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Flipped Classroom Applied to Teaching Artificial Intelligence

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Abstract

The flipped classroom is an active learning method that helps the teacher to promote a significant change in the teaching and learning process, inverting activities and revolutionizing the traditional learning model. However, the application of the flipped classroom is not simple and involves the teacher's dedication to facilitate the student self-regulation of activities to promote learning. The objective proposed in this article was to investigate the feasibility and effectiveness of the application of the flipped classroom in the teaching of Artificial Intelligence. To assess the results, a mixed methodology, qualitative and quantitative, combined with discourse analysis was applied. The results were satisfactory, indicating the potential of the flipped classroom applied to the teaching of Artificial Intelligence.

Keywords: Flipped Classroom; Teaching; learning; Artificial Intelligence.

1. Introduction

Studies on the various topics involving artificial intelligence grow exponentially. Artificial intelligence involves highly complex concepts, which require a high level of abstraction and significant capacity for analysis and perception (Barrios-Tao, Díaz and Guerra, 2021).

Teaching about the concepts and providing a broad understanding of artificial intelligence is difficult, demanding a lot from the teacher (Kengam, 2020). Faced with the difficulty of the subject in question, it is desirable that the teacher seeks a teaching methodology that can favor student learning.

The traditional teaching method involves the teacher as transmitter and students as receivers of knowledge. In the classroom, classes are usually expository, and work is done at home, so students act as passive agents in the teaching and learning process (Ritchhart, Church and Morrison, 2011). The flipped classroom changes the way classes are structured, what is done in the classroom will be done at home and what is done at home is done in the classroom. However, inversion involves other important factors, in the inverted learning model, the student is invited to watch a video produced by the teacher (O'Flaherty and Phillips, 2015). By obtaining prior knowledge about what will be seen in the classroom, the student will be prepared for group discussions,

for which collaborative learning is an important ally. However, there are drawbacks associated with the flipped classroom that must be circumvented, when watching the video, the student does not have the opportunity to ask the teacher immediate questions, the student may have difficulty, or even not understand the content of the video (Akçayir and Akçayir, 2018).

So the teacher should instruct students how to access and watch the video effectively, it is suggested that the student avoid distractions while watching the video, take notes and record doubts so that they can later be remedied by the teacher (Bergmann and Sams, 2012).

Some proposals for the use of flipped learning propose the use of forums to try to minimize the teacher's response time to students (Blanco, Nuñez, Gene and Medina, 2017). Bergman and Sams (2012) compare the use of time in traditional classrooms and in flipped classrooms, where most class time is devoted to questions and answers about video and guided and independent practice and/or laboratory activity.

Although the use of video is recommended, other materials can also be used, such as texts, videos by other authors, lectures, documentaries. In flipped classes, all actions revolve around the content taught and the students, not the teacher, the teacher acts as a mediator, coordinating the questions and providing specialized feedback to what is being treated (Lundin, 2018). The inversion of the classroom can transform the teaching practice, as it gives the student the opportunity to infer opinions, present ideas and suggestions about what is being worked on (Setren, 2019).

Thus, flipped learning has weaknesses that must be observed and treated carefully. Even in inverted learning, the students' learning pace is different, so the methodology and interactivity between the student and the teacher must be closer, so that possible doubts can be resolved (Brewer, 2018). The dedication and motivation of students to develop activities at home are very important for the success of flipped learning, and difficulties are often reported when using the method (Hadwin, Bakhtiar and Miller, 2018). In addition, teachers and students are not fully prepared to adopt this method to promote interactivity in the flipped classroom, as there are problems that need to be overcome, such as procrastination (Aljarrah, Thomas and Shehab, 2018).

Artificial intelligence is one of the fastest growing areas in computer science, there are several researches with well-structured arrangements that investigate and propose numerous intelligent solutions that involve high-level algorithms (Ajuzieogu, 2019). However, understanding the structure, programming languages and the proposition of algorithms at this level is difficult, requiring a lot of dedication from the student, a high level of abstraction, creativity, and the ability to build solutions that can contribute to the improvement and creation of different types of services. and applications (Tuomi, 2018).

During the coronavirus (Covid-19) pandemic, teaching in the area of artificial intelligence has become even more complex, as it is more difficult for teachers and students to interact in order to resolve doubts and propose solutions (Chua and Valencia, 2020).

Teachers and students are inserted in a society full of digital resources, the Internet is present in practically all areas of activity. However, while attending classes, students can be distracted and inappropriately use the most diverse Internet applications, which for the teacher can foment a war against technology, which can cause the restriction of the use of smartphones and other resources. digital (Strayer, 2012). Such actions would be a

setback for education, so it is necessary to streamline and make the teaching and learning process more attractive with the use of active learning methodologies. Flipped learning can help to exploit such technological resources, which are part of the daily lives of teachers and students (Bergmann and Sams, 2012). In flipped learning, what traditionally takes place in the classroom is done at home, with the use of digital resources, what is normally done at home, such as assignments, are done in the classroom with the participation of the teacher. It is observed that the flipped learning model has been satisfactorily applied in educational technology, with good performance in subjects related to higher education (Koh, 2019).

The objective of this work is to analyze the application of inverted learning in the teaching of artificial intelligence, promoting interaction between teachers and students inside and outside the classroom. Propose to teachers and students the use of inverted learning in the teaching of artificial intelligence.

2. Related Works

The analyzed literature aims to contribute to the theoretical foundation of the objects under study in flipped learning and artificial intelligence teaching, to encourage group interaction and discussion and the application of specific strategies for the flipped classroom application. Also to investigate the state of the art of published works that are based on studies related to flipped learning.

Regarding the application of flipped learning, Hao (2016) states that to better understand the flipped learning approach, it is necessary to investigate the individual characteristics of undergraduates. There is also no agreement on the way in which the interaction should take place in the classroom. The most common models include problem solving, cooperative resolution, there are also doubts about how the teacher should interact with students, to answer students' questions in the shortest possible time (Danker, 2015).

Yilmaz (2017) investigated satisfaction and motivation in the flipped classroom, readiness plays an important role in flipped learning and positively affects satisfaction and motivation. Student satisfaction and motivation in the flipped classroom are among the most observed problems, and these problems can reduce the efficiency of flipped learning.

Hao and Lee (2016) investigated teachers' concerns and anxieties about the application of the flipped classroom, analyzing that personal concerns influence the flipped learning process. The lack of knowledge about the technologies used and the lack of a specific tool for creating the content of the classes is one of the biggest concerns of teachers.

Sohrabi and Iraj (2016) joined forces to implement the flipped classroom using digital media comparing perceptions of demographically different groups. The authors report that they were the first to implement the flipped classroom model in Iran, they report that there was good reception by younger students, that different resources such as documentaries and TED talks were used. They also report that it was a great challenge and opportunity for students to watch the videos in English.

Sergis, Sampson and Pellicione (2018) address that self-determination is important for the flipped classroom model, that it can be beneficial for students, that self-determination theory can provide significant improvements and lead to better outcomes regarding cognitive learning. from the students. It can also promote the improvement of student satisfaction in the teaching and learning process.

Sengel (2016) promotes a study that evaluates students' perception of the use of the flipped classroom in the physics course, develops the flipped classroom model for higher education, makes a comparison of the flipped classroom with the approach traditional. The research investigates the effectiveness of the flipped classroom combined with problem-based learning and cooperative learning, compared to the traditional classroom. It also investigates the effects of watching videos and establishes a strategy for doing homework on achievements in the physics course.

Blanco, Nuñez, Gene and Medina (2017) proposes the use of an innovative model to promote the active involvement of students, the model can be applied to an entire discipline or part of it, analyzes issues that can influence learning outcomes, incorporates as a novelty, a link activity phase to link actions at home and in the classroom. The students participating in the experimental group obtained significantly better results regarding learning compared to the control group.

Regarding flipped learning applied to the teaching of artificial intelligence, it is found that it is difficult for students to learn content that has a high level of complexity, and it is desirable to use active learning methodologies, such as the inverted classroom that can help to facilitate the teaching and learning process (Barrios-Tao, Díaz and Guerra, 2021).

All the works investigated present relevant models for the application of flipped learning. However, the works report difficulties to be overcome and the need for a structured model for the application of flipped classrooms.

3. Methodology

A quantitative research methodology was used to analyze the results obtained through a structured questionnaire applied to students (Yu, 2020), to investigate the students' experience, in order to obtain results related to the success of the active learning methodology used.

The questionnaire involved objective questions and an essay question, in which the student was invited to analyze the use of inverted learning.

For the analysis and obtaining of the results, a control group was created without the application of the inverted classroom method and an experimental group with the application of the inverted classroom.

The Mann-Whitney U statistical test (Mann and Whitney, 1947) was used to determine whether there is a significant difference between the results of the control and treatment groups.

4. Results

The results obtained with the analysis of the control group and the experimental group follow.

4.1 Control Group

In an analysis carried out with a class at the University, which was not involved with flipped learning, 12 students from the computer science course, in the discipline of artificial intelligence, answered a questionnaire, in which the result of the following questions was highlighted:

1. “Did you feel more motivated during class?”
2. “Were the classes more dynamic?”
3. “Did you feel encouraged to research more about the topics covered in the classes?”

Table 1– Control Group

Questions	Yes	No
Question 1	37,1%	62,9%
Question 2	22,8%	77,2%
Question 3	26,4%	73,6%

The first question presented obtained a result of 62.9% for no, which indicates that the students did not feel significantly motivated with the traditional classes, in the second question 77.2% of the students indicated that the classes were not dynamic enough and 73, 6% responded that they did not feel encouraged to research the topics covered in the classes, which indicates that the use of a teaching method that helps the teacher to regulate student activities in the classroom involved in the teaching of artificial intelligence is indicated so that there is more motivation, dynamism and research on the topics covered in the course.

4.2 Experimental Group

In an analysis carried out with a class at the University that was studying the discipline of Artificial Intelligence involved in the inverted classroom, 11 students from the computer science course answered a questionnaire, in which the result of the following questions was highlighted:

1.“Did you feel more motivated during lessons with the Flipped Classroom?”
2.“Were the classes more dynamic with the use of the Flipped Classroom?”
3. “Did the use of the Flipped Classroom encourage you to research more about the topics covered in the classes?”

Table 2 – Experimental Group

Questions	Yes	No
Question 1	55,6%	44,4%
Question 2	100%	0%
Question 3	33%	66,7%

The first question presented obtained a result of 55.6% for yes, which indicates that the students felt more motivated with the flipped classroom, in the second question 100% of the students agreed that the classes were more dynamic, however 66.7% responded that the use of the Flipped Classroom did not instigate the research of the topics covered in the classes, which indicates the importance of that the use of a teaching method that helps the teacher to regulate activities in the flipped classroom related to the artificial teaching intelligence.

4.3 Application of the Mann-Whitney U Test

Regarding question 1, the p-value is equal to 0.02, so there is a significant difference between the responses of the treatment and control groups. Therefore, it can be said that the group where the flipped classroom was applied had a significantly better result, that is, the students felt significantly more motivated.

Regarding question 2 the p-value is equal to 0.01, is a significant difference, which indicates that students were more dynamic during classes using flipped learning.

Regarding question 3 the p-value is equal to 0.04, is a significant difference that indicates that a relevant part of the students felt encouraged to research the topics covered in the classroom, however it is a lower result than that obtained in questions 1 and 2, which makes the importance of the teacher's performance even clearer. to encourage students to research the topics covered in class. In the next section, the conclusion will be discussed.

5. Conclusion

The use of the flipped classroom has significant potential to improve the teaching and learning process, helping students to achieve more knowledge. However, structuring the use of the flipped classroom for teaching artificial intelligence is not easy, due to the high level of complexity, numerous scenarios must be predicted and coordinated.

The results obtained provide evidence that the use of the flipped classroom can help in the understanding of the contents that make up the area of artificial intelligence, however the students reported having difficulties to engage in fruitful activities.

In the analysis carried out, it is observed that the use of the flipped classroom helps to promote learning, normally the flipped classroom also involves another type of active learning methodology such as collaborative learning, interactive learning and complex problem solving.

The article was successful in investigating the application of the flipped classroom in the teaching of artificial intelligence and suggests as future work, more in-depth research related to remote teaching and the Covid-19 pandemic and also the proposition of a model that helps the teacher to regulate student activities in order to promote engagement in the flipped classroom.

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