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Teaching Specialty Courses Using Educational Applications: Five Teaching Scenarios from Technical Vocational Education

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Abstract

The main objectives of this study are to examine the teaching of specialty courses using educational applications and to assess technology-enhanced learning. More specifically, a unit of analysis of 25 teachers from five different subjects developed five teaching scenarios that utilize specific educational applications. Emphasis was placed on the targeted integration of these applications into the learning process and their framing with participatory and learner-centered educational techniques. According to the teachers participating in the research, the most important criteria for selecting an educational application are the relevance of the application to the teaching unit, the structure and content of the application, the ease of use, the possibility of assessing progress with quizzes and interactive tests, and the free access and use of the application by students. Concerning the benefits of using the apps, these focus on differentiating traditional teaching and providing new learning incentives, enhancing student interest, developing digital skills, enhancing collaborative learning, and lifting time and space constraints. The originality of this research lies in the use of specific educational applications for the development of teaching scenarios for specialty courses.

Keywords: specialty courses, teaching, educational applications, vocational education

1. Introduction

The way a subject is taught is of utmost importance and influences greatly the course of a learning process. By using appropriate teaching methodology and participatory and experiential educational techniques, a teacher can inspire a positive learning climate, activate student participation, and ensure the achievement of the teaching objectives (Papadakis, Kalogiannakis & Zaranis, 2018).

Teaching scenarios can also contribute to this direction, as predefined plans that describe in detail the structure and content of an educational process. The teaching scenarios' purpose is to support the teacher in planning and implementing the teaching, considering the lesson's objectives, students' needs, and available resources. More specifically, teaching scenarios, depending on the particular learning situation, can contribute to the planning and organization of teaching by enhancing the implementation of innovative approaches (Burden & Kearney, 2016; Cederquist & Golüke, 2016).

Moreover, in technical vocational education and training, teaching must keep pace with the latest technological and scientific developments and be updated according to the situation. This is the only way to achieve the best possible learning outcomes, and educational applications are an essential part of this, as they can qualitatively enhance the teaching experience, provide modern learning opportunities, stimulate student interest, and make a lesson more experiential (Bottentuit Junior, 2020; Christensen & Knezek, 2018).

Educational applications are now a common feature of smartphones and tablets. Their use in the learning process is becoming more and more common, especially since the onset of the pandemic (Schmidthaler et al. 2023). Moreover, most students use smartphones and tablets extensively and are highly proficient in using various applications available through these devices (Dias & Victor, 2017). At the same time, many teachers of different disciplines are adopting the use of educational applications.

1.1 Portable Devices

Mobile devices offer a wealth of possibilities for learning. Smartphones, digital music players, pocket computers and personal digital assistants are just a few examples of devices that can be used to facilitate users through sophisticated ways of interaction and communication. The extensive variety of mobile devices and corresponding applications used in the educational setting has transformed the way students enrich their knowledge. As Cui and Wang (2008) point out, smartphones will play a more important role in education. They are powerful tools and feature almost every function of personal computers. Their main advantage is the ability to access the Internet while their availability depends on commercial prices.

The fact that mobile learning is becoming commonplace in both secondary and higher education is not an exaggeration (Dias & Victor, 2017; Matzavela & Alepis, 2021). Several studies show that integrating mobile devices into the educational process is important. Mobile learning offers students the opportunity to transcend the boundaries of traditional classrooms, improving the efficiency of the educational process and enhancing their autonomy. In this context, a plethora of English-language applications for smartphones, iPads, and other devices have been developed in recent years (Teodorescu, 2015).

Peters (2007) states that “the communication and data transfer capabilities offered by mobile technologies (m-technologies) can significantly reduce the dependence on fixed work and study locations and have the potential to revolutionize the way we work and learn”. However, a mobile–connected society creates new challenges in terms of education delivery.

All previous categories of mobile devices use different operating systems. Operating systems are the systems that control and coordinate data input, output, and processes in a device. They are the core software. The two most prevalent operating systems in the smartphone and tablet market are iOS and Android. They are followed by RIM's BlackBerry OS, Microsoft's Windows Mobile, Mozilla's Firefox OS, Canonical Ltd's Ubuntu Phone, Samsung's Bada, Hewlett-Packard's WebOS and Nokia's Symbian.

1.2 Some Technical Characteristics of Portable Devices

Screen: Modern mobile devices, mainly smartphones and tablets, have a variety of technical features.

Screen Resolution: The number of pixels displayed. The pixel density (ppi), i.e. pixels per inch, is calculated based on the size of the screen.

Monitor Types: Display types include LCD, OLED, AMOLED, AMOLED, Super AMOLED, TFT, and IPS, among others.

Screen Refresh Rate: The number of times per second the image is refreshed.

Touch technology: Touch technology in liquid crystal displays is divided into two types: resistive and capacitive. Resistive displays require pressure, while capacitive displays support multitouch.

Camera: It is a fact that most mobile devices have at least one camera.

Built-in Memory / Storage: The devices have Flash ROM memory, which is used for the operating system and applications. Most devices also have external storage slots, usually in the form of SD memory cards.

Sensors: Mobile devices incorporate various sensors to improve functionality:

Accelerometer: Responsible for the automatic orientation of the screen.

Gyroscope: Improves screen sensitivity to orientation changes.

Light sensor: automatically adjusts the brightness of the screen.

Approach sensor: Senses when the person approaches to close the screen.

Digital Compass (Magnetometer): measures the magnetic field for navigation applications.

Barometer: Measures atmospheric pressure for weather forecasting and altitude calculation.

GPS receiver: tracks the position of the device via satellites.

Networking:

Mobile telephony networks: Support for 4G or 5G with high-speed download capability (HSDPA).

Wireless Network: Connect via Wi-Fi for wireless communication and connectivity.

Bluetooth: short-range wireless networking for communication between devices.

NFC: Wireless data transmission over short distances, useful for payments and data exchange.

Video Streaming Capability: transfer video data over a network or the Internet.

Other Additional Features

Portable devices are equipped with a radio receiver, various connection ports, a built-in microphone and speakers, and a battery. Many devices are dust and water-resistant to an extent.

1.3 Advantages of Portable Devices

Mobile devices offer significant benefits (Matzavela & Alepis, 2021). Students can improve their learning outcomes when they have access to schedules, grades, assignments and discussion groups via mobile devices. These devices offer instant access, collaboration and constant presence, making them ideal for modern learning (Dias & Victor, 2017).

Access: Mobile devices provide instant and efficient access to information regardless of time and place (Geddes, 2004). The cost of these devices is lower than desktop or laptop computers, making access feasible for more people.

Environment: Meaningful learning requires a connection to authentic activities where students can safely experiment and learn from their mistakes (Schank & Cleary, 1995).

Cooperation: Mobile devices facilitate collaboration between students regardless of physical location, in real-time, including text and multimedia (Geddes, 2004).

Presence: Physical presence or the use of communication applications is critical to the learning process (Geddes, 2004).

Klopfer, Squire & Jenkins (2002) definitively identify certain properties of mobile devices that offer unparalleled educational advantages: portability, social interaction, environmental sensitivity, and personalization. Studies unquestionably demonstrate that users value mobile devices for motivation, ease of use, improved writing, understanding of technology, and flexibility.

1.4 Disadvantages of Portable Devices

Mobile devices have significant advantages, but they also have disadvantages that can limit the learning process. The main difficulties include usability and application incompatibility issues (Kukulska & Traxler, 2005). Software is often not fully compatible with hardware, and users report cost, privacy, and security issues (Ally, 2009).

According to various researchers, the most common problems include:

Battery and data storage issues (Stošić & Bogdanovic, 2013)

Device reliability and sound quality

Wi-Fi signal loss and connection problems

Increased costs of Internet use (Thornton, 2002)

Device and application incompatibility

Small screens with low readability and limited keyboard

Limited storage space

In conclusion, mobile devices offer significant advantages and limitations that affect the full exploitation of their potential.

1.5 The Advantages of Using Educational Applications in the Learning Process

Educational applications capture students' interest by ensuring their active participation in the learning process. They provide interactive learning environments with exercises, quizzes and playful activities. They also provide access to a variety of educational materials, such as images, videos and specialized texts, enriching traditional teaching. In some cases, where textbooks are old and the information they contain needs to be updated, educational apps can act as a supplement by updating the content of the curriculum (Christensen & Knezek, 2018). Furthermore, the scoring and feedback system of many applications should not be overlooked, as it directly evaluates students' performance, helping them recognize their potential and enhancing their confidence and autonomy. It enhances collaborative learning experiences and supports informal and distance learning. Mobile phones make all activities easier, better, more fun, useful, and more interesting than traditional learning. Students feel more comfortable (Brown, 2005). Recording progress with scores and grades encourages student interest and active participation. Educational applications have a variety of assessment quizzes, with varying degrees of difficulty, which are tailored to the learning needs and cognitive level of each student.

Furthermore, the didactic use of educational applications familiarises students with the use of technology and improves their digital skills, thus preparing them for the challenges of the new digital age (Triantafyllou, 2019). Through educational digital environments, students practice the knowledge and skills they will need to use modern technology in

their later professional and social lives (Criollo, Guerrero-Arias, Jaramillo-Alcázar & Luján-Mora, 2021). The findings of Attewell & Webster's (2005) and Attewell's (2005) studies demonstrated that learning using mobile devices significantly enhances students' literacy and digital literacy skills. This allows them to identify their existing competencies. Learning through mobile devices fosters independent and collaborative learning, empowering students to identify their needs for support. It also effectively addresses resistance to using technology, engages reluctant learners, and boosts their self-esteem and confidence. Educational applications remove the limitations of space and time. Students can access knowledge almost anywhere and anytime, providing learning opportunities outside the classroom. This form of learning is ubiquitous and pervasive. It is embedded in the lives of young learners, making use of time that would otherwise be unused (such as when waiting or traveling). It is portable, allowing learning anywhere and anytime, thus offering flexibility and autonomy to learners. It ensures instant communication and allows access to learning even from remote and isolated areas.

Finally, Yousuf (2007) concluded that mobile technologies, such as smartphones, have enormous potential for flexible communication, which can be used strategically to support and enhance students' memory.

While there are many advantages to mobile learning, it is important to acknowledge the disadvantages compared to traditional learning. Examples include the lack of human contact, the fact that learners are easily distracted by tablet applications such as games, and the pedagogical use of mobile audio has practical limitations as it requires headphones, or else bystanders could be disturbed.

2. Method

There is a clear need for more extensive case studies that link the teaching of specific subjects with the use of specific applications. This has been overlooked in recent years, despite several scientific research projects being conducted internationally on the use of educational applications in teaching. This fact was an additional motivation for the present study, for which qualitative and quantitative research was used with the method of purposive sampling. This method has clear advantages, as utilizes the experience and network of acquaintances of the researchers, selects cases typical of the topic under study, and saves time and costs during the implementation of the research (Campbell et al., 2020; Kelly, Bourgeault & Dingwall, 2010). However, purposive sampling has some weaknesses. The subjective judgment of the researchers is inevitable, and the results of the survey may not always be generalizable and representative (Robson, 2010).

For the needs of the present study, five different subjects were selected, which are taught in secondary schools of technical vocational education in Greece: Agricultural Sciences, Information and Communication Technologies, Economics, Engineering, and Health Sciences. A purposive sample of five teachers of corresponding specialties, studying at the Higher School of Pedagogical and Technological Education (ASPETE), was selected for each of the above subjects. These teachers were asked to plan the teaching of a unit using a specific educational application as part of the Specialty Course Teaching, they were attending. Thus, a total of five working groups were formed, each consisting of five teachers. The groups were initially asked to select a specific lesson and a teaching unit in their area of expertise. Then they designed a 45-minute lesson for the teaching unit they had chosen, selecting an educational application to be used in the whole learning process. At the same time, they were required to use participatory teaching techniques and activate the students' potential to the maximum.

Once the teaching scenarios had been developed by the teachers' working groups, a qualitative research project was initiated with five semi-structured interviews conducted with one teacher from each group. These interviews were designed to capture the participants' views on individual dimensions of the use of educational applications and to prepare the ground for the formulation of a short but comprehensive questionnaire that would follow in the later phase of the quantitative research. The interviews revealed some key findings, which informed the design of the questionnaire. It was important to keep the questionnaire simple, short and comprehensive to ensure it met the study objectives.

3. Results

The following are the five teaching scenarios for the five different subjects, as formulated by the teachers' working groups under the guidance of the teacher of the course in Teaching Specialty Subjects.

1o Teaching scenario – Agricultural Sciences

Lesson: Arboriculture, Teaching unit: Citrus trees

Teaching objectives: Upon completion of this unit, students will be able to: a) list the tree species belonging to the Citrus family, b) identify the basic morphological and cultural characteristics of Citrus, c) list the basic cultural care of Citrus, and d) appreciate the importance of Citrus as a branch of Horticulture

Educational application: PictureThis (Plant Identifier)

Lesson design: at the start of the lesson, the students are asked to brainstorm words and concepts associated with the

term "citrus". The teacher writes these on the board and then presents an educational video on the main trees belonging to the citrus family. The students are then divided into three working groups and each group is assigned a tree belonging to the citrus family, e.g. orange, mandarin and lemon. They record the basic growing characteristics. The student groups then enter the educational application PictureThis from the tablets in the agriculture lab and record the basic cultural care of the trees in the areas of fertilization, plant protection and irrigation by reading the information and viewing the corresponding pictures in the application. Then, each group presents their findings to the whole class, giving the whole group of students a complete picture of the basic trees belonging to the citrus family. Finally, a short educational video is shown, highlighting the importance of citrus trees as a branch of modern arboriculture.

2o Teaching scenario – Information Technologies & ICT (Information Communications Technology)

Lesson: Computer Science, Teaching Unit: The hardware part of the computer

Teaching objectives: Upon completion of this unit, students will be able to: a) define the hardware part of a computer; b) list the various input and output devices of a computer; c) demonstrate the components of the mainframe and peripheral units; and d) appreciate the individual functions and utility of the hardware part of a computer.

Educational application: ICT Coach

Lesson Design: The lesson is conducted in the school's computer laboratory. The teacher presents the hardware part of computers, including the main processing units, input devices such as keyboards, mice and scanners, and output devices such as monitors, speakers and printers. The students are then divided into two working groups. One group is tasked with recording information about the particular features and information about the operation of the input devices, while the other group records information about the output devices. After ten minutes, each group presents the information they recorded about their respective devices to the whole class. Then, with the teacher's guidance, the teams use the tablets in the IT Lab and enter the ICT Coach training application, where they check the correctness of the data they recorded, compared with the data recorded in a corresponding section of the application. Each student then takes a quiz with questions within the application to test their knowledge gained from the teaching of the specific module.

3o Teaching scenario – Economic Sciences

Lesson: Principles of Economic Theory, Teaching Unit: Market Forms.

Teaching objectives: Upon completion of this unit, students will be able to: a) list the four market forms; b) identify the basic characteristics of each market form; c) formulate examples of firms and sellers operating in the four market forms; d) realize the importance of market forms in the modern economic environment.

Educational application Learn Economics – Tutorial Guide

Lesson design: Students are divided into four groups and each group is given a worksheet with one of the four market forms (monopoly, oligopoly, full competition, monopolistic competition). With the help of a slide and after an explanatory discussion, each group must identify the individual characteristics of each market form. Each group then presents to the whole class the market form in which they have identified its characteristics, followed by a discussion. The teacher then asks the students to open their tablets, go to the Learn Economics - Tutorial Guide app and, open the specific tutorial section in the app, and compare the data written there with the data they recorded earlier in their groups. Then, students must complete the relevant quiz available in the app to check their knowledge and receive feedback.

4o Teaching scenario – Mechanical engineering

Lesson: Automotive Systems, Teaching unit: Types of car tires

Teaching objectives: Upon completion of this unit, students will be able to: a) describe the structure and properties of tires, b) list the materials used in the construction of tires, c) identify the basic types of tires, and d) realize the importance of tires for the driving safety of a car.

Educational application: Tyre Size Calculator

Lesson design: The lesson is conducted in the School's Mechanical Engineering Laboratory. In the beginning, a short educational video is shown, in which different types of cars are described, each of which has a different type of tire. This is followed by a class discussion in which the students are asked to describe the tires they have just seen in the video. Then a second educational video is shown which briefly shows how tyres are made and the different materials that make them up. The teacher then divides the pupils into five working groups and assigns each group a type of tire category: winter tires, summer tires, all-weather tires, SUV tires and run-flat tires. On the tablets available in the Mechanical Engineering Lab, the groups open the Tire Size Calculator app and look up the specific characteristics of their assigned tire type with the guidance of the teacher. They then record these characteristics on a worksheet and present them to the whole class. The teacher then presents a PowerPoint file in which the main types of tires are

grouped in a table with relevant photographs. Finally, there is a discussion on the importance of tires in driving safety, and a short educational video is shown, showing road accidents that were avoided due to appropriate tires.

5o Teaching scenario - Health Sciences

Lesson: First Aid, Teaching unit: Trauma

Teaching objectives: Upon completion of this unit, students will be able to: a) define the concept of trauma, b) distinguish between the different types of traumas, c) effectively treat trauma, and d) realize the importance of proper management of trauma.

Educational application: First Aid - IFRC

Lesson design: The educational technique of discussion is used initially, with the teacher asking students to recall incidents of injury to either themselves or their loved ones. Based on what is said in the discussion, the different types of injuries are recorded, and a PowerPoint file is shown. Students are then divided into working groups of 4-5 people, with each person trying to list the main characteristics of each type of trauma and the ways of dealing with it. The groups then present the results of their work to the whole class, followed by a short educational video by the teacher on trauma. Then, the First Aid - IFRC educational application is used, which the teacher asks the students to download on their tablets in the nursing laboratory of the school unit. The student work groups are asked to enter the application, in the "Trauma" section, and compare the data and information recorded there with the data they had previously recorded themselves. Finally, students must complete the quizzes available in the educational application. This is a fun way to test the knowledge they have gained from the teaching of this module and receive relevant feedback.

After the working groups of 25 teachers completed the above teaching scenarios, they were asked to answer a short questionnaire. This was constructed for the needs of this study. Among the 25 participants in this case study, 14 were female and 11 were male (Table 1). In terms of age, 10 of them were between 31-40 years old, 8 between 41-50, 6 between 21-30, and only one between 51-60. Furthermore, 16 of them had postgraduate degrees, while 9 did not.

Table 1. The profile of the participating teachers

Sex	Men: 11	Women: 14			Total: 25
Age	21-30	31-40	41-50	51-60	Total: 25
	6	10	8	1	
Postgraduate Studies	Yes: 16	No: 9	Total: 25		

The next step was to identify the key criteria for selecting an educational application. We took the findings from the interviews conducted during the qualitative research phase and relevant literature into account when asking participants to rate the importance of each criterion on a five-point scale (5 = very important, 4 = important, 3 = moderately important, 2 = slightly important, 1 = not at all important). Table 2 clearly shows that the five most important selection criteria are the relevance of the app to the curriculum unit (4.98), the structure and content of the app (4.91), ease of use (4.76), the ability to assess progress (with quizzes and interactive tests) (4.52), and free access and use of the app by students (4.12).

Table 2. Criteria for selecting an educational application

Criterion	Degree of importance
Relevance to a teaching module	4.98
Structure and content	4.91
Ease of use	4.76
Ability to evaluate progress	4.52
Free access and use	4.12

Participants were then asked to rate the importance of the benefits of using educational applications in teaching on a five-point scale (5 = very important, 4 = important, 3 = moderately important, 2 = somewhat important, 1 = not at all important). The findings of the relevant literature (McQuiggan, Kosturko, McQuiggan, Sabourin, 2015) and the qualitative research both identified five specific strengths (Table 3). The teachers we interviewed told us that the most important advantages of using educational apps are diversifying traditional teaching and providing new motivation for learning (4.95), enhancing students' interest (4.92), developing digital skills (4.84), enhancing collaborative learning (4.27) and lifting time and space constraints (4.15). Educational apps are available through smartphones and tablets at any time and in any place, not only during class time at school.

Table 3. Advantages of using educational applications

Advantage	Degree of importance
Differentiation and new learning incentives	4.95
Boosting student interest	4.92
Developing digital skills	4.84
Enhancing collaborative learning	4.27
Lifting time and space restrictions	4.15

4. Discussion

Educational applications are becoming increasingly popular in the learning process. This is particularly evident since the onset of the COVID-19 pandemic (Menon, 2022). In light of the rapid technological developments taking place in the digital reality, traditional teaching is being enriched with modern educational applications. These applications can make teaching more engaging, interactive, and participatory (McQuiggan, Kosturko, McQuiggan & Sabourin, 2015). Also, educational applications can be integrated into teaching scenarios that, depending on the circumstances, can upgrade the quality of teaching, especially in specialty courses (Burden & Kearney, 2016; Cederquist & Golüke, 2016).

In modern times, most schools have the necessary equipment, and teachers can enrich their teaching with appropriate educational applications. As more and more educational applications are created nowadays, it is up to the teacher to decide how to make the most effective use of an educational application, depending on the level of education, the cognitive level of the student population, the type of lesson and the individual teaching techniques. In any case, educational applications do not replace the role of the teacher but function as complementary and auxiliary tools in a learning process. Teaching remains human-centered, and it is the individual teacher's responsibility to decide how to effectively integrate an educational application into the course flow.

Moreover, the concerns that arise from the use of smartphones and tablets in the learning process must also be considered (McQuiggan, Kosturko, McQuiggan & Sabourin, 2015). Mobile devices present unique challenges for students and teachers alike. The relative inexperience of teachers and school settings, coupled with the specific characteristics of mobile devices, can lead to distractions in the learning process and instances of students becoming involved in distracted situations. In some cases, there may be inappropriate or malicious use of these devices by individual students. Furthermore, the potential misuse of these devices can result in health issues for students and teachers, such as headaches or visual problems. Therefore, teachers must provide increased supervision and counseling in a supportive context to ensure the safety and well-being of everyone involved.

Educational applications in the learning process are a particularly interesting issue and an important field of study in the field of educational research. Therefore, it is crucial to research the individual dimensions of the issue, which concern all those involved in the field of education: teachers, students, parents, education executives, developers of educational applications, and educational policymakers. Mobile applications (apps) are the ideal solution for learners who need to update their information and skills while learning, without the constraints of time and place (Yang, 2022). This case study adds to the existing body of knowledge and provides a foundation for future research in the field of educational app utilization in teaching specialty courses.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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