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The Use of Academic Platforms and Simulators in the Pandemic Era

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Abstract

The social distancing policies generated by the pandemic have forced a large majority of universities to modify or rethink the pedagogical models used in the classroom. The development of educational platforms, the use of simulators, virtual labs, and the creation of serious games have been instrumental in achieving this goal. At our university, professors in the logistics area have been working since before the pandemic on the creation of an educational platform (GOAL Project), and on the creation of a serious game called Logistic Simulator (or LOST, for short). The conditions of isolation have forced us to modify the pedagogical design of the course to promote activities that foster the research and self-learning capacity of our students. This work discusses the use of educational platforms and simulators to face disruptive conditions when it is not possible to use face-to-face models.

Keywords— Higher Education, Educational Innovation, Supply Chain Education, Logistics Education.

I. INTRODUCTION

Social distancing measures drastically affected social, labor, and economic dynamics on all continents. For most education systems, this has represented significant changes in the way knowledge is transmitted. Within higher education, most universities chose to incorporate new information and communication technologies (ICT) such as Zoom, Google Meet or Microsoft Teams to offer courses and maintain communication with their students. Despite the conveniences offered by these platforms, new difficulties have arisen in terms of disinterest on the part of students, absence of personal contact, absence of visual interactions, poor distance assessment methods and other technological problems such as the poor capacity of the network system.

For the professors at our university, which is in Mexico City, remote models using these communication platforms began three years earlier when the 2017 Mexico City's earthquake occurred. The earthquake forced us to experiment with different pedagogical models of distance education, and the logistics professors at our university have worked on the creation of different educational platforms, new forms of distance assessment, simulators, serious games, educational videos, etc. On this occasion, the remote models were only applied for one semester, and we returned to the face-to-face model in January 2018.

The incorporation of ICT has led us to create innovative strategies and has changed the paradigms that favored repetition and has prioritized the development of new skills such as information search, critical thinking, problem solving and self-regulated learning. The changes that are generated when we move from a face-to-face model to a remote model have important implications in the design of learning activities, since the transmission of knowledge is only part of the objective, since it is also desirable to promote meaningful learning and to develop competencies that will be useful for students in this new millennium.

While within the field of logistics, traditional teaching is the dominant form of knowledge transfer, during this new millennium new techniques have been incorporated that favor practical activities with a more active approach with the intention of involving students in their

own learning. Some of these activities are for example, problem-based learning [1, 2], case method [3] and professional practices [4, 5]. In addition, in the last decade, the inclusion of technology in educational processes has supported didactic techniques such as the flipped classroom, augmented reality, virtual reality, and game-based learning [6, 7, 8].

The objective of this article is to show the changes that have been made in a pedagogical design for the implementation of a remote teaching-learning model using an educational platform dedicated to the teaching of logistics. The platform contains several strategies to promote active learning, develop meaningful content, modify traditional assessment, and promote game-based learning using a logistic simulator. The use of this simulator has facilitated the acquisition of theoretical knowledge, has increased the motivation of the participants, has provoked significant learning, and has developed the capacity for self-regulated learning.

GOAL Project and Logistic Simulator

GOAL Project is an educational platform designed with the aim of transmitting and integrating logistics concepts (see Fig. 1). The construction of this platform has led us to develop useful and meaningful materials for students, including videos, quizzes, and notes. These elements are linked to a game called Logistic Simulator (or LOST, for short).

Fig. 1 GOAL Project platform (https://goalproject.co)

LOST is a video game in which students apply logistics concepts and understand the interfaces of a supply chain. The intention of the game is that students can experiment, create strategies, manage interfaces, understand the constraints of a logistics system, and finally, motivate them to understand the different concepts that make up this area.

The game shows students the consequences of each decision and how a decision in a company's department affects the performance of the system. Using the simulator, students forecast demands, create a production plan, select raw materials, choose suppliers, and determine the size of orders. This game allows participants to observe the effects that decisions have in relation to the profits of the company.

The simulator includes multiple concepts (demand planning, production planning, inventories, optimization, and transportation decisions). One of the advantages of this simulator is that it contains different degrees of difficulty and can be used for different purposes. For instance, the simulator can be used with students who have begun to take subjects about logistics, or with students who have already seen some content in this area. In the latter case, the simulator allows students to apply previous knowledge in new scenarios (see Fig. 2).

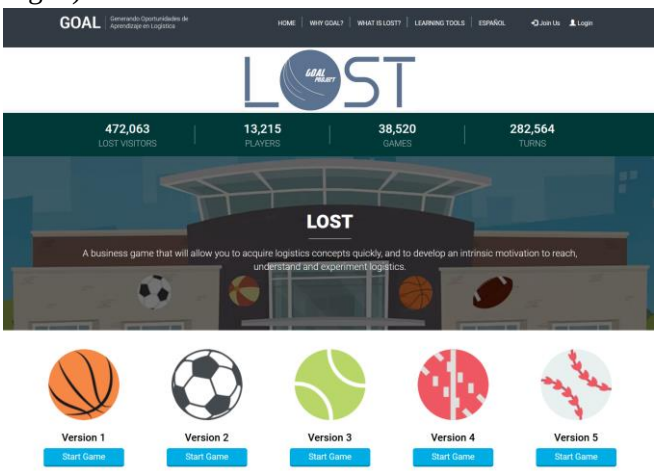


Fig. 2 Logistic Simulator LOST (https://goalproject.co/lost)

The aim of GOAL goes far beyond the use of this logistic simulator. The platform offers students support tools on different topics that relate to the decision-making process in the logistics area. To ensure that students achieve this goal, we have created a set of supporting materials that we placed on the platform. We also created a YouTube channel containing more than 200 educational videos (Fig. 3).

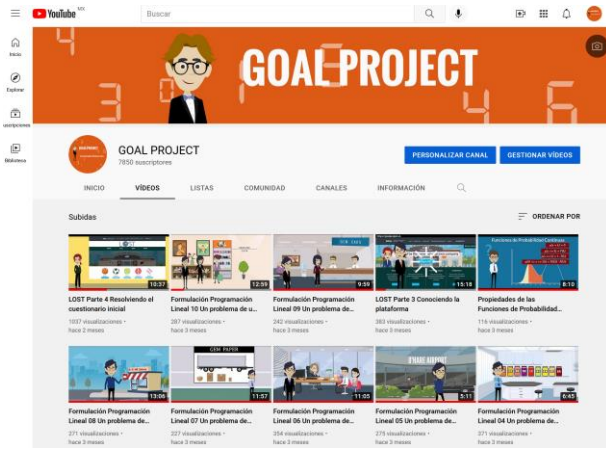


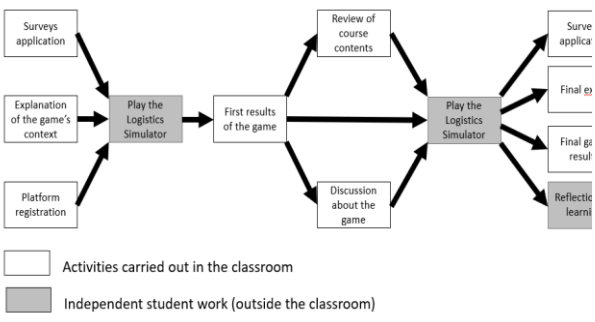
Fig. 3. YouTube channel of the GOAL Project

To motivate students to consult the existing materials on the platform, GOAL has been fully gamified, so that students can receive different rewards within the game when they respond adequately to the questionnaires that appear within the platform. These in-game benefits allow students to acquire certain privileges, such as increasing their warehouse space, having greater production efficiency, and raising demand, among others.

INSTRUCTIONAL DESIGN FOR A FACE-TO-FACE MODEL

From the second semester of 2017, we began to work on a pedagogical model based on the GOAL project platform to create courses in logistics that increase student learning, improve motivation, and develop skills in students for their learning self-regulation.

Including videos on the platform allowed us to experiment with different methodologies, such as flipped classroom, active learning, and the use of LOST led us to conduct game-based learning (GBL). These modifications of the original course led us to the pedagogical design shown in Fig. 4.



This pedagogical design was used from the semester August - December 2017 to the semester August - December 2019. The main academic results obtained in this period compared to those obtained in traditional teaching for the previous semesters are presented in Table I.

TABLE I
Main Academic Indicators

	Feb-Jun 2014 Feb-Jun 2017	Aug-Dec 2017 Aug-Dec 2019
Number of students	194	103
Percentage of dropouts (%)	7.7	2.8
Average of partial exams	72.4	82.1
Final exam Average	75.3	83.4
Pass rate (%)	76.8	88.6

This pedagogical design was used from the semester August - December 2017 to the semester August - December 2019. The main academic results obtained in this period compared to those obtained in traditional teaching for the previous semesters are presented in Table I.

On the other hand, at the beginning and at the end of the course we applied three types of surveys:

1. The first survey measured the motivation of the student during the course and was based on the classical literature of the area [9]. This survey measures lack of motivation (amotivation), extrinsic motivation and intrinsic motivation.
2. The second survey is based on the student's self-perception of self-regulated learning [10].
3. The third survey was designed to measure the relevance of the selection of strategies that students follow in the game.

From the results of the motivation survey, we can conclude that demotivation is reduced, while intrinsic and extrinsic motivation increase significantly. A summary of the results of these surveys can be found in Table II.

The perception survey conducted to know the opinion of students about the importance of self-regulated learning contains 52 questions and we have a database of 418 answers from students who have used the platform and the simulator. With these data we performed a factor analysis concluding that seven factors explain 62.15% of the total variance. These factors are the following:

• Self-management skills
• Openness to accept new ideas.
• Critical thinking.
• Self-direction and skills in information acquisition
• Enjoy learning.
• Awareness of your limitations
• High expectations

After obtaining the factors, we performed a t-test to determine if there were significant changes in the importance that students attached to the factors. The results show that in five of these areas students improve their assessment of the importance of self-regulated learning. The results of this comparison can be seen in Table III.

Finally, in terms of the strategies that the students follow during the game, we found significant differences between the first and the second time they play. The results studied show significant differences in topics such as forecasting, production planning, and inventory management.

INSTRUCTIONAL DESIGN FOR A REMOTE MODEL

The beginning of the COVID 19 pandemic resulted in the need to discuss the strategies that can change under this new scheme of remote work. The following decisions were made:

- *Increase the number of videos and notes that will be placed on the platform.*
- *Increase the number of activities that students will perform independently.*
- *Increase flexibility in the submission of assignments and projects in the course.*
- *Institute a greater number of personalized counselling.*
- *Promote team discussions about the various strategies students followed.*

The pedagogical design used during this stage is shown in Figure 5.

The academic results are quite like those obtained in the last two years, the percentage of dropouts was 0%, the average of the partial exams was 80.7, the average grade in the final exam was 82.7, and the pass rate was 90.47%.

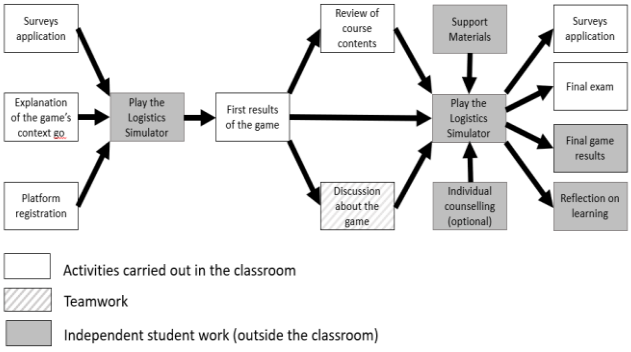


Fig. 5. Pedagogical design for a remote model

Table II shows a summary of the results of the motivation survey in the face-to-face model (2017 – 2019), and those of the remote model, (2020 – 2021). As can be seen, both in the face-to-face model and in the remote model, the lack of motivation decreases, while intrinsic and extrinsic motivation increases throughout the course. In the case of intrinsic motivation, it can be observed that in the remote model the second survey is also significantly different from that of the face-to-face model. This means, apparently, that the pedagogical design

used in the remote model increases intrinsic motivation in the students.

TABLA II
Results of the motivation survey

		First Survey			Second Survey		
	N	Amotivation	Extrinsic Motivation	Intrinsic Motivation	Amotivation	Extrinsic Motivation	Intrinsic Motivation
Remote	72	2.25	4.63	4.96	1.49	5.21	6.33
Face to face	103	2.19	4.51	5.10	1.51	5.17	5.83

In relation to the development of competencies of the self-regulated learning survey among students, the results are presented in Table III. In this case, the results are quite similar, however, there is a significant difference in favor of remote mode with the sub competence called "SelfDirection".

TABLE III
Self-Regulated Learning Survey Results

	Face to face Model		**Remote Model**	
Sub competencies	First Survey	Second Survey	First Survey	Second Survey
Self-management	27.95	29.52	27.56	29.44
Openness to accept new ideas	70.17	72.87	69.71	73.07
Critical thinking	32.15	32.17	31.87	32.46
Self-Direction on acquiring information	27.73	26.13	28.19	29.84
Enjoy Learning	31.30	33.19	30.63	34.05
Awareness of their limitations	52.18	53.22	51.16	52.93
High expectations	41.13	42.76	41.02	43.00

Finally, in terms of the relevance of the game's decision-making and the scores obtained by the students in the simulator, in both learning modes they were similar. The Pre-Test and Post-Test results are evaluated on a scale of 0 - 100 (where 0 is the lowest score, and 100 is the highest score). The game score is the result that the students obtain at the end of the game, regularly the scores of the 5800 participants who have played this game range between 0 and 1'000,000 (consider that the median of the scores is 680,000).

The average of the scores obtained in the post-test in face-to-face mode were higher than those of the remote mode, however, the score obtained in-game is better in the remote mode than the average score in face-to-face mode. The results can be seen in Table IV.

TABLE IV
Results Pre-Test, Post-Test and Game Score

		Pre-Test	Post-test	Score
Remote Model	N = 75	63.81	82.31	817 324

Face to face Model	N = 109	60.18	84.17	796 439

Discussion

With the use of the GOAL Project academic platform, significant improvements had been obtained in the most important academic indicators, and in addition, it had allowed us to experience the didactic technique of the flipped classroom, which we consider fundamental for students to develop sub competencies contained in self-regulated learning.

On the other hand, the use of the logistic simulator had generated greater motivation in the students before the pandemic. The game contains a leaderboard that allows students to identify their position with respect to the other participants. Most participants have played more times than requested, due to their desire to see their names appear at the top of the leaderboard.

In our classes we have observed that when a new topic is taught, students relate the contents with some of the decisions or data of the game, which increases their motivation to learn. In addition, the topics become meaningful for the students. Along with the increase in student motivation, we consider this to be the greatest contribution of the game in the course, to provide significance of the contents in the classes.

At the beginning of 2020, one of the projects in mind was to experiment with the platform with a smaller number of teacher-led sessions and with a more active participation of students in learning activities. The pandemic accelerated our plans, and in March 2020 changes were made in the programming of the simulator to allow the generation of new scenarios, the creation of more support videos for students and the generation of a greater number of activities outside the classroom. The original plan was to experiment with these changes in the August-December 2020 semester; however, the isolation policies that began in March 2020 accelerated the implementation plan.

Comparing the scenario face-to-face and the remote mode, there was a very significant increase in intrinsic motivation in the remote mode. This could be explained by the availability of new scenarios in the LOST game.

At another angle, six of the seven sub-competencies related to self-regulated learning were superior in remote mode. We would like to underline that the sub-competence "self-direction in information acquisition" was significantly higher in students under this new format. This could be explained by the new activities planned for the course.

The post-test shows a difference in favor of the face-to-face methodology. This fact may be expected since the students have a smaller number of theoretical elements to explain their decisions in the game, that is, the verbalization of the strategies is better expressed by the students who have had a greater number of theory classes. However, the score achieved by students in the simulator is higher in students in remote mode. These two results indicate that an area of opportunity in the case of students in remote mode is a greater theoretical content that allows them to better explain the concepts applied in the simulator.

The main academic indicators seem to be better in the remote model compared to those obtained in the face-to-face modality, however, we did not make a comparison between them since certain percentages of the course evaluation were modified, and according to the pandemic conditions, the students should have more flexibility in exams and tasks submissions.

Regardless of this change in evaluation policies, we prioritize in our pedagogical design the student's commitment to their learning, the development of self-regulated learning competence and the proper application of this logistical strategy, so the comparison of these elements is slightly favored by the methodology designed for distance learning more than in the face-to-face mode.

Conclusion

Social distancing policies implemented by governments have impacted work at universities, who have experimented with different models of distance learning. Among

the strategies for this new teaching modality are the use of academic platforms and the use of simulators. The implementation of these tools involves the modification of existing pedagogical designs, promoting greater responsibility for students over their learning, and considering schemes that provide greater flexibility for the execution of activities, review of materials and the modification of evaluation models.

On the other hand, an essential feature in these models is to corroborate that learning is significant, and that it can promote changes in students' behaviors, which must be observed with tangible results.

GOAL Project as an online learning platform had been a successful alternative when it was applied in the face-to-face model. The platform improves the teaching of logistics decisions making use of gamification, the flipped classroom and self-regulated learning. The disruptive conditions created by the pandemic allowed to test GOAL Project's value in new circumstances and it was necessary to adapt the contents, generate new learning scenarios in the game and give greater freedom to students in the search for information. This new instructional design allowed to increase the motivation and commitment of the students with their learning, significantly increased the development of the capacity of self-regulated learning and allowed the students to internalize the content of the game through meaningful learning, which can be related to the increase in the score obtained in the game.

This experiment, forced in part by the pandemic, leads us to conclude that LOST is a simulator that promotes remote and self-regulated learning. This work contributes to the enrichment of LOST as a learning space in which students can use different technological resources and collaborate remotely. In addition, the supports included in the platform provide the right flexibility for students to manage their own learning.

Future work is required to continue the enhancement of value of the GOAL Project platform and the LOST logistics simulator under the post-pandemic reality. It is necessary to generate new learning scenarios, to increase the variety of active learning resources, and to promote the intensive use of the platform.

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