

## The Use of Modern Mobile Platforms For Improving Quality of E-Learning Processes in Higher Education

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### ABSTRACT

During the past three years, the number of mobile broadband Internet users has surpassed the number of fixed broadband network subscribers. This change of global network access, shows that the mobile phone is one of the most frequent ways by which people are using broadband services. Mobile phones are used mostly by massive young population, which includes students. It is estimated that by 2016, mobile Internet use will significantly surpass fixed Internet. This change provides new features and benefits that are explored in this paper. New generation of mobile smart phones, based on various OS platforms, are very efficient education tools. In this paper we analyzed the students ability of using smart phones in learning process, through the case study, where students took part in e-learning process by implementing data in given or new smart phone applications, with the aim of improving overall quality of higher education.

**Keywords:** mobile platforms, smart phones, android, e-learning

### INTRODUCTION

According to International Telecommunication Union (ITU) estimates, there will be 6.8 billion mobile-cellular subscriptions by the end of 2013. (Fig 1.) – almost as many as there are people on the planet [10]. While growth in mobile-cellular penetration is flattening, reaching 96% by the end of 2013, mobile broadband continues to grow strongly, on average by around 40% annually between 2010. and 2013. Also, by end 2013, there will be an estimated 2.7 billion people using the Internet worldwide. In view of the steep growth of mobile broadband and the widespread deployment of mobile infrastructure, expectations are high that mobile-broadband services will become equally as available as mobile-cellular telephony in the near future. Ericsson forecasts that by 2018, there will be 6.5 billion mobile-broadband subscriptions, almost as many as there are mobile-cellular telephone subscriptions in 2013 [7].

Today, almost all people on Earth live somewhere within reach of a mobile-cellular signal. Not all of those networks, however, have been upgraded to 3G technology, which is necessary to qualify as mobile broadband and provide high speed access to the Internet. By the end of 2012, the percentage of the world's population covered by a 3G network was around 50%.

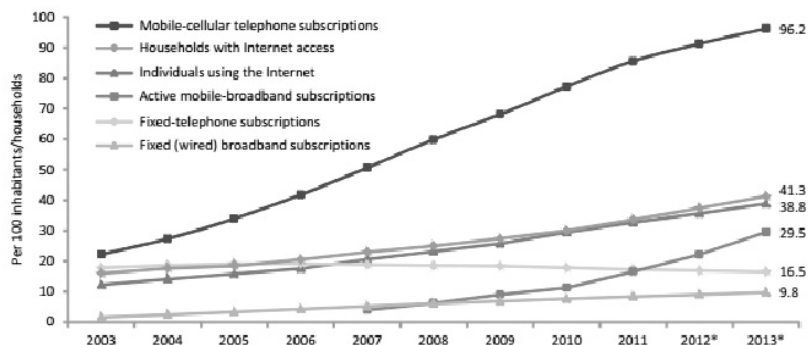


Fig. 1. Global ICT developments 2003-2013.

The use of Internet via wireless networks and devices will continue to grow strongly, accompanied and/or driven by an ever-increasing supply of mobile applications and services in the markets. An important trend highlighted

in previous reports [10], and which will continue in the near future, is the shift from voice to data traffic. According to Cisco [4], global mobile data traffic grew by 70% in 2012, to a level which corresponds to almost 12 times the entire Internet traffic in 2000. Half of the traffic was video traffic. Cisco forecasts that “global mobile data traffic will increase 13-fold between 2012 and 2017. Mobile data traffic (Fig. 2.) will grow at a CAGR of 66 per cent from 2012. to 2017, reaching 11.2 exabytes per month by 2017. [4]. The growth in traffic, mostly driven by smartphones, is closely linked to the spread of 4G services. While insignificant today, by 2017 4G is predicted to account for 10% of mobile connections and 45% of total mobile traffic.

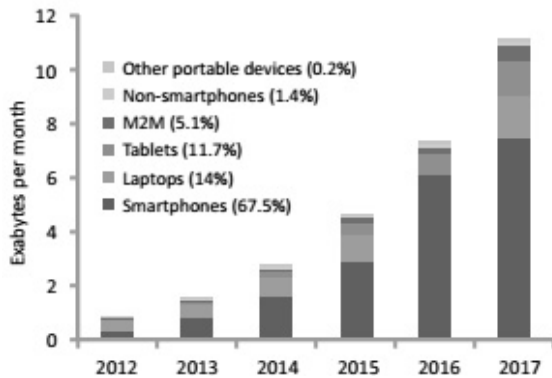


Fig 2. Mobile data traffic by end-user device

Ericsson reported that approximately 40% of all phones sold in Q3 2012. were smartphones and the growth of smartphone data traffic is expected to exceed the overall average. Also, they stated that mobile data traffic doubled between Q3 2011. and Q3 2012, and is expected to grow 12 times between 2012. and 2018, driven mainly by video. They expect total mobile subscriptions to reach 6.6 billion in 2012 and 9.3 billion in 2018 [7].

The number of mobile subscriptions worldwide has grown approximately 7% year-on-year during Q3 2013 (Fig. 3). The number of mobile broadband subscriptions grew even faster over this period – at a rate of 40% year-on-year, exceeding 2 billion in 2013. The amount of data usage per subscription also continued to grow steadily and around 55% of all mobile phones sold in Q3 2013. were smartphones. Together, these factors have contributed to an increase in monthly mobile data traffic over Q3 2013. that exceeded total monthly mobile data traffic in Q4 2009. [8].

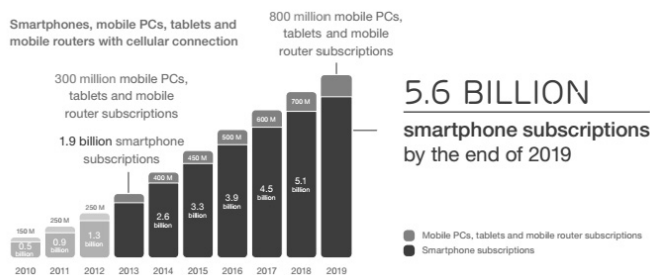


Fig 3. Mobile PCs, tablets and mobile subscriptions

Traffic in the mobile phone segment is primarily generated by smartphones. By 2019, smartphone subscriptions are expected to triple, resulting in rapid traffic growth. Total monthly smartphone traffic over mobile networks will increase around 10 times between 2013 and 2019. (Fig. 4). [8]

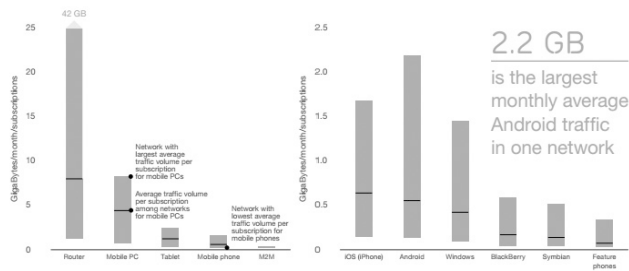


Fig 4. Monthly traffic volumes per subscription per device type a) and per operating system b)

Traffic volumes per subscription for mobile phones vary greatly both between operating systems and networks. The largest average traffic volumes per subscription are measured on Android smartphones that use up to an average of 2.2 GB per month, in the network with the largest usage for this device type. One reason for the wide spread is the difference in data plans offered to subscribers. Android models have a greater variance due to a larger diversity of device models. In networks where high-end models dominate, average usage on these devices exceeds average iPhone usage.

**ANDROID, THE WORLD'S MOST POPULAR MOBILE PLATFORM**

Since its debut in 2008, Android has evolved so quickly that it's easy to lose track of all the updates and milestones it reached with each new version. Heck, there are hundreds of updates, however minor, that are now so ingrained into our Android user experience that one might forget they once didn't exist. The platform has released 39 version updates to the public, chock-full of countless feature additions, improvements and fixes. During this whole period of android development the latest versions offer better ways to build new applications, especially in the educational purposes [21]. Android powers hundreds of millions of mobile devices in more than 190 countries around the world. It's the largest installed base of any mobile platform and growing fast—every day another million users power up their Android devices for the first time and start looking for apps, games, and other digital content [5]. Android gives a world-class platform for creating apps and games for Android users everywhere, as well as an open marketplace for distributing to them instantly. Android gives everything to build best-in-class apps experiences. It gives a single application model that lets you deploy your apps broadly to hundreds of millions of users across a wide range of devices—from phones to tablets and beyond. Android also gives tools for creating apps that look great and take advantage of the hardware capabilities available on each device. It automatically adapts your UI to look its best on each device, while giving you as much control as you want over your UI on different device types. For example, you can create a single app binary that's optimized for both phone and tablet form factors. You declare your UI in lightweight sets of XML resources, one set for parts of the UI that are common to all form factors and other sets for optimizations specific to phones or tablets. At runtime, Android applies the correct resource sets based on its screen size, density, locale, and so on [5].

Google Play is the premier marketplace for selling and distributing Android apps. When you publish an app on Google Play, you reach the huge installed base of Android. Beyond growing your customer base, Google Play helps you build visibility and engagement across your apps and brand. As your apps rise in popularity, Google Play gives them higher placement in weekly "top" charts and rankings, and for the best apps promotional slots in curated collections [5].

With Google Play for Education, teachers and administrators can browse content by curriculum, grade, and standard — discovering the right content for their students. Over 30 million students, faculty, and staff are already using Google Apps for Education and other Google services. Many of these schools are excited to take advantage of tablets with Google Play for Education and they look to bringing your apps into their classrooms, especially apps using Google sign-on. Google Play for Education brings the innovation of Android technology into classrooms. School districts can set up and deploy large numbers of devices in just minutes or hours rather than days. Powerful browsing tools let educators quickly discover apps, videos, and other content—with many recommended by teachers and categorized according to familiar Core Curriculum standards. After finding apps they want to use, educators can push them instantly to student devices over the air. They can send the apps to individuals or groups of any size, across classrooms, schools, or even districts.

**OPERATING SYSTEMS - IOS, BLACKBERRY, SYMBIAN, MICROSOFT, ANDROID**

Based on research and current trends, it is forecast that Google's Android operating system will have runaway market dominance over the next four years

According to research firm Gartner, Android will become the number one operating system for newly

purchased smart phones during 2011, as it is shown in Figure 5. At the same time the once dominant Symbian OS will slide into obscurity and the history books, as the next generation leave it behind, with handset manufacturers discarding it from their future plans [13,20-22]

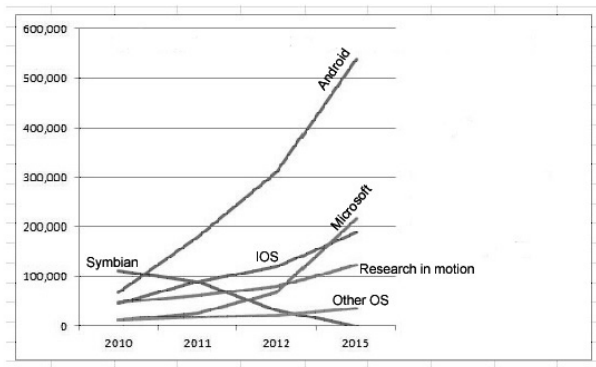


Fig 5. Worldwide Sales to End Users by OS

*Market diversity and variance*

There are currently around 6,500 different models of mobile internet device, this includes the whole spectrum of mobile phones with internet access, smart phones, tablets etc.

By 2015, it is expected just under half of new sales will be based on the Android OS, as is shown in Figure 6, but perhaps more surprisingly, and thanks to the paring of Windows mobile with manufactures such as Nokia, it is currently forecast that Microsoft mobile OS sales will overtake those of Apple's mighty IOS [13,20-22].

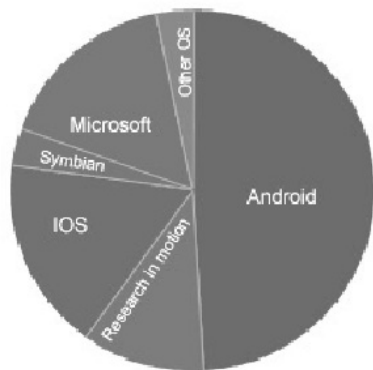


Fig 6. Market share 2015.

In February 2011, 15% of Google's searches were on mobile devices, which is nearly one in seven. Social Networking is an area where mobile apps are really moving ahead fast, with over 250 million users currently accessing Facebook through their mobile devices. There are more than 200 mobile operators in 60 countries working to deploy and promote Facebook mobile products 48% of Smartphone Users Watch Video on their devices. Over 70% of smartphone users search because of an ad they've seen either online or offline. Nearly 80% of large online advertisers still do not have a mobile optimized site [13,20-22].

**DIGITAL NATIVE – A NEW SOCIAL CATEGORY**

In social sense, all these changes have led to a new category of population, named by a new definition - a digital native. It is defined as a youth, aged 15-24 inclusive, with five years or more experience using the Internet [8]. Under this model, a simplifying assumption is made that once someone in their youth starts to use the Internet they continue to use it year after year. This is called the monotonicity assumption.

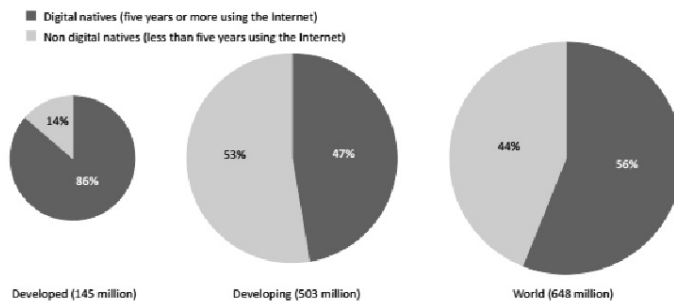


Fig 7. Percentage of digital natives among youth Internet users 2012.

It is clear that “digital media are changing the way young people learn, play, socialize, and participate in civic life” [11]. Digital natives are: highly connected, want quick access to information, want customization, are able to process parallel sources of information, and most important - have “never experienced a ‘pre-digital’ world” [16]. Most of the teachers have formed their brains in ‘pre-digital’ world. Although more research is needed in order to understand the impact that digital natives have in driving the information society, and on the way digital natives learn, work and do things, there is general agreement that young people learn and adapt to ICTs quickly. In other words, in their hands and with their minds, ICTs become a particularly powerful tool. According to this model, in 2012 there were around 363 million digital natives out of a world population of nearly 7 billion. This means that 5.2 % of the world’s population and 30% of 15-24 year olds engaged in sustained activity online. The digital natives are, globally speaking, a minority of today’s youth. Within the next five years, therefore, the digital native populations in the developing countries will more than double, assuming no drop-outs from Internet usage among the youth population.

Furthermore, young people are more likely to be online than the general population as a whole. In addition, there is a strong correlation between a nation’s ICT and the percentage of its population that are digital natives.

Education, is another important correlate to digital nativism. An analysis of the major educational indicators, using the most recent available data, and their relationship to a nation’s share of digital natives brings out a number of interesting linkages. There is a relationship between school enrolment at the secondary and tertiary levels and a country’s proportion of digital natives. The age range for digital natives, namely 15-24, places them within these stages of education. What can be seen overall is that, as secondary and tertiary school enrolment levels go up, so too does the percentage of digital natives. This suggests that secondary and tertiary education plays a positive role in enhancing levels of digital nativism, although this may also be the outcome of additional factors.

It is also clear that as a result of this ubiquitous environment and the sheer volume of their interaction with it, today’s students think and process information fundamentally differently from their predecessors. These differences go far further and deeper than most educators suspect or realize. “Different kinds of experiences lead to different brain structures, “ [6]. It is very likely that our students’ brains have physically changed – and are different from ours – as a result of how they grew up. But whether or not this is literally true, we can say with certainty that their thinking patterns have changed [6]. Each new generation of students asks us continually to re-think our understanding of the project and purpose of education, both online and off.

Another interesting relationship exists between a country’s level of digital nativism and gender balance within school enrolment. There is a statistically significant relationship between digital nativism and the ratio of females to males in secondary school and tertiary school. While it is too early to draw firm conclusions from this particular observation, for the moment, girls are more likely to gain access to the Internet from education facilities. This would require equal access to education for both boys and girls. The analysis shows that the higher the enrolment of females in secondary and tertiary schools, the higher a country’s share of digital natives. These findings will require additional research.

Literature review has found that despite the considerable attention focused on ‘digital natives’, few studies have carefully investigated the characteristics of this group [12]. The purpose of this study is to contribute to the debate on digital natives and e learning, giving our case study, with a group of students from ICT College Belgrade.

#### THE USAGE OF MOBILE PLATFORMS IN ICT COLLEGE - CASE STUDY

Worldwide, many forms of technology are being introduced into educational environments: smart boards, Web 2.0 technologies like blogs, Facebook and YouTube, Virtual Learning Environments such as Moodle and Blackboard, and mobile apps for learning that are available on cell phones or other mobile Internet-connected devices. For example, a project in New York teaches children entirely through the use of technology where students work in teams to make video games to learn the concepts they are being taught. Technology could even signal the end of traditional classroom-based education. The Khan Academy [19], among other Open Education Resource providers, seeks to

provide quality education on many different subjects using YouTube videos and online worksheets to test understanding for anyone, anywhere, anytime. Forecasts for growth in virtual or online schooling even predict that half of secondary level courses will be delivered online by 2020. [19].

As more teachers start to introduce more technology into their courses, educators need a clearer idea what kind of technological environment students are familiar with, and what are their abilities to successfully engage with technology to fulfill student`s activities.

Mobile technology allows students more efficient and convenient way to engage with their teaching materials and with other students 24/7. Mobile devices offer unique access to learning resources, both inside and outside the classroom, regardless of their location in the school, on the bus, or at home.

In order to improve the quality of acquired knowledge and to increase the number of students that passed exams, we did the questionnaire with the students of the ICT College Belgrade. The aim was to show how young population, especially students, currently use mobile phones, the Internet and how are they accessing the Internet. Questions in the questionnaire were given to the students of third year, and the results are shown below.

In Figure 8, is shown that all students from a questionnaire have a computer while studying. This figure differs significantly from the global picture in Serbia, where only about 50% of households own a computer [18].

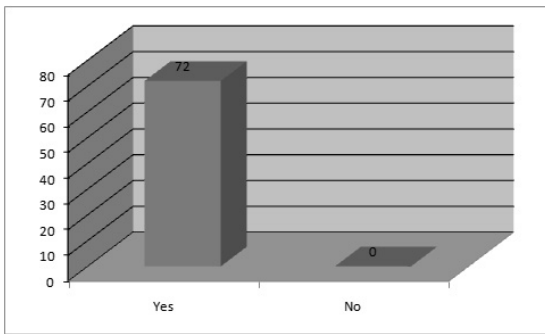


Fig 8. Do you have a computer in your accommodation?

Furtheron, according to the census conducted in Serbia in the last 3 months in the 2011th year, 99.5% of students use the Internet. [15]. Our study shows the same results. On Figure 9. can be seen that these values correspond to the situation among our students. Although only 40% of households in Serbia have Internet access, it is clear that for the population of students that picture is completely different.

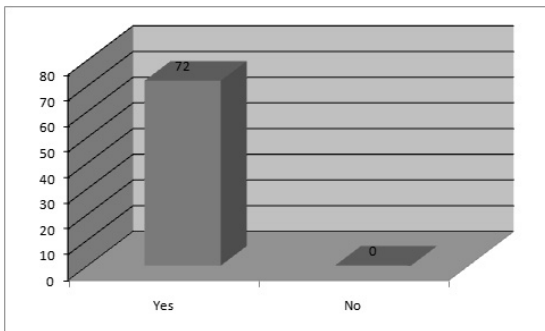


Fig 9. Do you have an Internet connection?

All of our students use the Internet, which can be seen in Figure 10, and this information allows easy electronic communication and downloading various facilities needed for teaching and exam preparation.

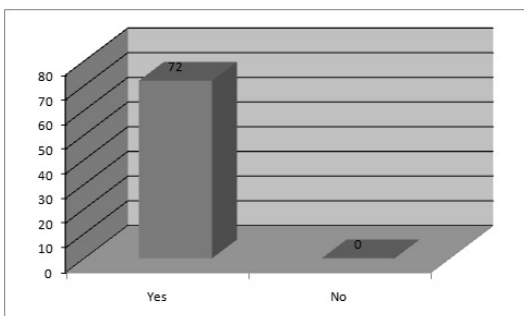


Fig 10. Do you use the Internet?

Expected results were obtained also for the number of mobile device users, which can be seen in Fig. 11

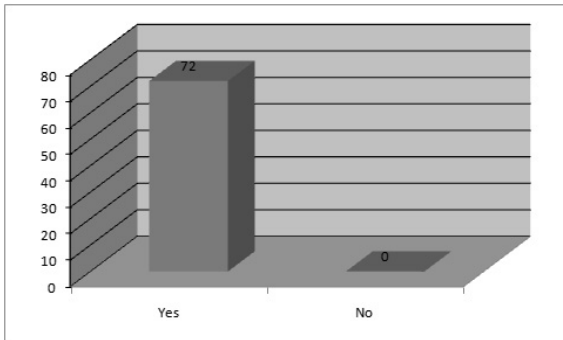


Fig 11. Do you have a mobile device?

Mobile devices, especially smart mobile phones, are massively used by young people. Students of ICT College widely use the possibility of mobile phones to connect to the Internet. Fig. 12 shows that about 80% of our students make a connection to the Internet by using a mobile phone, while Fig.13 shows that 43% of students are willing to use mobile phone to obtain the desired content from the Internet, 6% willing to use tablet PC, and 51% household computer.

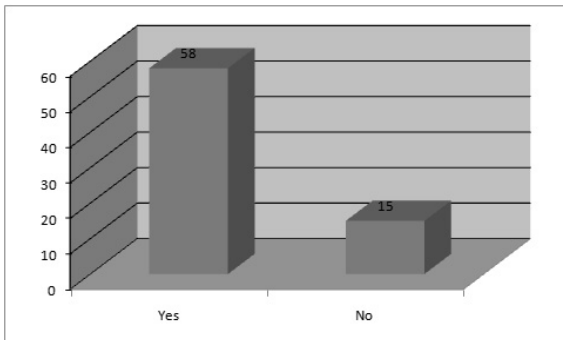


Fig 12. Do you use your mobile phone to connect to the Internet?

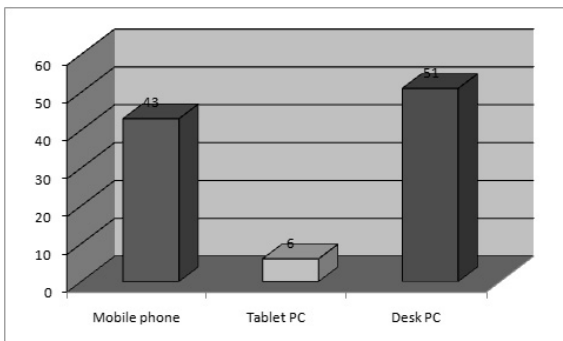


Fig 13. How do you prefer to download information from the Internet?

Smart phones are the latest wave of mobile phones. The delivery of about 4 billion smart phones is expected from 2011. to year 2015. [17], clearly imposing them as most pervasive computer and Internet access device today. In many respects, today's phones are more powerful computers than the computers of just a few years ago. Smart phones already play an important role in providing access to the Internet. In the United States, more than one-quarter of mobile phone owners use their smart phones, not PCs, for Internet access [14]. Fig.14 shows that 63% of students are using smart phones.



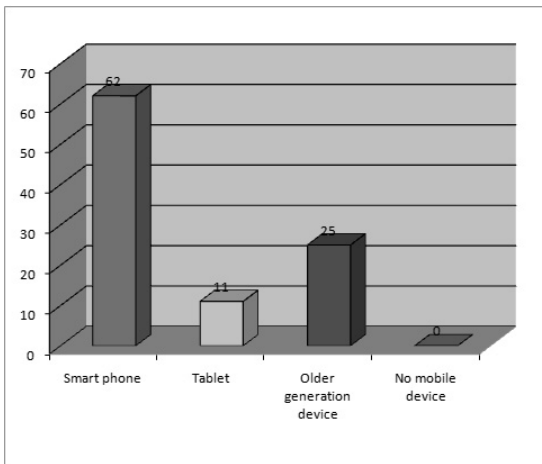


Fig 14. What type of mobile device you use?

Figure 15. shows that the most student mobile devices are based on Android OS, about 58%, so the development of educational apps for that type of OS, should be strongly encouraged.

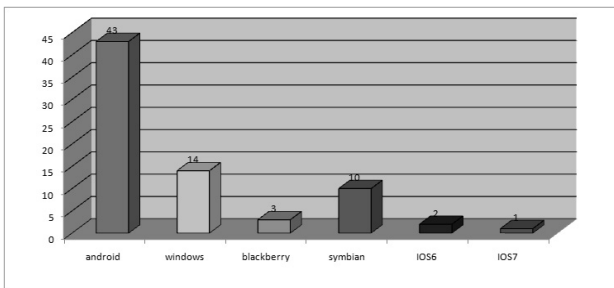


Fig 15. Which OS do you have on your mobile device?

The most applications of the mobile operating systems are possible to use, by the free download process. Student are free to download various types of the apps from the, so-called, OS markets. Figure 16. Shows that the 74% of students installed more than 10 apps on their mobile device.

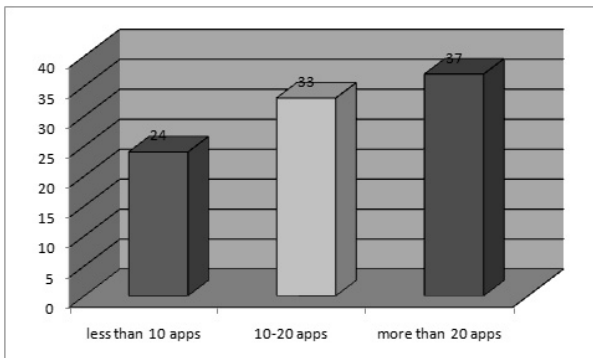


Fig 16. How many applications you use from appropriate OS market?

## CONCLUSION

The use of mobile platforms for the purposes of the educational process is definitely an important tool in development of e-learning processes. It is shown that the percentage of mobile devices in the younger population in whole world is very high, and, according to that fact, the development of the applications, based on a variety of platforms, is on the high level. Depending on the operating system which is the base of the mobile device, (it has been shown that it is currently the Android OS), and given the number of mobile users and mobile device profile of students in ICT college in Belgrade, it can be concluded that the learning process can be complemented by a multiple choice, or even the design of applications that can be easily incorporated into teaching materials, and thus the students 24/7 and anywhere, able to complete their exam prerequisites. Except for educational purposes, mobile platforms can provide an outstanding contribution to survey students, which would create the opportunity for rapid response, and



timely removal of problems arising during the process of teaching, extracurricular activities and the like.

One of the possible future analysis is certainly cost effective, which could deal with the assessment of the cost-effectiveness of the transfer of mobile devices to students by the high education institution, adding efficiency of mastering the course materials through a variety of statistical models with different learning and exams outcomes.

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