Accessibility and Social Issues in e-Learning for Engineering Students

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Abstract—An increasingly important topic in education is the use of video lectures. It is known that it has many advantages, for example, improving the accessibility of the education and in some aspects the interactivity of the learning process. Still, the accessibility is limited to those who have the right devices and internet access. In this paper we discuss the accessibility at developing countries such as Brazil.

It was given a survey to 440 freshmen of the biggest brazilian engineering school in terms of number of students, the Escola Politecnica da Universidade de Sao Paulo. We worked on the results as a case study in order to try to expand the results, for example, to the case of a general developing country. Some of the results of the survey was that almost one third of the students watches video lectures once a week, more than 80% of the students watch it to have a better understanding of the subject and the biggest part of the students are watching through Youtube.

Finally, this study suggests that in order to improve the accessibility it is important to invest in services related to smartphones and Youtube. We noticed that it is important to make similar studies at other universities because of the socioeconomic bias found at the case studied.

Index Terms—video lectures, e-learning accessibility, mobile devices, education in developing countries

I. INTRODUCTION

DISTANCE EDUCATION has been an important issue, which brings the opportunity to make available materials prepared by educational instructors to students who are not necessarily physically present in a regular class. One of the tools that are trending today are the on-line education videos, which has been classified in four main groups [1]: as live classroom recording, shots at an office desk, slide shows and digital drawings. The classification makes it easier to analyse the effectiveness of videos. Nevertheless, it is known that it might be better if it involves diverse methods of recording and edition [2]. It makes the videos more interactive, for example, which is one of the advantages of video lectures [3].

Although these points are important, it should be emphazised that video lectures are not meant to replace professors. Studies have shown that even though the students felt excited with these technologies, they still prefer to have the lectures in a classroom as usual [4].

The development of this kind of educational method makes it important to study the hosting of the videos. There are platforms such as Coursera and EdX which hosts MOOCs - Massive Online Open Courses -, a series of videos that substitute a regular course. The study of these platforms already found strategies used by this platforms to reach popularity [5]. Also, there are platforms such as Moodle which hosts regular courses for universities and institutions, and those are also important because they host the videos used for support [6].

Both cases still have issues such as lack of a version for many mobile devices, specially smartphones, for the website or the video lectures. It is known that smartphones are widely used by students today and the use is increasing [7]. The major problem is the small screen which makes Web browsing, reading some texts and watching some videos a difficult experience. Also, the small keys makes it hard to make use of the interaction models used today, making it necessary to adapt to new ways of interactions regarding smartphones.

One of the major advantages of the video lectures is the accessibility, as exemplified by the diversity of access at the MITx and Harvardx courses [9]. However, that brings us to a new question: how accessible are the video lectures? [8] It is a requirement to have a proper device and an Internet plan to use it, and it is also important to discover how to reach the contents and be willing to use it, what makes it a financial and social issue to work with.

In some countries, the biggest part of the students can handle with these devices requirements with ease. However, in others, a great portion does not have this opportunities. Latin America for example has a extreme poverty of around 7 % [10]. Hence, in these countries it is necessary to have a different approach to make the video lectures a reality.

To handle these questions, the government of Uruguay developed a program called "Ceibal Program" [11], which delivered tablets, laptops and notebooks with the purpose of giving one device per student, and they also produced platforms and prepared the institutions to that situation. That program solve not only the financial issue because it provides the hardware and the Internet but it works with the social issue by promoting the contents.

In order to understand these social questions, it is necessary to research about the students profile and the use of the technologies in a developing country such as Brazil and how to evaluate the scenario without such a bold policy such as Uruguay.

II. METHODOLOGY

This paper presents a survey applied to all freshmen of engineering courses in the year of 2016 at Escola Politecnica of University of Sao Paulo (Poli-USP), Brazil, representing a case study research [12]. The case study was chosen because it is an empirical research that analyses a contemporary

phenomenon within its real-life context. This choice was also due to the fact that one does not have control over behavioural events, dealing with recent situation in the twenty-first century and aiming to understand how certain phenomena occurs.

In the case study the goal of the researcher is to expand and generalize theories (analytical generalization) and not number frequency (statistical generalization) [13]. The case study is not a data collection tactic or a feature of planning, but a comprehensive research strategy [14] with theoretical propositions, a research project model and information sources for the analysis.

The Poli-USP was chosen because of its nationally and internationally recognition, being also one of the biggest engineering schools in Brazil in terms of student numbers. It is important to note, however, that the portion studied does not represent the country because of the high selectivity of the Poli-USP selection process. It can be seen in the Figure 1 that among the 11495 students that took part of the selection process, 870 were approved and those are candidates with a higher income per family [18] than the usual income. The calculations were made on 2016 and the brazilian minimum wage was U$ 2.67 per hour, which is around U$ 21.36 per day.
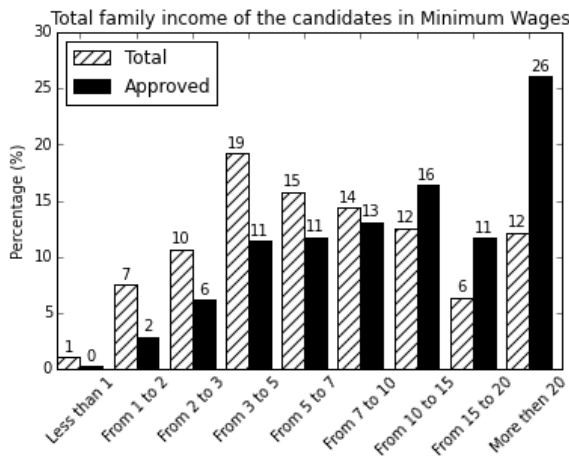

Fig. 1. Comparision of the total family income in percentage of the total number of candidates and of the number of approved candidates on the selection process

The freshmen were chosen because they have lower previous experience with the university. Even though they might bring some cultural habits from the previous education, as the time passes in the university the student start having other activities, for example internships. That means that the emphasis of watching video lectures might change.

A. Brazil and Escola Politecnica of USP

According to the latest technical report of the census applied in 2013 by the brazilian government [15], there are around 7.3 millions students enrolled in higher education, 1 million in engineering courses, over a population of 200.4 millions. One third of those receive a familiar wage from 0 to 5 minimum wages [16].

It is clear that the majority of the population has a low income, so it is not possible to ignore the socioeconomic
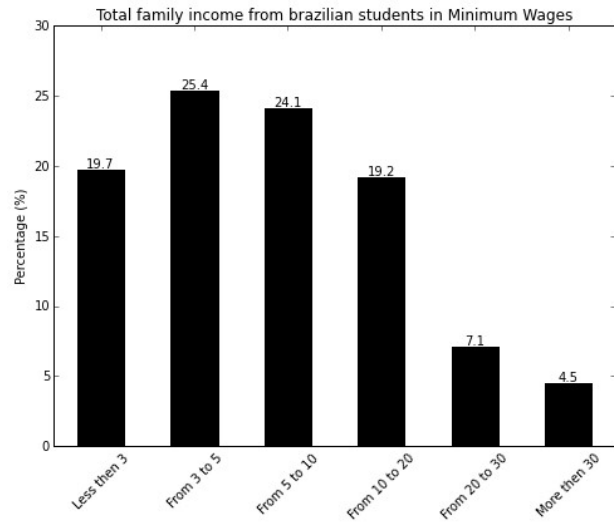

Fig. 2. Total family income in percentage of all the brazilian students in college

issues around the learning process with video lectures, because with a lower income it gets harder to have access to the content.

The information we have about the socioeconomic condition of the approved candidates means that perhaps the condition might not be a relevant factor to study how is the access to video lectures for these students because they might have the proper devices. However, it is still an important point to be studied to check the way we will treat the data.

B. Survey

The research was conducted in the first semester of 2016 through a optical survey and the analysis made with the software Auto Multiple Choice and the programming language Python. The questions were applied to 440 of the freshmen, bringing a high influence from the high school, not only the higher education. There were 11 questions of multiple choice:

1) Which year did you enroll university?

2) Which engineering course do you do?

3) Do you have smartphone with mobile data plan?
   A - I have smartphone with a mobile data plan; B - I have smartphone without data plan; C - I don't have smartphone.

4) With which frequency do you watch video lectures?
   A - I watch daily; B - I watch every week; C - I watch it the day before exams; D - I watched once; E - I never watched.

5) What is the best reason for you to watch it?
   A - Curiosity; B - Better understanding; C - Expand the knowledge; D - Relevant to the career; E - Other.

6) In which situation video lectures is a good learning tool?

A - As a resource to replace the regular classes; B - As an indispensable resource but not to replace regular classes; C - A support material; D - Never.

7) Are video lectures possible and useful for all courses? A - Yes, possible and useful for all courses; B - It is possible for every course but might not be useful to some; C - It is not possible to all courses but it would be useful to these; D - There are courses that it is not possible nor useful.

8) Which platforms do you use to watch video lectures? A - Youtube; B - e-aulas; C - Coursera; D - Khan Academy; E - Moodle; F - EdX; G - Faculty personal webpage; H - Others.

9) With which frequency do you watch video lectures in your mobile? A - Every week; B - Sometimes; C - Rarely; D - Never.

10) Have you ever watched video lectures in the computer lab? A - Yes, many times; B - Yes, a few times; C - No never.

11) Would you watch Calculus video as a complement to the Physics classes? A - Yes, I already did it; B - Yes, but I did not have the opportunity; C - No, but I recognize that it might be useful for other people; D - No because I think it would not be useful; E - No because I think that it is not possible.

III. DATA ANALYSIS

One of the most important results is the frequency in which the students watch video lectures: 14.6% never watched, 19.8% watched only once, 32.2% watches just before exams, 31.7% watches weekly and 1.6% watches daily. For mobile, the frequency is lower: 30.6% never watched, 34.4% rarely watches, 28% sometimes and 7% weekly.
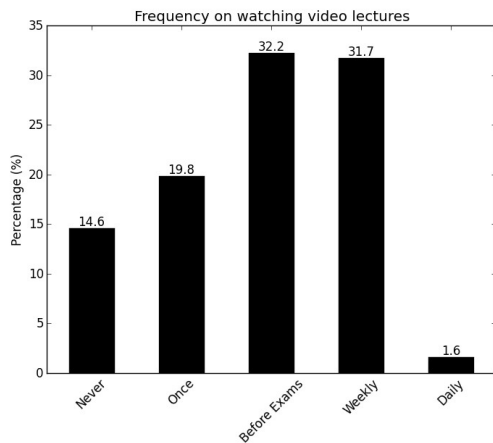
Fig. 3. Frequency on watching video lectures out of 440 respondents

Another interesting result is that most of the participants, 61.2%, thinks that the video lectures are good as a support
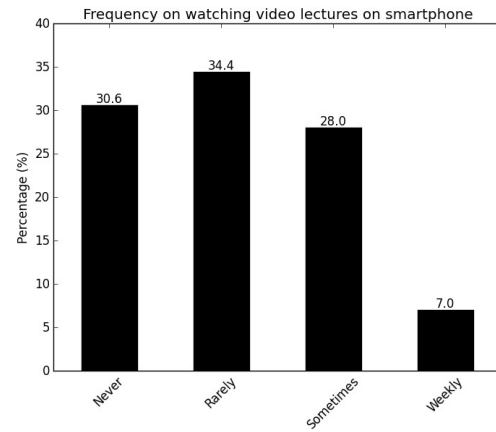
Fig. 4. Frequency on watching on smartphones out of 440 respondents

material but should not be imperative, while for 21.1% it must be imperative and for 15.9% it could replace the regular classes.
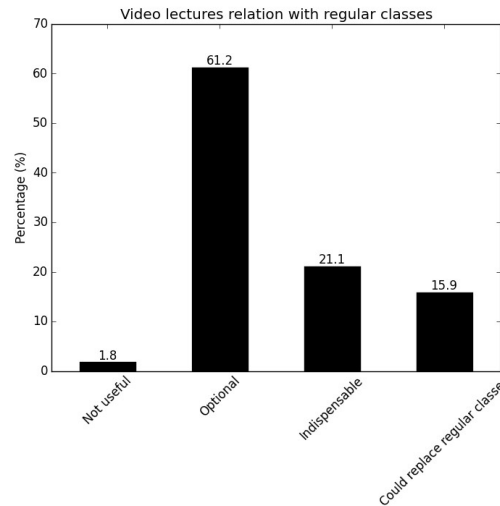
Fig. 5. Answers to the question "In which situation video lectures is a good learning tool?"

For 82.3% of the participants the reason for watching video lectures is to have a better understanding of the subjects, for 8.6% it is to deepen knowledge, 5.8% for curiosity, 0.3% because of the relevance to the career and 3% for other reasons.

The platforms are very diverse, but the majority (58.8%) use Youtube. Khan academy and Moodle also had a significant percentage, with 12.9% and 13.9% respectively. The other options cited were Coursera, EdX, e-Aulas, faculty personal websites and others, each one with less than 5% of the votes.

It is important to note that 87.7% of the respondents has smartphones with data plan, while 12% has smartphones without data plan as 0.3% did not have smartphone.

IV. CONCLUSION

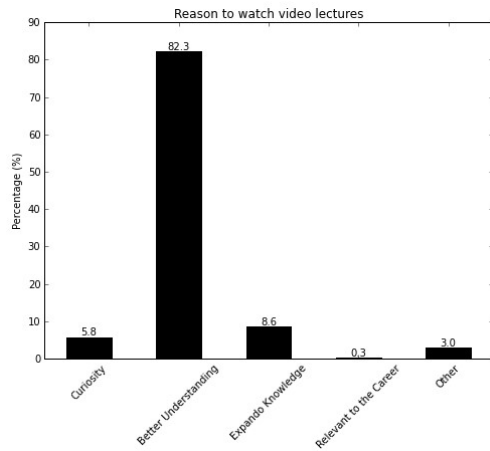We knew already that the compatibility with mobile devices are not good at many platforms. It can be seen that

Fig. 6. Answers to the question "What is the best reason for you to watch video lectures"
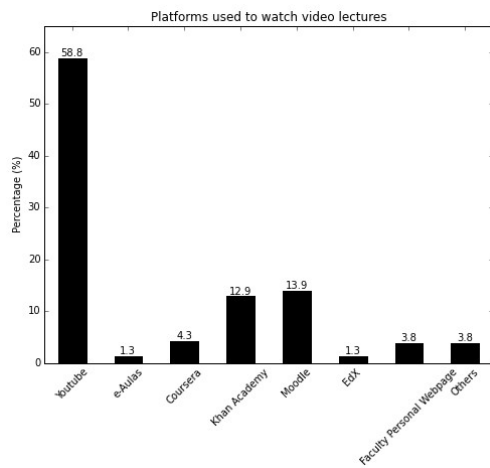

Fig. 7. Answers to the question "Which platforms do you use to watch video lectures?"
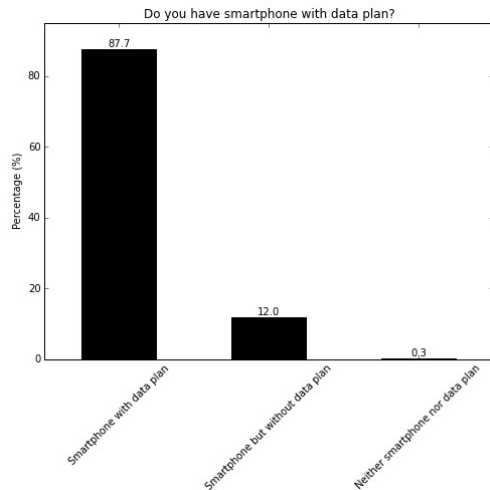

Fig. 8. Answers to the question "Do you have smartphone with mobile data plan?"

the students are not using their smartphones to watch video lectures. Maybe it can be due to the compatibility of video lectures that are available today with these devices.

It is possible nowadays to buy a regular smartphone for U$ 100.00 (around 25% of the minimum wage in Brazil). To have a better compatibility with smartphones is a way to deal with the accessibility problem.

Following the trend discussed that the access to smartphones is increasing, it is important for the schools to invest more not only on producing proper contents but on providing good wireless access. Once the students have the proper devices to access the video lectures, it might be more useful for the institution to provide adequate services rather than trying to have more devices.

The study indicates that Youtube is a largely used platform. To have a better compatibility with smartphones, it is known that Youtube is investing on new features. Perhaps by uploading the video lectures on Youtube would be another way on improving the accessibility.

In the case of this study, 82.3% of the respondants consider as a support to the classroom, not meant to replace the professor, as reported in other studies[4].

The profile of the student at Escola Politecnica da Universidade de Sao Paulo is with high socioeconomic conditions: they have smartphones and data plans. The accessibility for these students are not a critical point, although it can be improved for example by making more WiFi access points available.

Nevertheless, about the students that are interested in getting in this school, we verified that they might not have the same conditions because of the lower income. It is important as a next step of this study to make a similar survey at a university that has a student profile more similar with the brazilian one.

This survey was applied to engineering students, who usually need to use the computer more than other students for example those studying law or medical sciences. One important point to highlight is whether the results would be similar or not.

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