e-mentor

DWUMIESIĘCZNIK SZKOŁY GŁÓWNEJ HANDLOWEJ W WARSZAWIE
WSPÓŁWYDAWCA: FUNDACJA PROMOCJI I AKREDYTACJ KIERUNKÓW EKONOMICZNYCH

2025, nr 2 (109)

Janáková, M., & Suchánek, P. (2025). Changes in the education process to raise interest in creativity and innovations in IT. *e-mentor, 2*(109), 4–12. https://www.doi.org/10.15219/em109.1705

Milena Janáková

Petr Suchánek

Changes in the Education Process to Raise Interest in Creativity and Innovations in IT

Abstract

Rapid changes in society also require changes in education. Emphasis is placed on knowledge and skills, while modern society needs a broader perception of learning supporting key competences as a set of knowledge, skills, abilities, and attitudes for application in society. Information technology (IT) is key to the development of implemented processes and it is natural to think about the challenges for IT education. The purpose of this article is to explore new activities for learning IT that increase students' passion in IT and promote connectivism with an optimal competency framework based on measurable values of learning outcomes. Trust between a teacher and students and an open and creative environment in the classroom are essential for better results in IT education. IT has different variants of solutions and has a special impact on the search for optimal resources and methods using practical examples. The question is how to achieve optimal communication and organization of work while acquiring the necessary competences for the 21st century.

The method is based on a literature review and practical experience from teaching in a selected course focused on operating systems. The interest is in working in groups, diversifying tasks for seminars and surveys to support better communication, and in creativity and courage in learning. Data were obtained from surveys in which students answered questions, evaluated individual lessons, and specified topics for further assignments in which they would be interested.

Learning experiences and survey analysis show students' interest in variability in IT. The students' responses demonstrate their creative thinking, which is reflected in the diversity of implemented business plans, or in their deep understanding of IT processes. For teachers, it is about collaborating with students, and encouraging their curiosity by actively engaging them in the learning process. Communication was key to finding out more about students' preferences for showing advanced or student-inspired tasks, as well as providing assistance with complicated methods according to students' true needs. Students value freedom, cooperation, thinking about difficulties, or being able to create a plan for future business building using IT.

Keywords: education and learning, knowledge and skills, learning outcomes, information technology

Introduction

The focus of education is acquiring the necessary knowledge and having optimal skills for business practice. The main reasons for precision education include impact on society and support for change (OECD, 2025), with the future of education being shaped by current economic, social, demographic and technological trends. Another reason is the need for inclusiveness, progressiveness and support for changes at the level of society and economic development. For the modern information and global society that has evolved this century, it is a matter of supporting creativity and innovation leading to the stability of society (Trakšelys, 2013). Information and communication technology (ICT) is leading to changes in implemented processes, and artificial intelligence (AI) is causing enormous changes. Data is stored in databases, and IT users have

Milena Janáková, Silesian University in Opava, Czech Republic, https://orcid.org/0000-0001-7087-2777
Petr Suchánek, Silesian University in Opava, Czech Republic, https://orcid.org/0000-0002-5299-9958

to work with it correctly in the optimal format and time. The volume of data is large, and working with it is no longer intuitive. Again, this is a question of new knowledge and skills to use modern technologies.

Modern education addresses a wide range of issues related to the AI-designed approach (Hu et al., 2024), the construction of the teaching system (Yang, 2024), the competence of digital teaching (Shon et al., 2024), education reform and changes driven by digital technology (Wang et al., 2024), improving academic performance (Huang & Chen, 2024), interactive experience (Dune, 2024), impact on student creativity (Zhang et al., 2024), personalised framework in online learning (Amin et al., 2024), quality factors affecting e-learning (Bamaga et al., 2023), the role of educators (Li et al., 2024), support for sustainability (UNESCO, n.d.), usability dimensions (Akpinar & Yörük, 2024), use of ChatGPT in academic activities (Acosta-Enriquez et al., 2024), vision of education (Allman et al., 2024), or also evidence of zero knowledge in education (Xu, 2024).

The global information society co-creates social, cultural and political structures and norms that are associated with a given state or region. The functioning of society includes various aspects of life, values, traditions, and ideologies, but also the necessary technologies and institutions. An essential need of individuals and groups is the corresponding perception of knowledge and skills, which are created by active processes based on the active participation of the individuals. These knowledge and skills are supported by education in various forms. In the field of education, a number of theories have appeared that influence approaches to solving the necessary processes. This is a question of theoretical starting points and practical approaches to education to cause a better acceptance of learning by students regardless of age.

Approaches addressing behaviourism, cognitivism, connectivism, constructivism, and humanism have proven effective over time (National University, n.d.). And it is connectivism that represents the theory of learning for the 21st century. It is an approach that is useful for both students and educators. This approach is based on the use of technologies, which are an indispensable tool of education (learning) with regard to students of generation Z and the subsequent generations. The advantage of connectivism (360 learning, n.d.) is the interest in supporting the ability to search and filter information so that it is possible to conduct reliable research, and work in groups on assigned tasks. These activities combine technology with group and community interaction where learning outcomes help clarify specified expectations. Learning outcomes require systematic SMART access (Specific, Measurable, Agreed Upon, Realistic, Time-Framed).

The values of confidence, curiosity, and creativity for sharing an interest in new approaches and cooperation for practice are important for everyday education with students. From this point of view, the basic principles of connectivism learning theory contribute to effective education and learning (Siemens, 2005): learning and knowledge is based on a diversity of opinions (I), learning is a process of connecting information sources (II), learning may involve use of non-human appliances (III), the ability to know more is defining what is currently known (IV), connections need to be maintained to facilitate continual learning (V), the ability to see connections between disciplines, ideas, and concepts is a basic skill (VI), attaining current knowledge is the goal of connectivist learning activities (VII), and decision-making is a learning process (VIII).

The above-mentioned principles are the starting point for modern teaching of selected courses at the Silesian University in Opava, School of Business Administration in Karvina (SU SBA in Karvina). The topic of this article is changes in education for the 21st century in a selected course that focuses on IT as one of the key trends in the development of the information global society. In order to effectively address this topic (scientific question), a review of the literature was carried out to find out more about current approaches and theories. The necessary data and method were specified, and practical experiences from education (learning) were analysed supported by surveys from the selected course (Operating Systems course). The results were discussed and finally there is space for conclusion and references.

Education for a Creative Society

Society is based on a way of organising the common life of people in a certain place at a certain time. There is significant variability, and the changes are clearly visible. Contemporary society is postmodern, globalised, and informational. It is the next stage of development after the industrial society. The main sectors of employment include agriculture, industry, and services. Emphasis is placed on the processing and correct use of information in the information society (Castells, 2000; Mansell, 2009). Priority is given to thinking, emphasis on lifelong learning, and people's flexibility, which is reflected in the ability to learn new things. Information is important to society as a whole, and is a major strategic resource. IT is essential, and it is wonderful to assume that society will be like a great university for the creation of knowledge (Bell, n.d.; Bell, 1973).

Today's society values innovations and new approaches to solving existing processes. Knowledge from different perspectives is valuable for education to find more about the existing diversity. There is a particular interest in cooperation and connection to build relationships based on new ideas and innovations. It is natural to use applications, social networks and AI in the designed processes. A community of IT users is formed and IT users share their own experiences. This approach encourages developing knowledge and being more critical. A special requirement is the ability to learn this volume of knowledge in real time (Siemens, 2005). Such challenges require the ability to see connections between disciplines, ideas

and concepts. It is a learning environment that fosters a new learning opportunity based on human connection. Society is developing very fast, and it is natural that the current knowledge may change in the future. Thus, the knowledge gained will have to constantly evolve as new understandings emerge.

In relation to this reality, creativity is the central concern. Creative education is an essential key for the development of society. For example, a study by Adobe says that 82% of business leaders believe creativity is the most important skill for the future of work (Adobe, 2022). Creative thinking is important to prepare people (students) for new methods of making positive changes in the world. Creativity is based on the ability to create different opportunities in different ways. The topic of creativity is closely related to business and involvement in social challenges, related to the environment, for example. Getting involved and looking for different solutions is a way to develop creative and critical thinking.

In education, assigned tasks relate to accredited study programmes and courses according to syllables. These texts are more formal, but it is good when the teacher is able to create a space where creativity is encouraged due to the available time, so that *free play* has different results. For this time, the question is finding optimal resources and information, learning a suitable method of problem-solving, and practical examples of cooperation with others in learning groups. An important part of this way of teaching is encouraging students to ask questions, explore new things, and be open to different ideas between learning groups. Thus, curiosity is an important part of creativity (UKEssays, 2018) because creativity leads to innovations. An inspiring approach is evident in the pillars of the education model (Davidson & Goldberg, 2009; Davidson & Goldberg, 2010) to rethink learning and develop skills according to current challenges for education and university education. These pillars include a decentralised pedagogy, networked learning, open-source education, learning as connectivity and interactivity, or lifelong learning. The main concern is the promotion of collective learning, cooperation, and learning as a part of society and culture. Today's students learn to solve specific tasks by default, but new situations and challenges require the ability to adapt and improvise in responses and work methods.

Education for Information Technology

The development of the information society is based on the support of education and the constant addition of knowledge, professional flexibility and new possibilities based on the creative abilities of people, increasing the ability to respond to changes, new possibilities of applying cultural traditions, a qualitative shift in respecting ecological requirements and saving natural resources and the environment (Digital Future Society, 2022). Education plays a unique role in promoting access to knowledge and proven methods, but there is also an important interest in creativity and curiosity. This learning is like planting the seeds for a more creative society (Resnick, 2007). IT has great potential to help design implemented processes and process stored data, systematically supports innovation and creativity in society, and also needs creativity for its development and IT users' interest in better solutions.

IT development has close ties to mathematics and languages for the use of algorithms, and now it is only one step away from programming, modelling and simulations to find the optimal solution based on IT implementation. Again, the key to innovations is knowledge. Knowledge that provides control over implemented processes and data processing. It is not enough to just have knowledge, but thinking about how to do something and why is important in a rapidly changing society (Romeike, 2008). Early learning is all about browsing, clicking and chatting to learn more about a chosen topic. It is a special moment to browse the Internet for inspiration and interesting ideas. For working in groups, it is useful to specify the roles of the members of these teams, and thus communication skills are needed. It is not just about browsing, clicking and chatting on the Internet. It is necessary to support the ability to analyse the results obtained. This ability is about assessing the credibility of sources and their selection in terms of quality. The ability to analyse and synthesise the collected data is extremely valuable, as young people from Generation Z and other generations have significant problems with this (Majewska, 2021). The results of this approach have greater variability, and it is possible to try one's own unique way, to be inspired by another suitable solution, or to look for a way to modify it. The final step of this learning is the specification of a solution, which is verified and presented in learning groups (Center for Teaching and Learning, n.d.).

From the point of view of current trends, a set of knowledge, skills and attitudes is important for a person who acquires them to successfully manage tasks and situations (Šimek et al., 2024) in real life. The competency framework (CF) is made up of knowledge, skills and attitudes. Knowledge is an understanding of facts, information, and skills acquired through experience or education. It is a theoretical and practical understanding of a chosen topic, object, person, thing, idea or situation. Attitude is a summary assessment of the topic (subject) of thinking. Attitudes are perceived as self-confidence and responsibility to lead proactivity, toughness, and openness. Education is about willingness to learn and respect for sustainability. In practice, attitudes have a positive effect on commitment to lifelong learning, creative and innovative thinking, passion for technology, and willingness to collaborate.

A passion for IT may be manifested as the ability to demonstrate the implementation of a selected application in various ways and to be able to create new effective methods of implementation. IT has a large volume of proven methods and methodologies, but innovation requires creativity and is a deviation from the standards. The reason is natural, as better

results may be achieved differently in the future (Ginnis, 2002). The results of IT education related to attitudes, such as student's opinion on the topics being discussed, are specified as the competence to decide, think, summarise, and adopt (PO>STUDIUM, n.d.). The key to assessment is that learning outcomes (Bienertová-Vašků et al., 2016) may be created for each competency. The feasible tasks for demonstrating competence are shown in table 1.

Table 1
Feasible Tasks to Demonstrate Competence

Rank	Feasible task	Demonstrating competence
1.	creating	create a new result
2.	evaluation	defend the position (decision)
3.	analysing	find connections between ideas
4.	using	use information in new situations
5.	understanding	explain ideas or terms
6.	remembering	repeat the terms and facts

Source: authors' own work based on *The concept of creation and development of professional study programs* [Presentation], D. Šimek, T. Pražák, T., & M. Klepek, 2024, Silesian University in Opava, School of Business Administration in Karvina.

At the top of the list of feasible tasks is creating (1). This feasible task focuses on the creation of new results by formulation, design, development, compilation and further research. Evaluation (2) focuses on the process of defending one's own position by argumentation, estimation, assessment, evaluation or critical evaluation of the situation. Analysing (3) is about being aware of differences, looking at connections and contrasts, experimenting, expressing doubts, and verifying. Using (4) is about use, demonstration, and interpretation. Understanding (5) refers to description, discussion, explanation, reporting, and translation. The last on the list is remembering (6), which is repeating and specifying facts and terms. From an IT point of view, there is an interest in computer programming, consulting services and other related activities with a focus on analytical activities, data analysis, database management, software design, and testing. IT is one of the trends of modern society, and IT development has many advantages and challenges. There is also room for innovation, and AI is a more than attractive engine for future development. This reality needs new visions, advanced knowledge, skills, and an approach to designing using modern applications, systems and other tools. There is interest in an automatic solution for better IT support of IT user processes.

Data and Methods

This study uses a mixed-method approach that combines elements of quantitative and qualitative research to gain a more comprehensive understanding of the issue. The surveys contain both closed-ended questions (quantitative component) and open-ended questions (qualitative component). There are questions where students select numbers on a rating system, and others where they are free to provide detailed answers and opinions. Data for the analysis is obtained from surveys and practical experience with students on the Operating Systems course who study full time. These were standard students enrolled in the study, and a total of 75 studies were entered. The necessary data was collected from February 2024 to May 2024 based on ten surveys. The surveys were standardised to ensure uniformity of questions and the way they were presented to respondents, leading to comparability of results. The reason for this choice of method was to ensure that the surveys could be used by all respondents (students) and that the results were reliable. Specifically, the following requirements for consistent question format, clarity and unambiguousness, standardised instructions, and ensuring impartiality and neutrality were addressed. At the beginning of the work with each survey, the purpose of the survey was specified to make it clear what the survey was about. Normalisation of responses was supported by offering possible response options or a rating in the form of a scale, but many of the responses could be entered freely using a text field.

The Operating Systems course is an accredited course for the Managerial Informatics program (Silesian University in Opava, School of Business Administration in Karvina) taught in the summer semester 2024. Lectures and seminars are aligned with the course syllabus, which focuses on the operating system and its structure (1), operating memory and process management (2), peripherals and drivers (3), file systems (4), the service system and network environment (5), application programs and user environment (6), and security and monitoring (7). In the individual tasks, there is interest in active work in the selected Linux/UNIX operating system, graphical environment and terminal, requirements for automation, and possibilities of using AI. The practical tasks are divided into three parts, basic tasks for the topics taught according to the syllabus, advanced examples for inquisitive students, and topics based on the recommendations of the students as to what issues they would like to solve in the seminars. For each assigned task, instructional examples and solutions are available in the form of an operating system story, solved examples of operating system control, presentations, and project tasks; however, the concrete implementation by students is not limited to the demonstrated approach. On the contrary, initiative and other solutions, with an analysis of possible advantages and disadvantages, are welcome in learning.

Surveys were available to students throughout class time during the semester. The surveys were devised by the teacher of this course. The primary goal of the question blocks was to support understanding of IT (key concepts, useful ideas) to lead to the use of IT for new situations based on the connections between ideas. The surveys provided feedback using

questions for motivated active work, thinking about the discussed topic and cooperation in groups. This communication is highly appropriate, because anonymous access breaks down barriers, and reduces fears of possible punishment for an inappropriate answer. Some students had a negative experience with education, and prefer this method of communication. From a teacher's perspective, there is an optimal way to create a creative environment for sharing ideas in the classroom. A positive approach is taken by specifying topics for reflection based on the recommendations of the students as to what they would like to address in the seminars. These topics include running a Windows Server (such as Windows Server 2022) using virtualisation (VMware Workstation Player) or using the cloud using Microsoft Azure, practical monitoring services and running a Windows Server image, or comparing the performance of a selected Linux/UNIX image with Windows performance where virtualisation is running. Two innovation seminars were specifically focused on the application of IT in business and the use of AI. The innovation consisted in connecting operating systems and application hosting through implemented processes in business and after thinking about one's own business plan. Selected questions with answers from the ten surveys are available in tables 2, 3, 4, and 5.

The above-mentioned communication with students is evidence of students' interest in IT and operating systems. Some answers need correction, but it is a good reason for the teacher to focus more on practical work in the specified topics. This moment leads to a discussion. It is a great learning moment,

Table 2

Surveys from the Operating Systems Course, Selected questions about Working Methods in the Linux/UNIX Operating System

Selected questions from surveys	Students' answers
Where and in what file is user account information stored in Linux/UNIX operating systems?	/etc/passwd; usr/bin/psswd; passwd; files – User or bin – bash; etc/passwd and etc/shadow
What is the structure of the /etc/passwd file?	username:password:UID:GID:GECOS:home_directory:login_shell; has a structure with one record per line; name, password, UID, GID, full name, home folder, shell; it is a text database that contains information about all user accounts on the system; each line in the /etc/passwd file represents one user account and contains seven fields separated by colons; „."
Where are the files available for the Apache web server?	subdirectory apache2; directory /lib - drwxr-xr-x 3 root root 4096 Feb 25 10:43 apache2; /etc/apache2; computer/etc/apache2; /apache2
What is the meaning of directories rc3.d a rc2.d?	scripts that run when the computer is turned on; contain symbolic links to startup scripts that are used when switching to the appropriate runlevel; each runlevel represents a certain state of the system in which certain sets of services and processes are running

Source: authors' own work.

Table 3

Surveys from the Operating Systems Course, Selected questions about Experiences with Operating Systems and Course Expectations

Selected questions from surveys	Students' answers
What affects the development of operating systems?	software development, user requirements; hardware development; IT trends, innovation and development (currently mainly AI, windows copilot), competition; market competition, standards and regulations; open-source code; time, money, access
What operating systems do you have experience with?	Windows, Android, iOS, Windows (8, 10, 11); some answers were about Mac OS, Ubuntu
What would you change in your operating system?	increased speed, higher performance; greater possibility for modification; greater variability in iOS; customising some elements and making it free; nothing yet; I am satisfied with it; probably nothing
What do you expect from the Operating Systems course?	get better and better at working with operating systems and user account creating for different users; improving knowledge in this area, introduction to the issue of operating systems; learning the differences between systems and their control; ability to understand more about operating systems and how exactly they work; getting to know new operating systems and working with operating systems; I don't know, it will teach me to navigate the world of technology; the possibility of exploring other operating systems that can be used in future works; I will learn something new, because I don't have much knowledge in this direction

Source: authors' own work.

Table 4

Surveys from the Operating Systems Course, Selected Questions for Advice on Another Topic for Learning and Evaluation of Learning from the Students' Perspective

Selected questions from surveys	Students' answers
Indicate a topic for practical work in the seminar. What did you miss, or what would you like to continue to do?	Windows server; I learned everything important; everything is okay; I am looking forward to the next lessons, where I will learn more advanced things; I lacked nothing; I didn't miss anything; how to work in Kali or other system
Was the topic of the user account and its environment sufficiently presented for you? Would you welcome any further clarifications?	everything clear; I would welcome more hands-on work with accounts; sure yes – it was harder at first but then good; perfect – it was sufficiently presented for me; more emphasis and describe in more detail each command and what we can find out/do with it; yes, it would be better to discuss it in depth
Indicate a topic for practical work in the seminar. What did you miss, or what would you like to continue to do?	application development and functionality; creating an SQL database using a Windows server; an example from practice of how companies use other operating systems and why they use them (pluses and minuses); nothing comes to mind; I don't know; analysis of technologies used by large IT companies
The topic of file systems will also be addressed at the next seminar. What would you like to focus on?	that archiving; faster file data optimisation; I would like to know more about the systems used by Linux; I do not understand that; I have no idea; I don't know; I don't quite understand it, but I try; „."
How are you meeting the expectations of knowing how to manage Linux/UNIX operating systems?	8/10; I know everything we do; I still have to repeat the system monitoring; I'm glad that we cover the subject with this teaching style
Advanced examples are part of the tasks in the seminars. Is the selection of these tasks optimal?	7/10; the tasks are difficult at first glance, but they can be mastered; is optimal; yes they are sufficient; yes, it is optimal

Source: authors' own work.

Table 5

Surveys from the Operating Systems Course, Selected Questions about Practical Work Related to a Business Plan to Reflect on Appropriate IT Integration, and Operating Systems too

Selected questions from surveys	Students' answers
What topic have you chosen for your intended business plan with regard to addressing hardware and software requirements?	streaming platform; start-up cafes; 3D printing company; video game company; drone food delivery company; (Droonora) – an e-shop for the sale of garden tools; baby connect a wristband for newborns or even older children to control their bodily needs via a mobile application; an automatic coffee shop with selected coffee; an AI doctor connected to the distribution of medicines
If you worked in groups, what roles did you assign to individual members?	speaker, researcher, writer, project manager; division into hardware and software; manager and cook; marketing manager, support manager, project manager; one processes orders, the other manages the e-shop, the third packs orders; graphic artist, programmer, marketer, game writer, designer, music; CEO and master
What was difficult in solving the task?	choosing a set topic; big and established competition; food storage and shelf life; creation of an application to pair a finance drone; agree on a start-up topic; distribution; necessary budget for IT; capital and technology; time, finding qualified people, finances
What was easy to solve in the given task?	selection of software; selection of software and hardware; a wide range of customers; workflow; idea, division of roles; hardware devices that we need for the company
What limited you when choosing a solution to the assigned task?	topic selection based on software and hardware requirements; budget; low number of ideas; lack of knowledge of technology; little selection of optimal creators; finance and space for implementation; prices, time
What do you value about your work in this innovation seminar?	freedom; cooperation; group work; the possibility of thinking about the difficulties of starting a company in the group (achieving consensus); I could make a plan for the future business building; communication with each other; we do what we like

Source: authors' own work.

because the discussion is about thinking about how to perform processes better. Some answers are without expressive ability. These are answers of the type ".". The surveys also show the students' journey from simple tasks (user environment) to more complex ones (website or database server administration or using the command line). At the beginning of the lessons, only some students tried the advanced task, but over time they became more confident and were able to solve even the advanced tasks. One of the answers accurately reflects the experience with these tasks: the tasks are difficult at first glance, but they can be mastered. Sometimes students asked about more advanced issues, more hands-on work, or more detailed description of mentioned commands. On the other hand, they also asked for help on a complicated topic, such as file systems. This communication had a positive effect on learning, as the teacher was able to give advanced and gifted students more space, but it is also important to create space for repetition and working with advanced methods for setting up and monitoring operating systems.

Results and Discussion

The results show that learning helps students create their own way of understanding the chosen topics, proceeding step by step with interest, and confident that they are able to achieve their own goals. Communication has been the most important thing in learning, and integrating survey into teaching has unique benefits. Students have the opportunity to have a say about ideas and what they want to do in learning. This approach is singular, because it tries to combine business plans with the topic of the chosen course. From the teacher's point of view, interesting ideas and suggestions from students regarding the integration of IT, including operating system support, into business plans related to start-up cafes, 3D printing companies, drone food delivery companies, or a bracelet for newborns to monitor them using a mobile application. The last business plan was created using IT in detail. The idea of using drones in business was closely tied to AI, which is a key trend of IT development. This reality in education creates better IT support for business and everyday use of IT by students.

There is a meaningful space for monitoring the perception of the study material discussed in learning outcomes. Students are free to ask for help without being concerned about a bad grade. They also have the opportunity to compare opinions with others, and in many cases this fact leads to the topic being discussed. They confirm that everything is clear, they want to have further advanced examples, or they state that they need to repeat the topic again. This is an indispensable moment for learning, because feedback is essential. There was a shift from initial embarrassment to the possibility of mutual discussion on the solved examples, and a greater interest in teaching was shown. This situation is visible in addition to the suggestions of topics such as Windows server, Kali, or a different operating system, creating a web server, and working with the command line. Some of the suggested additional topics were part of the course, but more time could have been devoted to detailed setup of Linux/UNIX operating systems.

The following lines generalise practical knowledge and experience from teaching the Operating Systems course for a better understanding of the process of such teaching. Educational activities (EA) are specified in a manner similar to the function of activities such as lectures (L), seminars (S), and tasks (T) with a focus on basic, advanced and student-inspired, and communication (C) innovatively oriented towards survey communication and communication in teams, and also other types of communication according to student preferences, based on the Teams application from Microsoft, the information system (IS) of the university and, of course, traditional personal communication by words. There is the formula:

$$EA = f(L,S,T,C) \quad (1)$$

When weightings are added to each element of educational activities to monitor its educational importance, then this formula is:

$$EA = w_L L + w_S S + (w_{Tb} \bullet SE)T_b + (w_{Ta} \bullet SE)T_a + \\ + (w_{Ti} \bullet SE)T_i + w_{Cs}C_s + w_{Ct}C_t + w_{Co}Co \quad (2)$$

where L and S are the number of lectures and seminars, T_b,T_a,T_i are the numbers of basic, advanced, and student-inspired tasks, and C_s and C_t indicate the intensity of communication through surveys and teamwork; C_o is for all other types of communication. SE is a factor representing student engagement in the survey and teamwork through feedback, and the symbol w is for weightings that specify the importance of each item. If the CF is made up of knowledge, skills and attitudes, then optimal education requires maximising (EA) to achieve the corresponding CF with links to measurable learning outcomes, so that:

$$CF = f(K, S, A) = max\ (EA) \quad (3)$$

where K represents the volume of knowledge, S represents the volume of skills, and A represents the volume of attitudes.

Evaluation of learning in education is a well-known topic of many conferences and articles. Conferences such as the 6th Barcelona Conference on Education (BCE, 2024), and the 12th European Conference on Education (ECE, 2024), in London, or the 16th Annual International Scientific Conference, Theoretical and Practical Aspects of Distance Learning, (DLCC, 2024), in Cieszyn, show that the real interest is in education and difference, experiences of students and teachers, learner diversity, learning difficulties, lifelong and distance learning, student learning or theories and methodologies. Well-known articles explore the issue

of adaptive learning in university students' opinions (Smyrnova-Trybulska et al., 2022), methodological and technological aspects of using automated programming (Zielosko et al., 2022), happiness levels of students (McKay et al., 2022), or also educational and ethical aspects of AI (Smyrnova-Trybulska et al., 2023) and lifelong learning as a factor of innovative potential (Kuzior et al., 2023). Modern trends in education at universities are focused on technology, discussion, and problem-solving methods, but there is also an emphasis on communication, friendliness and humanity. It is important for universities to have the courage to take an interest in interdisciplinary research and to support groups of students with an active approach to innovation. Such learning is about quality, variability in approach, and internationalization to prepare students for practice with advanced skills.

This study involves surveys and draws on insights gained from lectures and seminars. This method is widely accepted. Similar studies use techniques such as topic-specific analysis within a master's program in information systems (Kurnia et al., 2024) and qualitative feedback collection (Haerawan et al., 2024) to assess how interactive videos can increase student engagement in online learning. Data envelopment analysis procedures (Munteanu & Aldea, 2024) are also used to assess teaching effectiveness in 40 European universities focusing on information technology and communication. Other approaches include the use of interactive simulations and formative assessments through online content (Wijenayake et al., 2022), mixed research methods that integrate standardized assessments with qualitative feedback (Khan et al., 2025), and the use of the Vevox platform for data collection (Zeidan & Young, 2024). Findings from this recent study highlight the effectiveness of group work, simulations and educational videos in increasing student engagement, enjoyment and focus. In terms of future initiatives to support innovative approaches in IT lectures, it is noteworthy that the interventions led to increased interest and greater concentration among students. Further insights can be drawn from research examining the impacts of education system reforms on student learning outcomes (Khan et al., 2025), where formative assessment highlights the need to implement changes aimed at increasing student academic performance. Both quantitative and qualitative improvements in performance, in which all relevant stakeholders play a part, are essential.

Conclusion

This article addresses teaching changes in IT-focused courses with practical experience from an accredited IT course focused on operating systems and their structure. The method employed is based on a mixed approach, and this approach combines elements of quantitative and qualitative research. Specifically, it is a series of surveys with closed and open questions. The closed questions represent quantitative components, and open questions relate to qualitative ones. This feedback monitored the current development of students' knowledge and skills for practical work with operating systems, and understanding of the necessary terminology. A place was created for individual tasks for students with advanced knowledge according to their preferences, to share with others their passion for IT and to encourage students to think creatively. For this reason, practical tasks in seminars were divided into basic tasks in the topics on the syllabus, advanced examples for curious students, and topics according to student recommendations. These tasks operate simultaneously in teaching and develop communication with students.

Communication in the classroom took place without any concerns from the students through surveys aimed at obtaining answers in front of the teacher, and group work was supported. The benefits are visible in the communication and diversity in the learning method due to students' individuality. At the lectures and seminars, the diversity of approach, and cooperation in individual groups and also between them, was visible. The value of such learning for students was in freedom, cooperation, and thinking about a start-up or a business plan integrating the implementation of different IT. For practice, there is a focus on more critical thinking and the ability to learn continuously. It is seen that the students' journey ranges from simple tasks, such as the user interface, to more complex ones, such as managing a website or database server and using the command line. The working environment in the classroom is well characterized by a statement made by a student, that the tasks are *difficult at first glance, but they can be mastered*. From the point of view of IT education, this reality requires a CF made up of knowledge, skills and attitudes based on learning outcomes supporting work in groups and diversifying tasks to find variability in IT implementation.

References

360learning. (n.d.). *What is connectivism learning theory and how can you apply it in learning and development?* Retrieved July 17, 2024, from https://360learning.com/guide/learning-theories/connectivism-learning-theory/

Acosta-Enriquez, B. G., Arbulú Ballesteros, M. A., Huamaní Jordan, O., López Roca, C., & Saavedra Tirado, K. (2024). Analysis of college students' attitudes toward the use of ChatGPT in their academic activities: effect of intent to use, verification of information and responsible use. *BMC Psychology*, *12*, 255. https://doi.org/10.1186/s40359-024-01764-z

Adobe. (2022, August 25). *Adobe "Future of Creativity" Study: 165M+ Creators Joined Creator Economy Since 2020 Creators in the Creator Economy*. https://news.adobe.com/news/news-details/2022/adobe-future-of-creativity-study-165m-creators-joined-creator-economy-since-2020

Akpinar, F. H., & Yörük, T. (2024). Investigation of students' intent to use the online learning platform with usability dimensions. *Acta Scientiarum Technology*, *46*, e64817. https://doi.org/10.4025/actascitechnol.v46i1.64817

Allman, B., Kimmons, R., Dickson-Deane, C., Bozkurt, A., Warr, M., Stefaniak, J., Dash, M., & Bondah, F. E. (2024). EdTechnica: A vision of an educational publishing community of practice that is accessible, flexible, and just. *International Journal of Educational Technology in Higher Education*, *21*, 37.

Amin, S., Uddin, M. I., Alarood, A. A., Mashwani, W. K., Alzahrani, A. O., & Alzahrani, H. A. (2024). An adaptable and personalized framework for top-N course recommendations in onle learning. *Scientific Reports*, *14*, 10382. https://doi.org/10.1038/s41598-024-56497-1

Bamaga, A., Terzis, S., & Zafar, B. (2023). Quality factors impacting e-learning with the mobile environment in Saudi Arabia universities: An interview study. *International Journal of Data and Network Science*, *8*(1), 269–288. https://doi.org/10.5267/j.ijdns.2023.9.025

BCE. (2024). *The Barcelona Conference on Education*. https://bce.iafor.org/bce2024

Bell, D. (1973). *The coming of post-industrial society: a venture in social forecasting*. Basic Books.

Bell, D. (n.d.). Daniel Bell on the post-industrial society. Retrieved July 17, 2024, from https://newlearningonline.com/new-learning/chapter-3/productive-diversity-towards-new-learning/daniel-bell-on-the-post-industrial-society

Bienertová-Vašků, J., Cejpek, V., Gavalcová, T., Pasáčková, E., Rajmon, R., & Valová, L. (2016). *Využití výsledků učení na vysokých školách: příručka pro pedagogickou praxi ve vedení VŠ* [Use of learning outcomes in colleges: Handbook for pedagogical practice and management of universities]. The Ministry of Education, Youth and Sports.

Castells, M. (2000). *The information age: Economy, society and culture*. *Vol. I: The rise of network society*. Wiley-Blackwell.

Center for Teaching and Learning. (n.d.). *Using roles in group work*. Retrieved July 17, 2024, from https://ctl.wustl.edu/resources/using-roles-in-group-work/

Davidson, C. N., & Goldberg, D. T. (2009). *The future of learning institutions in a digital age*. The MIT Press. https://doi.org/10.7551/mitpress/8517.001.0001

Davidson, C. N., & Goldberg, D. T. (2010). *The future of thinking: learning institutions in a digital age*. The MIT Press. https://doi.org/10.7551/mitpress/8601.001.0001

Digital Future Society. (2022, May 17). The rise of the information society: Harnessing the potential of ICTs. https://digitalfuturesociety.com/the-rise-of-the-information-society-harnessing-the-potential-of-icts/

DLCC. (2024). *16th Annual International Scientific Conference, Theoretical and Practical Aspects of Distance Learning*. https://dlcc.us.edu.pl/

Dune, T. (2024, February 26). What is interactive learning and why is it important? *Mandatory Training Group*. https://www.mandatorytraining.co.uk/blogs/education-training/what-is-interactive-learning-and-why-is-it-important

ECE. (2024). *The European Conference on Education*. https://ece.iafor.org/ece2024/

Ginnis, P. (2002). *The teacher's toolkit: Raise classroom achievement with strategies for every learner*. Crown House Publishing Company.

Haerawan, H., Woolnough, C., & Barroso, U. (2024). The effectiveness of interactive videos in increasing student engagement in online learning. *Journal of Computer Science Advancements*, *2*(4), 244–258. https://doi.org/10.70177/jsca.v2i5.1322

Hu, J., Huang, Z., Li, J., Xu, L., & Zou, Y. (2024). Real-time classroom behavior analysis for enhanced engineering education: An AI-assisted approach. *International Journal of Computational Intelligence Systems*, *17*(167). https://doi.org/10.1007/s44196-024-00572-y

Huang, Q., & Chen, J. (2024). Enhancing academic performance prediction with temporal graph networks for masive open online courses. *Journal of Big Data*, *11*(1). https://doi.org/10.1186/s40537-024-00918-5

Khan, A. S., Gallo, A. M., Comite, U., KOÇ, E. S., Alkholi, A. A. S., Prabavathy, M., & Pande, D. (2025). Assessing the impact of education system reforms on student learning outcomes: A longitudinal study. *Journal of Infrastructure, Policy and Development*, *9*(1), 10468. https://doi.org/10.24294/jipd10468

Kurnia, S., Chow, W. W.-Y., & Linden, T. (2024). Technology-enhanced learning in information systems education. In T. Cochrane, V. Narayan, E. Bone, C. Deneen, M. Saligari, K. Tregloan, & R. Vanderburg (Eds.), *Navigating the terrain: Emerging frontiers in learning spaces, pedagogies, and technologies* (pp. 340-344). ASCILITE 2024, Conference Proceedings. https://doi.org/10.14742/apubs.2024.1052

Kuzior, A., Krawczyk, D., Onopriienko, K., Petrushenko, Y., Onopriienko, I., & Onopriienko, V. (2023). Lifelong learning as a factor in the country's competitiveness and innovative potential within the framework of sustainable development. *Sustainability*, *15*(13), 9968. https://doi.org/10.3390/su15139968

The full list of references is available in the online version of the journal.

Milena Janáková is a teacher, researcher and project manager with interests in the fields of databases and operating systems, business intelligence and Customer Relationship Management (CRM). These include applications in education and small and medium-sized enterprises that use creative thinking and the benefits of artificial intelligence. She is employed at Silesian University in Opava, the School of Business Administration in Karvina, Czech Republic. She is the author or co-author of various scientific works published in conference proceedings, encyclopedias or journals.

Petr Suchánek is an experienced researcher dealing with implementation and integration of IS/IT into the business environment and public sector. In this respect, the key issues solved are modelling, mathematical modelling and simulations of socio-economic systems such as e-business systems, logistics systems, manufacturing systems and measuring the benefits of IS/IT, especially in business and in direct relation to Business Intelligence and AI applications. Since 1998, he has been employed at Silesian University in Opava, the School of Business Administration in Karvina, Czech Republic. He is author or co-author of more than 90 scientific works.