at a convenient time and in a convenient place;

– modularity – each individual course creates a holistic view of a particular subject area;

– parallelism – training is carried out in parallel with production activities;

– scalable audience – simultaneous work of students from small group to several universities;

– equality – equal educational opportunities regardless of health status;

– manufacturability – the use of new information technology advances;

– new teacher role – coordinates the learning process and constantly improves the course.

Authors of the article improve the effectiveness of the educational process by developing open training courses and posting them on the Wiki website (http://surl.li/biec).

Considering the new educational trends and the great benefits of open learning, we have created the Open Web-resource "Modern operating systems" (http://surl.li/bicy).

This electronic resource "Modern operating systems" has an important practical application. During the COVID-19 coronavirus pandemic, many educational institutions switched to online distance learning.

Providing both external and internal operational feedback, electronic educational resources as a component of the training system made it possible to exercise pedagogical control, self-control, and adjustment by the organization of students' educational activities.

It was necessary to quickly modernize the education system. Provide equal access for all participants in the educational process to high-quality educational and methodological materials, regardless of their place of residence and form of study.

The electronic educational resource "Modern operating systems" developed by us corresponds to the curriculum of the academic discipline Modern operating systems for specialty 014 Secondary education (computer science). This course was used in the lessons at the Volodymyr Vynnychenko Central Ukrainian State Pedagogical University for teaching 1st and 2nd year students, bachelor level, specialty 014 Secondary education (informatics), study groups MI19b, INF19b, INF20b.

During the development of an open learning environment for the course "Modern operating systems", we have taken into account modern elements of learning technologies, such as multimedia, interactivity, and the provision of educational material depending on the previous result (Figure 1).

Purpose of the course: to form students' knowledge about requirements for operating systems,

Fig. 1. Main page of course

Fig. 2. Course content

history of development, classification. Provide them with knowledge related to operating systems and their development. The student must understand the concepts of "process", "processor", "virtual memory" and others. Using the operating systems of the MS Win2K (Windows 7 or Windows 10) and GNU Linux (Ubuntu Linux) families as an example, study process control systems, memory management, file system operation, and input-output control systems.

Tasks: consider the current state of operating systems, development trends, the latest research. To form students' skills to work in the environment of operating systems, such as commercial or free operating systems. To acquaint students with operating systems that are different in principles of work and structure. Show the advantages and disadvantages of these systems. Introduce students to the tools of operating systems being studied.

The training course consists of five main content modules (Figure 2):

1. Introduction to the course.

Змістовий модуль 4. Процеси

Тема 1. Процеси в Linux. Стани процесів. Опис. Керування процесами. Моніторинг процесів в системі. Команда ps. Програми top, htop, pstree.

1. Процеси та їх стани
2. Стани процесів
3. Призупиненні процеси
4. Контекст і дескриптор процесу. Перемикання процесів

До моніторингу процесів в Linux

Тема 2. Потоки. Стани потоків. Багатопоточність. Потоки та нитки в Windows. Класифікація багато поточних систем. Структура процесу в Windows. Діаграма станів потоків в Windows.

1. Процеси та їх приоритети (Windows). Створення та завершення процесів у Windows.
2. Нитки
3. Потоки та нитки в Microsoft Windows

До моніторингу процесів в Windows

Fig. 3. Module "Processes"

Матеріали для самостійного опрацювання

1. Операційна система Windows
2. Класифікація Операційних Систем
3. Встановлення Windows XP на VirtualBox
4. Встановлення Linux Ubuntu на віртуальну машину
5. Основні можливості віртуальних машин
6. Сучасні мобільні операційні системи
7. Операційна система реального часу
8. Алгоритми синхронізації
9. Що краще: Windows або Linux?
10. Склад операційної системи і призначення компонент
11. Управління процесами в Linux
12. Об'єкти USER і GDI
13. Архітектура пам'яті в Windows: міфи і легенди
14. Прихована операційна система смартфонів
15. Базова архітектура UNIX
16. Як створити новий розділ диску за допомогою Gparted
17. Вірус Linux.Wifatch захищає маршрутизатори від злому
18. Створення SWAP-файла в Ubuntu

Fig. 4. Self-study materials

2. GNU Linux operating system.

3. Users and file rights.

4. Processes.

5. Virtual memory.

For example, consider the fourth content module "Processes" (http://surl.li/bids) (Figure 3).

The lecture material of the module is presented in two topics:

Topic 1. Processes in Linux. The states of the processes. Description. Process management. Monitoring of processes in the system. The ps. command. Top, htop, pstree programs.

1. Processes and their states (shorturl.at/ajJM1).

2. Process states (shorturl.at/koyAK).

3. Suspended processes (shorturl.at/agGJ8).

4. Process context and descriptor. Switching processes (shorturl.at/fmvJ1).

Topic 2. Streams. Streams states. Multithreading. Streams and threads in Windows. Classification of many current systems. Process structure in Windows. Streams chart for Windows.

1. Processes and their priorities (Windows). Creating and ending processes in Windows (shorturl.at/wzJQ2).

2. Threads (shorturl.at/oCDMO).

3. Streams and threads in Microsoft Windows (shorturl.at/cIJSY).

For successful completion, each lab work is completed with methodological guidelines for students:

– monitoring processes in Linux (shorturl.at/bgQV0);

– monitoring processes in Windows (shorturl.at/glsHI).

Laboratory work of the "Processes" module provides for work in two operating systems: Windows and Linux. The tasks of laboratory work are of a research nature, and the tasks themselves are mirrored for both operating systems (Table 1).

Developed a differentiated system for evaluating laboratory work "one condition – one point" (Table 2).

During the course "Modern operating systems" students are given a set of questions for independent work (Figure 4). Execution of independent work is fixed on personal pages of students, and links to works are published on the course page: shorturl.at/gtwC2.

Each content module contains additional teaching materials developed by teachers and prepared by students, for organizing a workplace for laboratory work and as auxiliary material for assimilating theoretical material. For example, when studying the topic "Virtual Machines", the supporting material can be viewed at the link: shorturl.at/dCEI8.

The training course ends with the execution of test tasks at testing.cuspu.edu.ua.

Conclusion. Creating of own open web resources requires more flexibility, detailed content development, and careful planning. The teacher should be able to: determine the goals and objectives of the course, divide the educational information into separate blocks; consistently submit information according to a certain logic; compose questions to consolidate the content of an open course.

Developed an open web resource "Modern operating systems" (http://surl.li/bicy) for the field of knowledge: 01 Education / Pedagogy, specialty 014 Secondary education implemented in the educational process and is used in the current year.

The open resource is not only a means of activating students' cognitive, creative activity, but is objectively conditioned by the need for the epidemiological situation (COVID-19 coronavirus spread), which occurred in spring 2020 not only in Ukraine, but throughout the world.

Table 1

Comparison of laboratory tasks in different operating systems

Laboratory tasks for the Linux operating system:	Laboratory tasks for the Windows operating system:
1. Monitor processes in the Linux system.	1. Monitor processes in the Windows system.
2. Working in the system, find a demo example for each of the process states.	2. Working in the system, find a demo example for each of the thread states.
3. Install a program-monitor that allows you to constantly monitor the processor load.	3. Install a program-monitor that allows you to constantly monitor the processor load.
The task page link: shorturl.at/mQ379	The task page link: shorturl.at/cxBL6

Table 2

The system for assessing the educational achievements of students

Satisfactory	In a running Linux or Windows operating system, find or simulate three different states of the process (flow).
Good	In a running Linux or Windows operating system, find or simulate four different states of the process (flow).
Excellent	In a running Linux or Windows operating system, find or simulate five different states of the process (flow).

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