IoEduc – Bring Your Own Device to the Classroom

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Abstract

The evolution of technology brings new challenges to teaching platforms. Students are demanding and want to have dynamic and interactive environments. Classrooms are much more than a simple place to study. Students can work and learn anywhere and anytime they want. Having this reality in consideration emerges the concept of Bring Your Own Device to classrooms. So, in the first instance, it is essential to understand the concept and which tasks can be transported to students devices. After that, it is time to design a new tool capable of answering new teaching demands. ioEduc arises as a platform able to support a unique and interactive way of teaching. This emerging platform was tested during a semester, and the assessment results of utility are promising (0% of negative answers and more than 60% of students consider this tool indispensable to the future).

1 Introduction

Nowadays students find the need for a different type of learning approach in order to find a motivation to expand their knowledge [2]. With the evolution of technology all the processes that used to be on paper are now becoming digital. This transition is also present in education and is impacting the way of how the students learn and study [9]. Gamification is one way to help students to find motivation to learn and work harder in classes [1].

Even though there are already solutions and platforms to encourage e-learning, these still have weaknesses, such as the difficulty of being used in several types of devices and receive information in real time, which is really important in order to follow Bring Your Own Device (BYOD) concept since students should be able to use this platforms regardless of the device they want to use [3]. With this e-learning platforms being available to everyone use in their personal devices some concerns arise, the biggest of them is data privacy, a concern that is transversal to all digital services, although is missed in many of these e-learning platforms (e.g. Teachers publish students evaluations on platforms and every student has permission to see the evaluation of his colleagues).

ioEduc arises in this context and it wants to address these concerns and create an innovative and interactive way of learning where students can access all the materials used in classes, play real time subject related quizzes, evaluate their workgroups anonymously, and view only their grades, not compromising the privacy of the remaining students.

This paper has the goal of presenting an innovative and interactive platform which personifies the concept of BYOD to the classroom. This platform was used in a real context at University of Minho and the results are motivating. This paper is divided into six sections, the first one is an introduction to the problem itself, providing some concepts to take into account during this document. The second section provides the background concepts like BYOD and gamification, having also a subsection referred to related work, in order to understand the problematic. The third section talks about the ioEduc platform, their features and own it improves the teacher work and the student's learning process. The fourth section shows a SWOT analysis of ioEduc platform, trying to understand the ioEduc capabilities and the problems that may appear. The fifth section shows the result of a questionnaire performed at University of Minho during the first semester of 2019/2020 in a subject that used ioEduc, in order to understand the receptivity to this platform. Finally, on the sixth section there is a conclusion of this document, trying to summarize the ideas shown earlier.

2   Background

2.1   Bring Your Own Device

According to Moreira et al. [11] Bring Your Own Device (BYOD) is a subset of the consumerization of Information Technologies (IT) as private or personally owned IT resources, such as computer devices or software that are used for business purposes. In education, BYOD consists of bringing laptops, smartphones or other devices to the classroom in order to increase active learning [6].

ioEduc implements the concepts of Bring Your Own Device to classrooms as it is a multi platform app that can be accessed through students personal devices.

2.2   Gamification

Gamification can be defined as "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" [7]. The main purpose of gamification is to merge non-gaming environments with gaming components, particularly points and rewards. The use of game mechanisms as a method of learning has been discussed since 1938. Although gamification has only started to be a widespread technology trend since 2010 [1, 4].

Education is one of the most important factors for the development of any country [1], so it is important to have students motivated and prepared to deal with pressure. Gamification plays an important role in helping students who need to be motivated as they'll have a goal to achieve they'll work harder and hit the deadlines, boosting their skills, and confidence [5].

The ioEduc platform allows the teacher to assign yellow cards to students that don't show any interest or relevant work during the semester. After a certain number of yellow cards, pre configured by the teacher, the student can get a red card. With this feature the teacher have a record of work and evolution of each student. That can help to either alert the student that his performance is insufficient or the teacher if the student evolved during a certain period.

2.3 Related Work

ioEduc is not the first solution that encourages students to bring their own devices to the classroom [8]. Moodle is an e-Learning platform made for students and teachers where they can write summaries, upload documents and helpful materials, create evaluation moments where students can submit their work and view their grades later. Another solution is Blackboard Learn, which is a virtual learning environment and learning management system. It is a Web-based solution with features of course management, customizable open architecture, and scalable design.

Although both solutions are well-known and much-used, none is fully adapted and optimized to mobile devices.
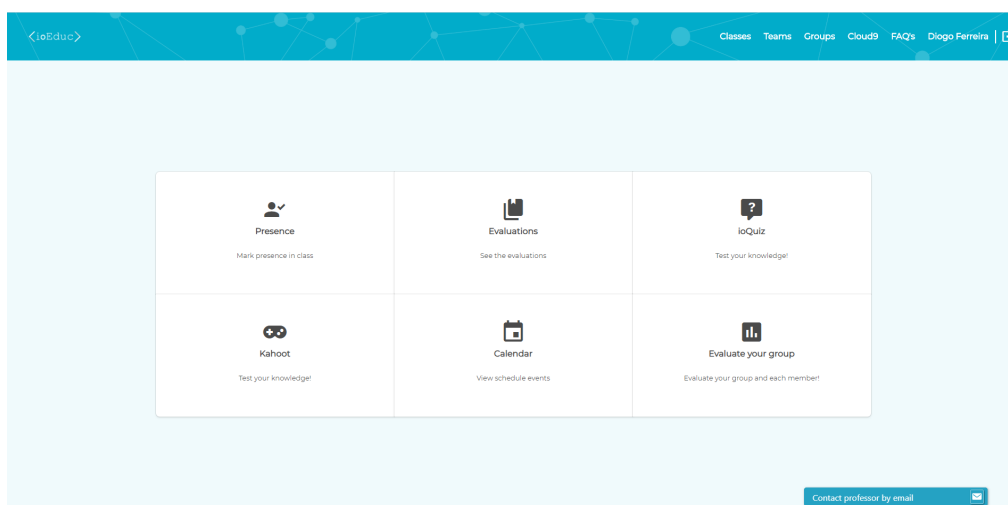
3 ioEduc

Nowadays, people tend to increasingly use their mobile devices on every task and at every moment of the day. The concept of being always connected is a reality that does not seem to change easily. That is even more evident in the younger age groups, the current students, those who were raised in a generation where there is an app for everything and all they need is a click away.

Thus, why not take part in this phenomenon and use it to create an engagement with the students? It is essential to create a new and interactive teaching environment capable of motivating students in computer science classrooms [10].

Based on this opportunity, the ioEduc platform was born. This platform was designed to be used in education, aiming to support both teachers and students. That objective is achieved by allowing the users to access all the information of their subjects since the class slides, files that the teachers wants to share, evaluations, presences register, groups creation and evaluation, and much more functionalities that will be explained later.

At the same time, ioEduc fills a gap that we can find in others e-learning platforms, the lack of privacy of each student grades, the ability to let the students mark presence in the classes using their mobile devices and the ability to contact the teacher via chat and expose any doubt that the student can have, even during the classes, allowing the students to overcome shyness and and eventually increase their knowledge.

Figure 1 First page of the student's account.

Table 1 ioEduc main features and users access.

Feature	Teacher	Student
Mark presence on the class		X
See presences and assign bonus	X	
See class slides and other resource files	X	X
Manage slides and other resource files	X	
See software credentials	X	X
Manage software credentials	X	
See FAQ's	X	X
Manage FAQ's and FAQ's categories	X	
Create evaluation moments	X	
Submit student's grades for each evaluation moment	X	
See student's grades at each moment	X	
See only the logged user grades		X
Create and see quizzes on ioQuiz tool and the results	X	
Submit and see the logged user ioQuiz grades		X
Create Kahoot quizzes and see the results	X	
Submit Kahoot quizzes		X
Create projects and teams	X	
Create groups	X	X
Evaluate group and each group member		X
See the logged user's group evaluations	X	X
See all the group evaluations	X	
Assign penalization to students	X	
Create calendar events to a subject	X	
See calendar events of a subject		X
Manage Live Class	X	
Interact with live class	X	X
Ask questions on the integrated chat		X

So, we can say that ioEduc is an innovative, adaptive and user-friendly platform that can be a valuable asset in education because it provides several tools that can simplify the related parties lives. As referred earlier, ioEduc aggregates multiple modules and functionalities, in order to provide a solid working platform.

As seen on Figure 1, the first page that the students see when they are logged on ioEduc platform, the design is really simplistic, in order to make the user experience as smooth and pleasant as possible. However, although the design is really simplistic, the platform has a lot of features that can help both students and teachers on a daily basis.

Some of the main features are introduced in Table 1, showing also which type of users have access to them.

ioEduc is a tool created to answer the TechTeach metodology [10]. Thus, the side by side comparison with other LMS (Learning Management Systems) wouldn't represent any advantage to the context of this analysis.

The next subsections present some of the the capabilities of ioEduc and how they benefit their users.

3.1   Use your own device to mark presence at the classes

ioEduc allows the students to mark their presence in the classes, by inserting a unique class code in a specific timing defined by the teacher. Later, the teacher can see the students that attended the class and can also give an aleatory bonus to them. With this module, the way of validating their attendance makes the process more reliable, since one student cannot mark the presence of another student in a simple way and in the given time; is a much faster process than the traditional piece of paper to record the presence or the teacher calling each student name. Besides, with the possibility to bonify an aleatory student that attended the class, the students will feel more motivated to go to the classes.

So, this module for itself, by having the capability to increase the attendance to the classes can consequently improve the students results at the subject.

3.2   See your evaluations

As seen in other e-learning platforms, the teachers are capable of releasing the students grades. These releasings have a privacy issue, because the students can see each other grades, leading to comparisons between them, conflicts and eventually problems with the teacher's criterion.

With the ioEduc platform, the teachers can create multiple evaluation moments, that can be quizzes, exams, group evaluations. The teacher can evaluate each student individually or he can upload a CSV file with the student institutional identification and her grade. Then, each student can only see the evaluation that concerns him, mitigating the privacy problem explained earlier.

3.3   See frequently asked questions and credentials to subject's software

In order to facilitate the teacher's work, ioEduc provides a way to create and manage frequently asked questions, commonly known as FAQ's. This feature facilitates the teachers work because if he sees that the students have common doubts, rather than respond to all of then the same answer, he can create a new FAQ and if he wants to, he can organize them in categories, facilitating the student's search.

Similarly, the management of the student software credentials is more simple since they can consult the ioEduc credentials area to access them, without the need to ask the teacher and make him search between all the student credentials.

3.4   See scheduled events

This module is really simple, however it can play an important role in a subject organization, because all the official events (e.g. classes, topics by week, assessments, milestones, presentations, among others) are scheduled on the subject's calendar in order to avoid confusion with multiple events and have all of them organized and quickly available.

3.5   Make quizzes with ioQuiz and Kahoot

Another great ioEduc tool is called ioQuiz, and is a tool that allows the teacher to create quizzes in a simple and quick way, allowing the students to answer them. Since the ioQuiz tool is integrated with ioEduc, all the process is transparent and both teachers and students can see the quiz results on the evaluations page. If the teacher chooses to, the bonuses earned

with the presences (explained when we talked about the mechanism to mark presence at the classes) can be applied to the quiz results, allowing the students to have extra points and eventually improve their final grades. ioEduc is also integrated with Kahoot, a live quiz platform, allowing the students to interact more and test their knowledge during the classes.

3.6   Manage projects, teams, groups and assess you group

The group management tasks are the most time consuming to teachers because they need to register the projects, the work groups and even the assessment of each student to his own group. ioEduc provides a solid way to manage all this process without all that work. The subject's teacher creates the projects that the students can choose, then he can associate each project to a team. The group creation can be made by the students, by choosing the group leader, choosing each element role and their project. Later on, if the teacher creates evaluation moments to do so, each student evaluates their group and each element individually (in a grade between N-4 and N+4), reporting if each member worked and collaborated as expected, and giving each element a grade based on their collaboration.

To avoid problems with the evaluations and in order to have the truth about what happened during the project without any constraints, all the evaluations are anonymous, although they can be traced back by the teacher if he really needs to. The teacher can always see the group assessments, having an overview of the average evaluation of each group. If he wants to get more details, he can see the average individual assessment made by the group colleagues and the number of times that each one is marked as if not collaborated as expected. If the teacher considers it appropriate, he can penalize the student.

The penalization system works with four card colors, without any penalization the students have a green card, the teacher can penalize a student and after that, green card becomes a yellow card. If the student has another penalization the yellow card becomes an orange card, and after that, any penalization means that the student has a red card and if the teacher wants to, he can fail the student. This feature allows the teacher to maintain a full report of each student's evolution during the project.

3.7   Online chat and offline messages

The ioEduc platform also has an integrated chat, allowing the students to communicate with teachers and expose their doubts. If teachers aren't online to answer the students, an email will be sent to them with the student's question. One of the particularities of this chat solution is that the questions can be sent to the teacher during the classes, allowing the interaction and the clarification of the questions in real time. This one turns into a more important feature when applied to shy students that are not comfortable to talk in public.

3.8   Live class

The live class module is an area where the teacher can access all the resources that he needs during the classes. This module allows the teacher to select interactive slides to present to the class, videos, it has a clock and an alert and notification system. The teacher can also see the students that are present at the class and assign bonuses or even penalize a student directly from this page. This module also allows the creation and presentation of Kahoot quizzes, making the students interact more in the classes. Another interesting feature is a noise meter that is a tool that alerts both teacher and students that the amount of class noise is critical.

4 SWOT Analysis

ioEduc is an in-development platform, so it is crucial to do a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis as can be observed in Figure 2.

The major strengths of ioEduc are the possibility of students bringing their own devices to the classroom and validate their attendance, which could be really helpful in order to replace the old methods like signing and card validation. One of the biggest opportunities of ioEduc to grow is by implementing it in more universities so students and teachers can bring their own device to classes and start to have more interactive classes. ioEduc also has weaknesses and threats, the biggest weakness is that it is not possible to access the information offline, so if there is no internet some classes could be compromised.

Some threats can be faced by ioEduc, universities could start to develop and implement their own systems or collaborate with existing platforms in order to have a more robust solution that could have more feature overtime.
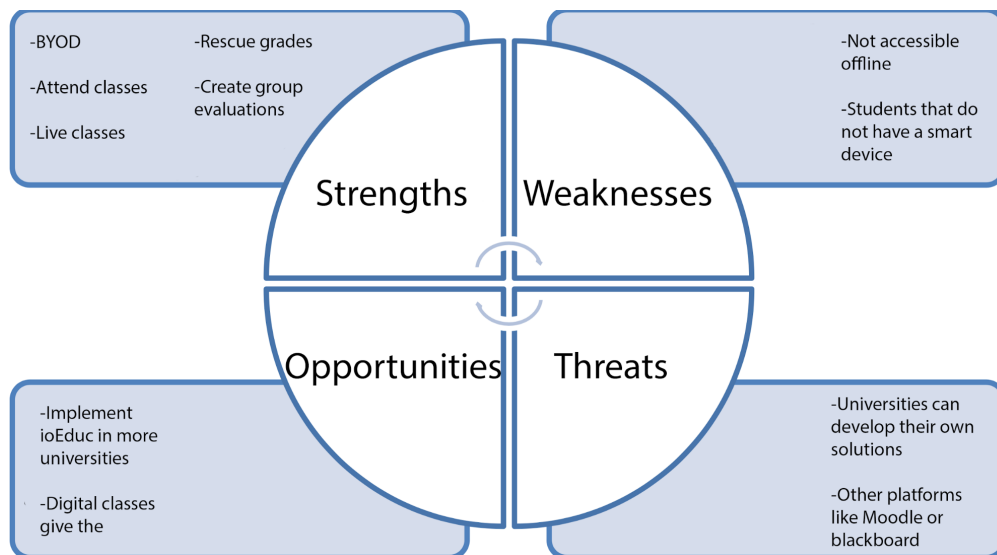
Figure 2 SWOT analysis of ioEduc platform.

5 Results

ioEduc was exploited at the University of Minho during the first semester of 2019/2020. During this period professor used this platform to turn the classes of Web Programming more interactive and attractive. More than One Hundred of students used this tool, and the feedback received is too positive. A semi-structured questionnaire was designed by the leading professor to assess and understand the impact of the platform. This questionnaire was disseminated near the students on the last lesson of the semester during two phases:

1. Structured questions:
   - Should ioEduc be a gamble?
   - Do you approve the concept of BYOD in the classroom?
2. Open Question. Give your opinion regarding the platform (positive / negative / or aspects to consider)

Seventy Three students answered to phase one and One hundred and fifty four students participated in phase two.

Table 2 Student's answers distribution.

	No	Maybe	Yes	Definitely Yes
Q1	0,00%	39,73%	30,14%	30,14%
Q1	4,35%	–	95,65%	–

The second phase was used to understand the real opinion and understand their answers in step 1. All the students answered step two. After analysing the responses, it was possible to observe that the students who put maybe in phase one are associated with some external issues like internet:

The second phase was used to understand the real opinion and understand their answers in step 1. All the students answered step two. After analysing the responses, it was possible to observe that the students who put maybe in phase one are associated with some external issues like internet:

- Slow to load pdf images
- the application often went down in the middle of the class which made the monitoring of the taught pp more complicated
- I think the only things to improve are small aspects like lags, session and login failures.
- Good, simple platform, it just takes a while with the university internet.

As the most positive aspects, it is important to highlight:

- The platform is well organized and constituted, interactive, of interest to students, good dashboard and good information regarding student data, study methods etc.
- Very well designed and encourages programming.
- Very educational and accessible.
- It is a well accomplished and very interactive platform. I loved the idea of online presence booking.

At last, it is fundamental to mention that the ioEduc was developed at the length of the semester. Several improvements and optimisations performed in "real-time" after receiving the users (students) feedback. This fact can be proved by the student analysis:

- It is still in development and therefore some bugs are seen. However, the platform itself is a good initiative.
- The platform is improving more and more. At first I found some bugs but recently it is much more stable and works most of the time.
- The idea is good, I think it was well incorporated by the teacher, despite the 'bugs' registered in the first weeks.

6 Conclusion

The evolution of technology created several opportunities in almost every working area. In the education area there are only a few platforms that try to mitigate this lack of solutions. However, they have some issues like data privacy and their resources should be improved in order to create a bigger participation and engagement of the students. With the new technology reality, the idea of having all the information on your mobile devices, concepts like BYOD (Bring your own device) and gamification could enhance the interaction with the students and eventually increase their grades.

The ioEduc platform is a software built to turn these concepts into a reality. It was built taking into account the needs of both the teachers and the students, having features that goes from using the students own device to mark presence at the classes and get a bonification or, if the teacher wants to, a penalization, turning the gamification concept into a reality,

see the evaluations individually in the case of the students, see frequently asked questions and credentials to subject's software, see scheduled events, make quizzes with ioQuiz and Kahoot, manage projects, teams, groups and assess groups and each member individually and anonymously, online chats and offline messages and a live class module to allow teachers to have all the tools needed to the classes without opening multiple pages.

This platform was exploited at the University of Minho during the first semester of 2019/2020 [10] where a semi-structured questionnaire was designed by the leading professor to assess and understand the impact of the platform. The student's receptivity to this platform was very positive, giving the idea that a vast majority of them (60%) approved this platform to use on a daily basis. Taking this into account, ioEduc has potential to become widely used and to grow, using the concepts as BYOD and gamification to improve the interactions at the education area and consequently the student results. The gamification is accomplished by the cards system, allowing teacher to reward or to punish the student according to his interest and work.

Although this platform represents a practical tool that aims to generate value to the society by helping the educational process, it can act like an inspirational agent to the development of new solutions applied to this area.

In the future, this platform will be optimised (e.g. offline mode), and some of the problems reported by the students will be solved. Then, it will be time to do some partnership to explore ioEduc in other institutions.

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