Contemporary issues and mobile application development learning: where is the connection?

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Abstract

As a result of discussions about the studies on Science, Technology, and Society (STS) we identified the need to understand how to promote discussions about those subjects on a mobile programming learning. The purpose of this paper is to demonstrate how to introduce subjects that are relevant to society's problems in a discipline with a high technical focus. Therefore, the present work contains an informative approach and becomes a possible subsidy to aid teachers who wish to establish, in their mobile programming classes, STS discussions. The suggestions here documented characterize themselves as resources for a probable improvement of the critical thinking, civil conduct of the students and also raise discussions and reflections among students and future professionals about the current reality, leading to imminent educational changes.

Keywords: Teaching resources. Teaching mobile programming. Contemporary social issues. Technological education.

INTRODUCTION

As well as the use of smartphones and their respective software applications are very attractive, the development of these applications can also fascinate many young people. We can affirm that, often, the opportunity to be enlightened with an impactful, revolutionary idea in the mobile computing universe is the reason why many young people seek vocational training in this area. The Brasscom (2019) report indicates Brazil as the fourth largest computing and telecommunications market in the world, behind only the United States, China, and Japan. This same report places Brazil as the fourth biggest Smart Connected Devices (desktop, notebooks, tablets, and smartphones) market, with an estimate of 71 million devices sold in 2014.

However, teaching and learning software development can not fail to address contemporary social issues, especially those resulting from its use, fads, uncritical fluency and even addictions or dependency. My concern in recent years, as a programming teacher, was to "give a sort of an uncompromising training on these topics". By beginning the studies on "Science, Technology and Society" (STS), one opens a glance at these points. Soon there was an urge: How to approach contemporary matters in a computer programming course, or discipline, specifically for mobile devices programming?

Information Technology (IT) permeates almost all human activities, including work, leisure, health,

education and communication, and the professionals in this area are the ones responsible for the development of a large part of solutions, tools, and processes that are consistent with ethical values and social interest and that also seek humans wellbeing and technological advance. However, to exercise these tasks with competence, fullness, and capacity, it is essential that the professional has carried out studies referring to social, philosophical and ethical issues, with a good degree of reflection and systematization.

In summary, even in a reductionist manner, it seems that in one end lies the current trend to develop applications for smartphones, and in the other – diametrically opposite - the contemporary social themes. How to properly connect and work these poles in an integrated and contextualized way?

POINT "A": MOBILE TECHNOLOGIES

It's easy to visualize the essential role that IT, or simply Computing, has assumed recently. Almost all everyday activities make use of one or more computing resources. Information automation changed the speed on which information is created, managed and recovered. Paying a bill on a bank branch or at a lottery agency, buying something at a supermarket, taking a plane trip or any public transport, are activities that need a computer system supporting business management. Therefore, not only companies benefit from the use of Informatics. Such advent also directly affects people either individually or collectively (ABES, 2019; BRASSCOM, 2019).

With the advance of computing technology, devices, and their components decreased in size while expanding processing capabilities. Until then, computers, which used to occupy massive amounts of physical area, nowadays fit on the palm of a hand. The so-called smartphones essentially have become personal assistants. Small-sized computing devices perform services such as alarm clock, notepad, contacts, and appointments agenda (with virtually infinite capacity), audio and video mini-stations, photo studio, personal 5 meters precision Geo-location device with embedded world atlas, instantaneous audio and video personal communication device among other countless personal use resources. In the 4th quarter of 2019, according to Statista (2020) statistics, Android's applications virtual store had 2,570,000 applications available, while its main competitor – iOS system – contained 1,840,000 mobile applications at disposal.

Mobile application development has attracted many enthusiasts to technical and graduation information technology courses. Such interest arises due to the increasing market expansion and the possibility of making money through those applications. It is remarkable the dizzying growth of mobile application development. In the 3rd quarter of 2019, the App Store brought in gross revenue of $14.2 billion, up from $11.6 billion a year ago. In comparison, Google Play revenue grew 24% to $7.7 billion. In other words, Apple represented roughly 65% of all spending on mobile platforms, with Google representing the other 35%, despite the fact that it powers over 75% of all mobile devices globally, according to Techspot (2020). A few years ago Gartner (2014) surveys show a forecast of this market reaching $77 billion in 2017. In 2019 users consumed an average of about 2 hours and 38 minutes per on using smartphones and tablets, being 86% of that time (2 hours and 19 minutes) spent on apps and 14% (22 minutes) accessing mobile websites. Also according to the Gartner (2014) report, back in 2014 Internet access by mobile devices surpassed desktops access (desktops and notebooks). This high increase in the consummation of mobile applications has attracted the interest of several areas of society, including the government.

To foster the production of national applications for mobile devices and smart-TVs, the Brazilian government opened, through the Communications Ministry, at the beginning of August 2019 a public notice that aimed to stimulate the creation of public utility mobile applications and also "serious games". A total of $1 million in investments will serve a total of 50 apps (25 applications and 25 game applications). According to the Communications Ministry, "the development of games and applications has not followed the demand of the Brazilian market – which is the fourth consumer in this segment, moving $200 million per year". The competition called INOVAapps is part of the National Policy for Creative Digital Content from the Communications Ministry.

Parallel to the incentives, through notices and contests, we can witness an increase in the number of IT courses being open. The increasing offer of these courses aims to attend the increased demand for professionals in this area in Brazil as indicated by many researches. A study by the Brazilian Association of Software Companies (ABES) in 2019 showed that Brazil lacks more IT professionals. This study reveals that Brazilian IT professionals find a growing job market with low qualified competition for open positions. Researchers also alert for a worsening lack of technology professionals in the country by 2023. According to the ABES survey (2019), there are now in Brazil a shortage of approximately 40 thousand IT professionals. This number can grow to as many as 117,000 open jobs in 2023 without employers being able to hire people with the required qualifications to fulfill them. The training of these professionals to occupy open positions must be rethought to include the STS themes in the training process. Hence, the expectation is to train qualified citizens to critically and consciously participate in the decision-making process and in social debates, people concerned with the social implications inherent in the development of scientific and technological innovations (WAD, 2019).

POINT "B": CONTEMPORARY SOCIAL TOPICS

The technical and graduate courses in the Information Technology approach in their curricula technical contents of Computing with minor grafts of humanistic and/or social disciplines. Back in 2012, the Education Ministry / Educational National Council issued a purport – CNE/CES 136/2012 on the National Curricular Guidelines for baccalaureate and graduation courses in Computing (MEC, 2012). This document suggests the embracement of disciplines with a humanistic and social nature, such as Computing and Society, Philosophy, Environment, Human relations at work, Social impacts of software technology. The insertion of debates about these topics in IT courses, not only thin the University ones, but also in the technical level courses, aims to capacitate the future professionals to exercise their attributions with competence.

In an interesting study, Côrrea & Araujo (2014) presents the perception of students and teachers of a medium level federal public technical education institution on STS subjects. The work of these authors is relevant to our discussion, given that our point is the insertion of these STS themes in vocational and technological education courses. The opinion of Côrrea & Araújo (2014), which is equally ours, states that:

> [...] *we need to have, as far as is necessary, knowledge in science and technology, but also about science and technology, and to compose a critical and reflexive society, watchful to the situations and dilemmas arising from the relations between S & T and social, economic and political activities, as well as to the risks generated by technical-scientific applications*. […] (CÔRREA, ARAÚJO, 2014,

p. 15).

In essence, the perspective of Côrrea & Araújo (2014), defends the promotion, in the classroom, of discussions to elaborate modern conceptions about science, technology, and society, in order to contribute to minimizing inadequate visions to the challenges presented to science education nowadays.

According to Bazzo et al. (2014), entering a classroom to deal with STS relations seems more challenging every day.

> *Tackling with the education foundations, primarily the technological one, is extremely complex. But in the author's day-by-day pursuit of problems of the world he felt the urge for some serious modifications. It's necessary to move away from the comfortable position of a purely technical formation, technical training that is uncompromised with social issues. It is necessary to address issues related to social content.* (BAZZO ET AL., 2014, p. 39).

The teacher and all that he teaches are part of the same world that the students live. It is evident the need for an awakening to other dimensions in technological education, dimensions that address the current social issues.

According to Bazzo (2012), STS studies aim to promote an education that seeks indispensable human values towards achieving a more just and egalitarian society. There needs to be a harmony between the human and the scientific-technological areas. But as reported by Bazzo (2012), we will only achieve such harmony whenever we combine those areas and, at the same time, we have clarity as to the importance of "being" in relation to "having". Until that happens, perhaps it's no more than a daydream to attempt to impress upon a deeper reflection on the harmonious relationship between science, technology, and society.

Eduardo Galeano, Uruguayan author, in his book "Upside down – a primer for the looking glass world" speaks about several contemporary social questions. The author brings a set of facts, historical and journalistic events that prove the world inversion in which we live. In this inside out world school, students follow basic courses on injustice, racism, and chauvinism, attend professorships on fear, seminaries on ethics, classes on impunity, all elaborated through the pedagogy of solitude. Although it's dated 1998, it remains a dossier of the hard, strange and unjust reality in which we all live.

Galeano (2001) addresses environmental issues by showing how large companies, based in countries that possess high hegemonic power, destroy nature in favor of exorbitant profits, exploiting countries through the use of cheap labor and little challenging power. The author also admits historical data and facts about urban violence, traffic violence, and other areas. Galeano also talks about the society of the consumption and how "having" has stood out over "being". Topics such as those outlined in the book that should be discussed in IT courses, especially in the mobile application programming disciplines that are the heart of this paper.

CONNECTION BETWEEN THE POINT "A" AND POINT "B"

The insertion of STS subjects and courses in vocational and technological training institutions is of essential importance. Oliveira et al. (2012) seek in their work to identify whether there is a concern in these institutions about social implications arising from the relationship between science and technology. Based on this, the authors discuss how to conceive knowledge development linked to technical and technological

education, considering its social implications. The researchers further complement that such institutions are "consisted of public production spaces and knowledge diffusion, and must be a channel to provoke this kind of discussion in the formation of the subject" (OLIVEIRA et al., 2012, p. 10).

Eichler & Del Pino (2014) have developed a work where the relationship between STS themes and digital technologies is well articulated. An important perspective of this work refers to the relevant contributions that the STS approach has in scientific education. The authors support this by stating:

> *i) the abstraction level can be reduced; ii) knowledge can be repackaged by teachers; iii) knowledge can be reconstructed by students, and iv) knowledge can be contextualized.* (EICHLER, DEL PINO, 2014, p. 121).

According to the authors, it is possible to declare that it takes a generation of politically and scientifically formed citizens, who do not settle for the role of shallow passive critics, in the solution of contemporary social and environmental issues.

Considering previous experience at teaching the specificity with the challenges and complexity of related STS issues, we will present some suggestions that for us it seems to be timely and relevant information on how to connect teaching mobile application development and modern social topics.

Racial discrimination is a recurring subject in our society but unfortunately barely debated in schools, and it has zero approaches in application development courses/disciplines. Currently, in Brazil, the racism cases most mentioned refer to those practiced in football matches. It is possible to orchestrate a sequence of classes that integrate application development and racism. To address this issue, the teacher can propose to the students the development of an application in which the user reports anonymously discriminatory behaviors. The application could be used within football stadiums, anonymously informing the proper authorities of the racist act location. To assist students in the educational process, the teacher should indicate readings, videos and other materials that discuss the subject with an up to date analysis. The work of Galeano (2001) is an excellent material that can be used in this kind of project. In this book, the “Basic course on racism and chauvinism” chapter introduces historical and current facts that can enrich and provide valuable input so that students can dig deeper into racial inequalities and discrimination. The thematic violence has many aspects, and one of them is perpetrated against children and women. Unfortunately, in our society, this is a recurring fact. In order to discuss this topic, the teacher may suggest conducting a project in which the students would develop an application to assist the repression of this behavior. The application would possess the main characteristics of each type of violence, based on which it would return the phone and the address of the closest places to the user's location, from which he can get help. These kinds of information can be found in booklets specialized in this subject. However, the teacher should instruct students to seek information about these services in their local communities, in their cities, information such as an address, telephone, and service hours. Thus, if the teacher has already taught the implementation of the Global Positioning System (GPS), the application may even indicate the distance between the user and these help centers. Also, such an application could support the option of automatically calling the appropriate help center. Another aspect of this topic refers to urban violence: assaults, kidnappings, robberies, regrettably more frequent every day. The educator has the option to indicate the development of a project to create an application that allows us to inform and monitor dangerous situations. Therefore, there is the possibility of creating a recommendation system informing the violence levels in

different city regions. It would be possible to map risk regions in cities based on a GPS system. Through the application, the user could silently receive and send help requests. At the same time the project is being developed, the teacher would use targeted readings and complementary materials that address violence in all its nuances. Each state's Military Police has the practice of preparing booklets with tips and information about citizens' safety. This type of informative material is very useful and can be found at each state police headquarters, some are present even on social media networks like Twitter and Facebook.

The environmental issue also holds many fields, such as air and water quality, deforestation, liquid, and solid waste management. One proposition that the teacher can make to his students would be the creation of an application that indicates location and access route to a certain solid waste recycling stations, such as cooking oil, cell phone batteries, and also recyclable waste in general. Besides, the application will inform the user where and how to dispose of different types of waste. In order to obtain this kind of information, the teacher can present the students with the Environmental Education Primer – Solid Waste Disposal (FIOL, 2015) which specifies each type of waste and how to dispose of them. Also, it is important for the teacher to seek - along with the students - information about waste disposal in their community. Thus, students can learn more about the location, the city, where they live and the environmental services available in their region.

Another serious problem today in Brazil is the scarcity of water. The Cantareira system is one of the main water capture and treatment systems in the greater São Paulo. The dams levels were sharply reduced in 2014 mainly due to the drought registered in São Paulo state and the headwaters of the dam. The water supply to the greater São Paulo is compromised. Saving water and electricity is an essential practice. Considering this context, the educator can propose to the students elaborating on a project to produce an environmental educational game portraying good practices for water and electric energy conservation. In the game, the user/player earn points by performing actions that promote the conscious use of this natural resource. The engagement that a game elicits in the youth of the 21st century is greater than reading or even a film can induce. Creating a game that has the proper game-design elements can make an application attractive and present in other people's smartphones, in addition to the students, one's themselves (BATISTA ET AL., 2016). The game-design elements of a successful game can be found in detail in the work of Jesse Schell (SCHELL, 2008). To subsidize the water theme, we suggest the technical report "Taking care of the waters", produced jointly by the United Nations Environment Program (UNEP), National Water Agency (NWA/ANA) and Brazilian Business Council for Sustainable Development (BBCSD/CEBDS) organizations. The UNEP report (2019) delivers relevant knowledge about water resources and also suggests solutions to improve water quality and actions to avoid water scarcity. Conscious consumption is a subject that needs to be addressed in our schools. Knowing the product that we are buying is very important. Knowing if it contains toxic, harmful elements, if it affects the environment in any way, can make a difference when making a conscious purchase. In an increasingly consumer-driven, media-driven society, the educator can propose creating an application to be used in a supermarket. Initially, a database is built with information and prices of various products in different commercial establishments. Thereafter, a function is implemented in which the device's camera visualizes the bar code of the product being bought, then the application returns - from the database - the information if the price for that product is better or not, in other commercial establishments. To serve as a parallel guide

to conduct this project, the teacher can use the Conscious Consumer booklets and guides, which can be found at the Consumer Protection Entity of each city, either in person or on the Internet.

At this moment we place some proposals on how to connect modern social issues to disciplines - or courses - on mobile application development. They are not redeeming proposals, with the pretense of rescuing the planet from these problems. But they can emerge as an orientation, a window, to discuss with the learners about the humanitarian and social problems that we face today.

FINAL CONSIDERATIONS

The emerging mobile technology has gained a remarkable place in our society. IT courses have been trying to keep pace with this demand. The directions of technological education, especially IT, are essentially technicists with little - or almost no - approach to the relevant issues to the modern social context in which we are inserted. A change in direction is imperative. The approach to socially contextualized issues through the coordination of mobile application design projects is shown as an alternative for educators. The content presented is meant to be a spark, so the teacher can ignite ideas and promote discussions around these and other socially relevant topics.

The direction change will enable the formation of more enlightened, aware and educated professionals regarding the civilizing process in which we are inserted. We should not be technophobic. Informatics and its advances are evident and extremely relevant, but technological advances can not suppress or even be unrelated to the issues regarding the civilizing process. The connection between these two points can and must exist, and in need to be strengthened and well-articulated.

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