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SURVEY ON MOBILE APPLICATIONS FOR ADAPTATION TO NEW TECHNOLOGIES IN AGRICULTURAL ENGINEERING EDUCATION

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Abstract: Computer software plays a significant role across various domains of Agricultural Engineering, whether it's used for structural calculations, lighting, pesticide dosing, or project presentations, among many others. Furthermore, there is a growing array of mobile applications (Apps) integrating technical aspects that offer substantial potential for hands-on teaching in multiple subjects. Determining the most suitable software application and device for teaching different subjects, based on student characteristics, is essential for their evolution and alignment with emerging technologies and trends within the profession. At the Technical School of Agronomic, Food and Biosystems Engineering at the Universidad Politécnica de Madrid (Spain), a study was conducted within a third-year course to assess student profiles and identify the most suitable devices for technical subjects within the Food Engineering program. The use of laptops, closely followed by mobile phones, emerges as the most compelling tools at present. Differences are observed in the utilization of video conferencing and file-sharing applications based on whether students interact with each other or with the academics.
Keywords: ICTs, Apps, engineering software, mobile devices.

INTRODUCTION

The use of computer software in various areas of agricultural engineering is steadily increasing, offering a wide array of possibilities and a diverse range of developers. Incorporating software applications into engineering education is of paramount importance in university instruction (Sarrab et al., 2012; Hung et al., 2015) to maintain a tangible connection to the professional sector.

Furthermore, with the implementation of the so-called Bologna Plans in Spain

(2010) and more significantly, due to the subsequent COVID-19 confinement (2020), traditional in-person education delivered through lectures has been partially or entirely displaced by more collaborative systems, often reliant on the use of computer applications, whether through laptops or mobile devices (Diaz-Sainz, 2021; Javed & Estep, 2021; Salas-Rueda, 2022). Classes now frequently alternate between various models, including practical laboratory or field activities, and may blend in-person with e-learning systems.

In the teaching of engineering-related subjects, the use of computer-assisted design software, such as AutoCAD, and programming software in various languages (Java, LOGO, C+, and others), depending on the academic program and corresponding professional sector, has been commonplace for many years. However, the use of other software applications is relatively recent in many engineering schools. This includes applications for structural analysis (Metal 3D), electrical installation design (Dialux, Prysmitool), statistical calculations (Statgraphics), simulation applications (Matlab, SketchUp), and the calculation of phytosanitary application rates (DOSACITRIC), among many others.

Undoubtedly, it is essential to push the boundaries and leverage new technologies to enhance practical education, and currently, there are numerous possibilities. Modern mobile phones, for instance, are capable of hosting applications that are naturally used by millions of individuals in their private lives. This technology, widely embraced by students, holds potential for use in formal education (Nahapetian, 2013). Applications like WhatsApp, Google Maps, Nike+ Running, Amazon, or eBay, utilized for messaging/video conferencing, route navigation, training plans, or online shopping, respectively, are commonplace in private life but less so in the university context. The university should integrate current technology and web applications into teaching (Hung et al., 2015), making technology more accessible to students in a familiar manner.

This is achievable, as demonstrated by Díaz-Sainz et al. (2021) and Liu et al. (2022) in chemistry courses. Similarly, there are apps relevant to the field of agroforestry engineering, such as those for plant species identification, irrigation calculations, garden and sports field maintenance, area calculations, speed calculations, geolocation applications, among others, all holding significant potential for use. On occasion, as demonstrated by Zhu et al. (2015), developing a specific app for teaching a particular subject, such as engineering economics, could be worthwhile.

Assessing students' capabilities to work with their own electronic devices in classes and determining the most suitable device and application for each case should be the first step towards their integration into the teaching of any discipline.

OBJECTIVES

The study has two main objectives:

- To ascertain the feasibility of incorporating mobile devices in classrooms, identifying the most suitable option based on student profiles.
- To investigate how students utilize mobile applications and social networks, with the aim of designing new collaborative activities in the classroom for Agricultural Engineering students, following the Bologna Plan.

MATERIALS AND METHODS

SURVEY AND PARTICIPANTS

A survey was conducted among students enrolled in the course "Electrical Installations and Automation," a third-year subject in the Food Engineering program. This technical course is offered during the first semester of the academic year and involves electrical calculations. The program is taught at the Technical School of Agronomic, Food and Biosystems Engineering at the Universidad Politécnica de Madrid.

The course structure comprises a combination of theory, problem-solving exercises, and the utilization of computer software, namely Dialux for lighting design and AutoCAD for drafting purposes.

The survey was structured into two sections: the initial section encompassed personal inquiries aimed at understanding the surveyed students' profiles, while the second section consisted of 20 questions focusing on their usage patterns of electronic devices, software, and social networks.

A total of 43 responses were collected (60.5% female and 39.5% male participants) from students aged between 19 and 46 years, with an average age of 22.2 years.

Participants were queried regarding their access to electronic devices in the classroom and their engagement with various apps and social media platforms.

OPERATING SYSTEMS FOR APPS

Mobile operating systems (geared towards wireless connectivity) for which Apps can be developed include the following:

- Android: A mobile operating system developed by Android Inc., a subsidiary of Google since 2005. It is designed for touchscreen devices such as phones and tablets.

- iOS: A mobile operating system developed by Apple Inc. It is used in devices like iPod touch and iPad. It cannot be installed on devices from other companies.

- Windows 10 Mobile – Windows Phone: A mobile operating system developed by Microsoft, available since 2015 for various platforms including smartphones, tablets, and computers.

- BlackBerry OS: A mobile operating system developed by BlackBerry for their devices.

- Symbian: A mobile operating system born from a collaboration between companies like Nokia, Sony Ericsson, Samsung, LG, and Motorola, among others.

- Firefox OS: A mobile operating system developed by Mozilla Corporation for smartphones and tablets.

- Ubuntu Touch: A mobile operating system based on Linux, commercially available since 2013.

RESULTS

STUDENT RESPONSES AND DEVICE AVAILABILITY

According to the responses provided by the students, the device most commonly brought to the classroom is a laptop (97.7%), followed by a mobile phone (95.3%), and a digital tablet (46.5%). Notably, all students affirm that they can regularly access one of these devices throughout the course. The operating systems found on mobile phones are distributed between Android (53.5%) and iOS (44.2%). The remaining students claim to be unaware of their phone's operating system.

The use of laptops and mobile phones in classrooms seems feasible if the University

provides devices on loan to those students who do not have their own. The Universidad Politécnica de Madrid is a public institution, and owning an electronic device should not be mandatory to pursue a degree there. Students should have the opportunity to pursue their studies regardless of their family's economic resources.

Regarding the number of devices available within their households, the majority of students have a maximum of 3 laptops (37.2%). Of the respondents, 23.3% have 2 laptops, while 27.9% have only 1. Few families possess 4 or more laptops (11.6%). Concerning mobile devices and digital tablets, 18.6% report not having these devices in their families. 48.8% have 1 tablet, and 32.6% possess 2 or more.

USE OF MESSAGING AND VIDEO CONFERENCING APPS

Regarding social networks and messaging applications, all students affirm having an account on at least one social network (Figure 1). The most common social networks among students are Whatsapp (93%), Spotify (90.7%), Instagram (88.4%), and Youtube (88.4%). Other social networks they also use include Twitter (62.8%) and Tik Tok (65.1%). MySpace, Flickr, Chil, and Badoo are social networks that the surveyed students do not use.

USAGE OF VIDEO CONFERENCING AMONG STUDENTS

Regarding the utilization of video conferencing among students (Figure 2), the Whatsapp application (69.8%) once again emerges as the most extensively used application, although its usage appears more focused on text or voice messaging. Other applications employed include Skype (46.5%) and FaceTime (23.3%). Fourteen percent (14%) state that they do not use video conferencing, while the remaining students employ different applications not previously mentioned.

When queried about video conferencing with professors, Skype (35.7%) is the most commonly used application, followed distantly by FaceTime (7.1%), Whatsapp (4.8%), and Google Hangout (4.8%). In this case, 33.3% of the students affirm not engaging with professors through video conferencing. Other students employ different applications such as Teams or Zoom.

Additionally, students state that they access social networks two or more times a day (79.1%), remaining connected to the internet for an average of two hours or more (95.35%). Out of this time, 76.1% report engaging with social networks.

The medium for document exchange between students and professors is Moodle/ Teams, these being the official platforms of UPM.

USAGE OF COMPUTER SOFTWARE

The use of computer software is highly intriguing among students. The entirety of them employ programs included in Microsoft Office (Word, Excel, PowerPoint), and 88.4% confirm using computer-aided design, through AutoCAD or similar tools.

Fifty-three point five percent (53.5%) use software for lighting design, such as Dialux or Relux. Very few students utilize software for modeling (9.3%), construction (2.3%), or budgeting (2.3%).

USAGE OF MOBILE APPLICATIONS (APPS)

The use of Apps within classrooms is quite limited. Only 11.9% claim to employ technical or professional Apps, despite the considerable number of Apps available for technical or professional use.

However, it's worth noting that the use of Apps in their daily lives is customary.

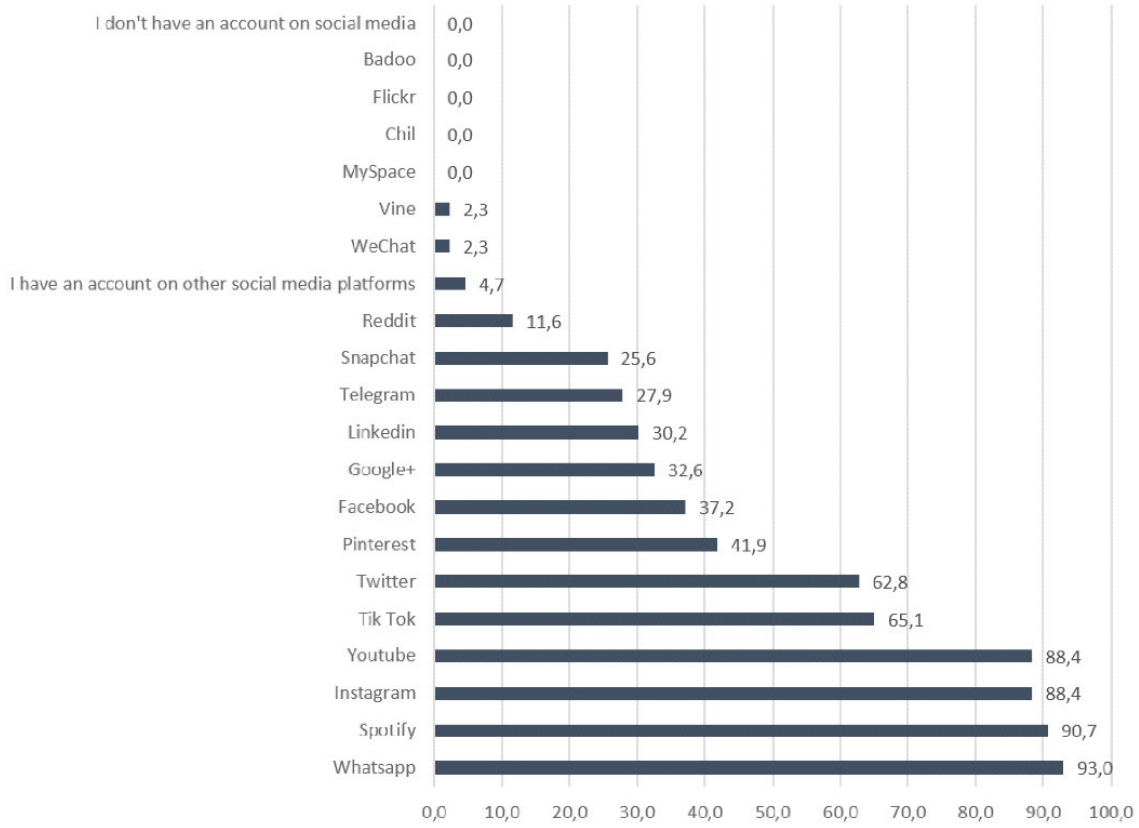

Figure 1. Social Networks Used by Students (2022).

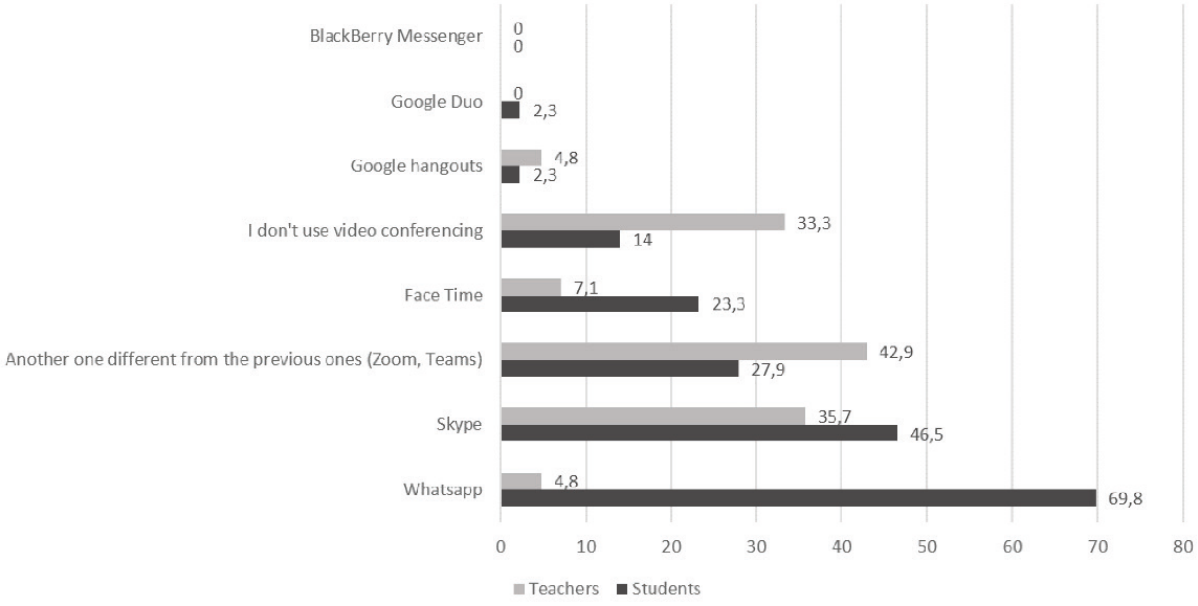

Figure 2. Video Conferencing Systems Utilized by Students with Peers and Professors (2022).

All students confirm using at least one App, with the most frequently used being Whatsapp (95.3%), Google Maps (83.7%), Moodle (83.7%), and those related to public transportation (74.4%). To a lesser extent, they also utilize Apps related to products and services (fashion, dining, or sports).

USAGE OF COMPUTER LABS

Despite the significant usage of the internet and computers today, 67.4% state they have never used the computer labs at ETSIAAB; 30.2% use them occasionally.

The reason for not attending computer labs is that a large portion of students bring their own laptops to class.

Thought should be given to the usage of computer labs and the necessity of maintenance, as currently, only a few students utilize them within this Center, and the upkeep incurs significant financial costs.

DISCUSSION

The integration of computer applications in many subjects related to food engineering (Dialux, Logo, BIM, SketchUp, Autocad, Arquímedes, among others) has led to an increase in the number of students regularly bringing laptops to classes, consequently reducing the utilization of the computer labs on campus. The adoption of mobile phones, referred to as m-learning by Sarrab et al. (2012), Hung et al. (2015), and Whalley et al. (2020), has gradually incorporated the use of professional Apps, available for both Android and iOS platforms. Free Apps that can be employed to understand specific technical parameters in various subjects—where calculations of areas, velocities, distances, and others, are essential—have become available. They hold relevance in agroforestry, enabling the determination of factors like machinery yields, terrain elevations, slopes, or machine paths. Some of these applications, as studied by Perdigones et al. (2019), include "Area and Distance Measurement," "GPS Digital Speed Tracker," "Sprayer Calibrator," "ArbolApp" (plant species identification), and "Light Meter" (measuring light intensity on a surface in lux), among others. Their utility extends beyond technical training, contributing to the development of programming and computer-related competencies (Skalka & Drlik, 2018).

Similar to the findings of Ming Tang et al. (2022), this study validates that the use of Apps positively motivates students, enhancing their independent software proficiency and fostering associative thought processes (Ismail et al., 2008).

CONCLUSIONS

The main findings of the study are: - Students at the Universidad Politécnica de Madrid have, for the most part, digital devices at their disposal to carry out classroom activities.

- The main operating systems used are Android and iOS. The most common social networks among students are Whatsapp (93%), Spotify (90.7%), Instagram (88.4%), and Youtube (88.4%).

- Students are accustomed to using Apps; according to the conducted survey, the main App they use is WhatsApp. It seems evident that this presents an opportunity to utilize various types of Apps in lecturing related to each subject.

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