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## Decreasing Failure in Programming Subject with Augmented Reality Tool

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### Abstract

University education, it has considered using technology application to motivate and increase performance and student achievement in their learning units. As our knowledge, the academic world is excluded from these initiatives; the use of emerging technology in education has begun introducing it of Augmented Reality in some of their disciplines. However, the knowledge and application of this technology in teaching are minimal. Augmented reality and game theory promote research among students. This methodology has been used before in order to capture the interest, attention, and learning when the students are motivated [1]. This article shows mainly as the failure rate has decreased by 50% in the subject of structured programming, thanks to the learning activities undertaken with an augmented reality tool based on the principles of game theory. This application has supported the performance and motivation among students and has influenced to continue with the rest of the course and they may continue their studies by not failing their school year and their career.

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**Keywords:** Augmented reality; academic failure; academic progress application.

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### 1. Introduction.

The diagnosis of higher education in Mexico, quoted in the National Education Programme 2001-2006 [2] sheds alarming data showing the extent of the phenomenon of failure and dropout [3].

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The efficiency terminal rate in bachelor's degree at national level is only of 50%, a figure that has remained consistently according to Didrikson [3], which implies that half of total of the students who enter high level education stagnate or "disappear" from the education system [4].

However, there is a supported evidence by reliable data that one of the most important reasons -or excuses - to quit or give up on studies is due to the disapproval of one or more subjects that operate as "funnels" during the first year of some undergraduate degrees [4].

Different approaches and theories have emerged to improve learning. Technology has proven to be a useful in learning because it has helped to achieve goals by providing tools such as objects and learning repositories, learning management systems (LMS), content management systems (CMS), intelligent tutoring systems (ITS) and virtual reality and immersion is increased for training, among others. Virtual reality and augmented reality are among successful training technologies [5].

Augmented Reality (AR) has acquired presence in the scientific world in early 1990s when technology based on:

- fast processing computers,
- graphics rendering techniques in real time,
- Portable monitoring systems accuracy.

Allow implement a combination of computer-generated images (CGI) from user's point of view of the real world [6].

In many industrial and domestic applications there is a lot of information associated to real-world objects. Augmented reality is presented as the link that ties and combines information with objects in the real world [6].

Thus, many of the designs made by architects, engineers, designers can be viewed in the same physical location in the real world for which they have been designed [6].

Augmented Reality is related to Virtual Reality technology, which is more common in society; it presents some common features such as 2D and 3D graphical virtual models inclusion in the view of the user; the main difference is that Augmented Reality does not replace the real world for a virtual one, but in the other hand; it maintains the real world where the user sees supplemented by overlay virtual information over the real [6].

The user never loses contact with real world which is in plain view and at the same time he can interact with the overlaid virtual information [6].

Augmented Reality (AR) games can potentially teach 21st century skills, such as interpretation, multimodal thinking, problem solving, information management, teamwork, flexibility, civic engagement, and the acceptance of diverse perspectives [7].

Video games and other types of games are gaining increased acceptance as potential learning environments and as supplements to classroom curricula, partially because they support engagement, curiosity and motivation, social interaction, new semiotic systems, and identity reconfiguration [8, 9, 10].

## **2. Problem statement.**

In our Faculty of Ingeniería Mecánica y Eléctrica offer the subject of Structured Programming, which is a basic learning unit for the training of an engineer who is studying in the area of information technologies. Specifically, analyzing historical data, this subject has a high failure rate, which we noticed during the course, the failure rate is in 70% of the students after the first midterm exam, they are discouraged because they could not understand the logic in the subject.

The problem of failure of the subject affects the performance and academic progress of the student, leading to the student get behind in his career, as the subject structured programming is the first of a series of subjects that provide students with the necessary skills to enter the world of programming.

### 3. Approach

To reduce the rate of absenteeism it was proposed to use the technique of Augmented Reality (AR), which is related to the virtual reality technology; When you are using the technique of augmented reality in the subject, it has had a major impact as it has improved the learning technique, making it more dynamic and emotional, well students to grasp the logic of programming, one of the objectives of the subject of the program.

The technique used is an Android Mobile Application.

Which it is provided to each of the students to work with. The process performed by the student to work with the application can be seen in Figure 1.



Fig. 1. Student process to work with the AR app.

The process performed by the teacher to evaluate each student's work can be seen in Figure 2.



Fig. 2. Teacher process with the AR app.

The augmented reality application requires a functioning QR code as can see in Figure 3 and Figure 4.

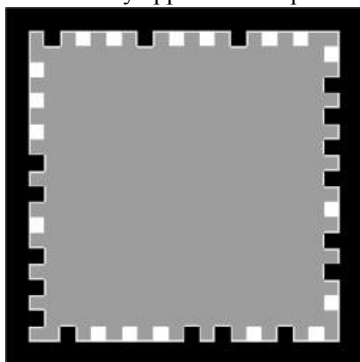


Fig. 3. QR-Code

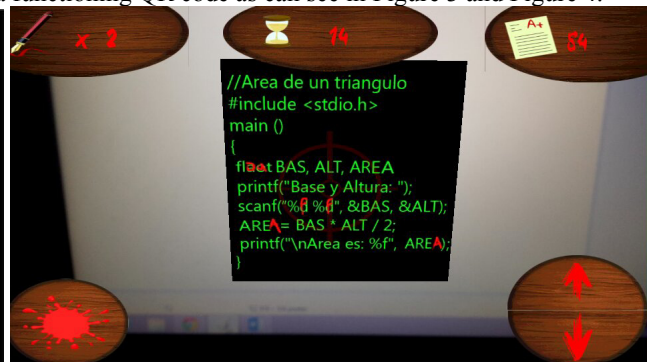


Fig. 4. Example of AR application

#### 4. Results

The following chart, Figure 5 and Figure 6, shows the percentage of the progress of the group prior to the implementation of RA in the group, as shown in the Figure 5, there is a positive impact in the group, in a range of about + 20%.

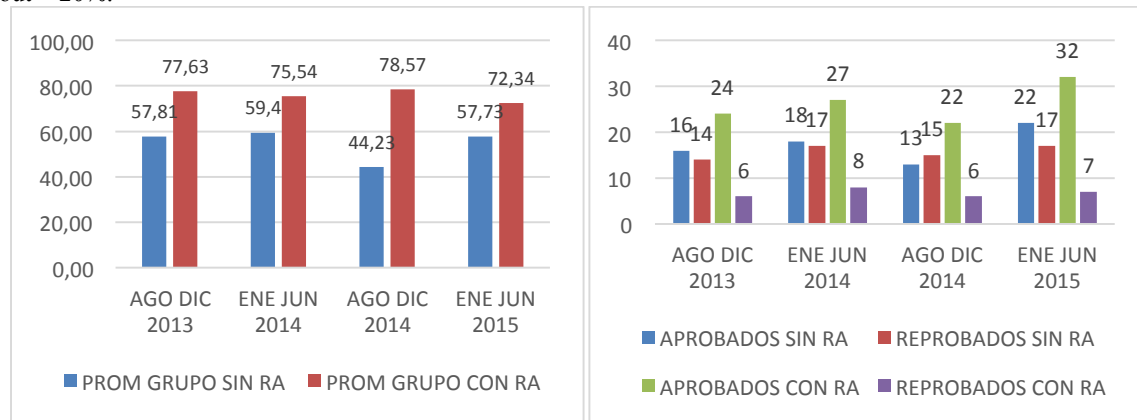


Fig. 5. Academic progress in the structure programming subject. Fig. 6. Academic progress record.

In the Figure 7 it is shown the history of four periods compared before and after implementing the application in the learning unit structured programming.

In Figure 8, you can see the positive impact on the group of structured programming, so there is a congruence between the application and increasing approved, which contributes to increasing terminal efficiency and the retention rate in the learning units.

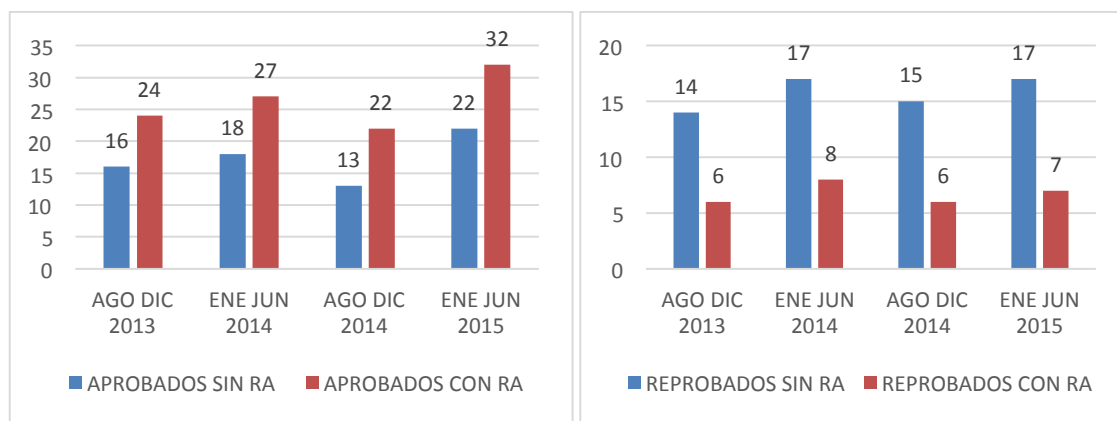


Fig. 7. Academic progress approved.

Fig. 8. Academic progress failure rate.

With the evidence declining failure rate in the subject, to implement AR application improving achievement of the students

## 5. Conclusions

In summary, the application of augmented reality as a strategy to increase the percentage of achievement of the students in the structured programming subject is consistent with the learning outcomes, see Figure 9.

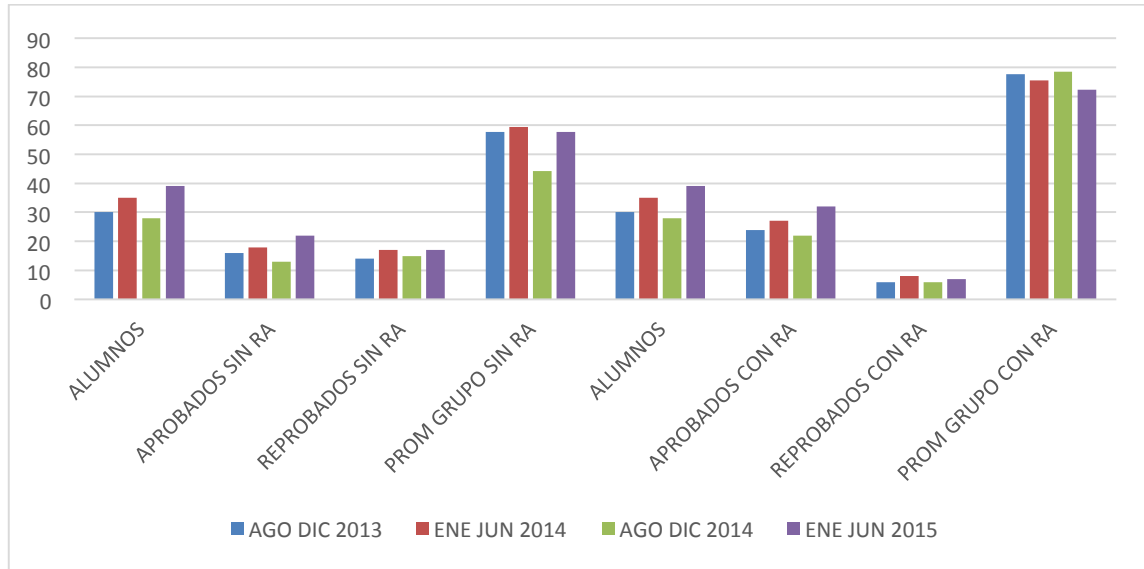


Fig. 9. Academic progress with AR-app.

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