

**(C-189)**

**ACTIVE LEARNING: CREATING INTERACTIVE  
CROSSWORD PUZZLES**

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**Indique uno o varios de los siete Temas de Interés Didáctico:** (Poner x entre los [ ])

- Metodologías didácticas, elaboraciones de guías, planificaciones y materiales adaptados al EEES.
- Actividades para el desarrollo de trabajo en grupos, seguimiento del aprendizaje colaborativo y experiencias en tutorías.
- Desarrollo de contenidos multimedia, espacios virtuales de enseñanza- aprendizaje y redes sociales.
- Planificación e implantación de docencia en otros idiomas.
- Sistemas de coordinación y estrategias de enseñanza-aprendizaje.
- Desarrollo de las competencias profesionales mediante la experiencia en el aula y la investigación científica.
- Evaluación de competencias.

**Abstract.**

The crossword puzzle is a well-known game that can be easily integrated into our classes. Our Corporate Finance students were suggested to create their own financial crossword puzzle in collaborative groups using a free Internet program. As a second step, they had to upload the crosswords in the virtual learning environment of the course, where could be solved online by the rest of their peers. Students' perceptions about this crossword puzzle exercise were examined with a survey. Results on a sample of 84 students are very encouraging. Most students considered this activity as enjoyable and useful for learning. In this study we have also found that students' perceived value of crosswords for their learning is positively correlated with both their perceived learning in the course and their attitude toward the course.

**Keywords:** Active learning, crossword puzzles, intrinsic motivation

## 1. INTRODUCTION

Intrinsic motivation is essential to reach a deep level of learning, since intrinsically motivated students become more deeply involved in the learning tasks and pursue the goal of furthering their knowledge.

Several empirical studies have shown that incorporating active learning helps to motivate students and improves understanding and learning (see [1] for a review). During the last decade, a growing body of literature has studied the benefits of games and puzzles, forms of active learning, on intrinsic motivation and deep learning ([2]-[5]). Educational games let introduce a fun element into the lesson, which can help to generate more positive feelings about the subject matter and to enhance learning outcomes.

The crossword puzzle is a well-known game that can be easily implemented in the classroom. In our search for innovative activities to enhance student motivation and facilitate learning, we incorporated crossword puzzles into a Corporate Finance course.

Crossword puzzles have been shown to be effective learning tools in disciplines such as medical education ([1]), psychology ([6]), sociology ([7]), communications ([8]), nursing ([9]), or biology ([10]), among others. And they can also be thought to be useful in learning other social sciences, such as Business Administration.

Recently, [5] have shown the advantages of constructing versus playing an educational game on the student motivation and deep learning. According to their results, “constructing a game seems to be more motivating and stimulates a deep learning approach more than playing a game”.

Therefore, we decided to design a task that demanded more student activity than solving an existing crossword puzzle, and could be received as a more challenging task: students were suggested to create their own financial crossword puzzle in collaborative groups. Once constructed, the puzzles had to be uploaded in the course webpage, where could then be solved online by the rest of the class. This kind of activity involves students taking a greater degree of responsibility for their learning, lets them become more active participants of the learning process and make them feel more in control of their own learning and thinking ([11], [12]).

This paper describes the design and use of this crossword puzzle exercise and provides evidence on its usefulness for enhancing students’ intrinsic motivation and learning, as well as on its association with the students’ attitude towards the course. This study contributes to the existing literature in two ways: (1) As far as we know, there’s no empirical evidence about the utility of crossword puzzles in Finance learning. (2) All of the above mentioned studies have focused on the usefulness of resolving the crosswords, not of creating them.

## 2. CROSSWORD PUZZLES AS A LEARNING TOOL

As university teachers we have the responsibility of trying to promote interest and learning and to find ways to reach students, which is not very easy, especially in large classes. Crosswords puzzles have been shown to have several advantages that make them a good adjunct to the repertoire of active learning strategies.

One major advantage is that most students associate crossword puzzles with game playing and recreation ([8], [9]). Hence, incorporating crossword puzzles as a learning activity can help to make the subject more fun and to increase students’ engagement with the course material.

In addition, according to [8], “crossword puzzles can also appeal to various student learning styles”, so teachers using this nontraditional teaching pedagogy can reach to more students.

On the other hand, crosswords have been found to increase students’ confidence in their ability and understanding ([6], [7], [9], [11]). The satisfaction derived from successfully solving one clue encourages students to continue toward completion of the puzzle.

The students’ acceptance and popularity of this exercise is also explained by its perceived usefulness as a means to learning. Crossword puzzles have been reported to be a useful tool for reviewing and reinforcing concepts ([1], [10]). Crossword puzzles provide students with an opportunity to evaluate their level of knowledge and to identify areas of further study in a fun way. In fact, students using the crossword puzzles as a study aid have been shown to score higher than those who did not ([6], [8]).

Other major advantages of crossword puzzles are that they expand vocabulary, stimulate the mind, encourage logical

thinking and help to improve retention of facts and association of concepts. Besides, they can even be used for assessment.

Hence, including crosswords in the Business Administration teaching repertoire can be an innovative way to engage students in learning and help them to acquire knowledge and skills.

In particular, undergraduate students of Corporate Finance have to deal with a big amount of new concepts and connections and have to know factual information regarding economic and financial news. Solving a crossword puzzle can help students build a vocabulary of technical terms and improve their understanding and knowledge of financial subjects.

But creating a crossword puzzle also involves other very useful skills for Business Administration students: imagination and creativity, reasoning, written communication and researching.

Furthermore, according to literature, this kind of exercise consisting in constructing the crossword puzzle would stimulate more students' curiosity and interest about financial subjects. Finally, the challenge of creating a crossword to be solved by the rest of class members can encourage students to do their best at making the puzzle looking for recognition among their peers.

### **3. METHODS**

#### **3.1. The activity**

At the beginning of the latter half of a course, we created an interactive crossword puzzle. We used free software from EclipseCrossword.com. The crossword puzzle was constructed with words concerning major concepts from course lectures and also names of companies, financial markets, and relevant people in the financial area. Some clues were statements, other were examples and others fill-in-the blank. This is, not all the clues were definitional; there were clues that were related to words at an application level.

We presented this crossword puzzle in the classroom and it was solved by the entire class together. Students said the answers to the clues and the faculty completed the words in the computer. The activity was very well received by students and they seemed to enjoy it.

This faculty-created crossword puzzle meant to be an example for students, who were then proposed an optional assignment consisting in creating collaboratively (in groups of 2 to 3) a crossword puzzle covering the contents of the course material.

Students were instructed to develop twenty clue-and-word pairs. Half the words had to be names of companies, financial markets, relevant people in the financial word, or facts from economic news. The other half should be financial concepts or terms concerning course material, even from the chapters not already discussed in lessons. Our goal was to provoke students to do some research.

As for the clues, they should accurately describe the words. Besides, some of the clues had to do it at the application level (this is, some clues should contain a scenario or example concerning the solution). Clues could incorporate a reference to a webpage, a blog, etc. that could shed light on the solution.

As a second step, students had to enter clues and words into one of the crossword puzzle maker programs available in internet (for example, EclipseCrossword) and to upload the crossword in the virtual learning environment of the course so that the rest of students could solve them online and use them as an aid to studying.

#### **3.2. Sample**

We carried out a survey in order to assess students' perceptions about this crossword puzzle exercise and about the course. Data were collected from 2 classes by administering an in-class survey. The sample was composed of 84 students (43 males and 41 females). Respondents' average age was 23,09 years old.

#### **3.3 Measures**

All measures were based on extant literature. Students responded to a self-report questionnaire. In the first part of the

questionnaire we asked students to answer questions related to the crossword activity using 7-point Likert scales. Firstly, we measured their perceived competence, interest and effort at creating the crossword puzzle. We used a selection of 12 items from the intrinsic motivation inventory developed by [14] to measure those variables (Table 1). Secondly, we measured the students' perceptions about the crossword puzzle's usefulness for enhancing learning with items extracted from the scales used by [1], [5] and [10].

In the second part of the questionnaire we asked students about their perceptions about the course. Firstly we measured their perceived learning experience using a 7-point Likert scale ([14]). Secondly, we measured their attitude toward the course adapting Ajzen and Fishbein's attitude scale ([16]). For this variable we used a 7-point semantic differential scale. Table 1 shows the scales used in the study. Finally, we also asked respondents to provide any additional comments about their experience with the exercise.

**Table 1. Measures**

Construct	Items
<b>Competence</b>	I think I was good in creating the crossword puzzle I think I did pretty well in creating the crossword, compared to others I am satisfied with my performance while creating the crossword I was pretty skilled at making the crossword activity I think I was pretty good at creating the crossword
<b>Interest</b>	I think making this activity was quite enjoyable I think making this activity was fun I think making the crossword was interesting While I was making the crossword, I often thought about how much I enjoyed it
<b>Effort</b>	I did my best while I was making the crossword I tried very hard to do well at making this activity I put much effort in making this activity
<b>Usefulness for enhancing learning</b>	I found creating the crossword puzzle interesting and want to spend extra time trying to produce more crosswords. While making this activity, I asked myself questions to check whether I understood some concepts I want to spend more time making these kind of puzzles After making this puzzle, I would like to make more of these puzzles I thought making this puzzle was instructive The crossword activity was useful in helping me to learn The crossword puzzle was a useful learning tool The crossword helped me to understand the course' concepts This activity helped me with the recall of definitions/terms The crossword activity prompted me to revise a particular topic
<b>Perceived learning in the course</b>	I think this course is stimulant and challenging I have learnt valuable things in this course Attending this course has increased my interest for the contents of this subject I have learnt and understood the contents of this course
<b>Attitude toward the course</b>	Unnecessary - Necessary Dislike - Like Useless - Useful Boring - Fun Unenjoyable - Enjoyable Not recommendable - Recommendable

#### 4. RESULTS

The crossword puzzle activity was very well received by the students. Indeed, although it was an optional assignment, a large percentage (88%) of students participated in the activity creating the crossword and 75% of them tried to solve other students' crossword puzzles.

Descriptive results are shown in Table 2. The internal consistency (Cronbach's alpha) of all variables shows a high level of reliability (third column of Table 2). Students' responses for all the variables with means above 5 indicate strong agreement. They show a high level of perceived competence (M = 5.23) and interest (M = 5.31) at making the crossword puzzle and that students specially put a lot of effort at making the activity (M = 5.7). So we can affirm our students were highly motivated for making this activity.

As for the perceived usefulness in their learning, results show that responders considered crossword puzzles a useful learning tool, with a mean of 5.16. The mean values for some items of this scale (not reported) show that students found the crossword puzzle useful for understanding (M = 5.22) and revising (M = 5.89) concepts, and for learning definitions and terms (M = 5.53).

Regarding the variables related with the course, students' responses also showed a strong agreement for both their perceived learning (M = 5.67) and their attitude toward the course (M = 5.73).

Students' perceived learning in the course was positively correlated with their perceived competence ( $r = 0.30$ ,  $p < 0.01$ ), interest ( $r = 0.22$ ,  $p < 0.05$ ) and effort ( $r = 0.38$ ,  $p < 0.01$ ) at making the crossword puzzle. In addition, the crossword's usefulness for enhancing learning perceived by students was positively correlated with their perceived learning in the course ( $r = 0.40$ ,  $p < 0.01$ ) and marginally positively correlated with their attitude toward the course ( $r = 0.23$ ,  $p < 0.10$ ).

**TABLE 2. Descriptive statistics**

Construct	Mean	Standard Deviation	Cronbach's $\alpha$
Competence	5.23	0.86	0.91
Interest	5.31	1.40	0.95
Effort	5.70	1.16	0.93
Usefulness in enhancing learning	5.16	1.18	0.95
Perceived learning in the course	5.67	0.85	0.88
Attitude toward the course	5.73	0.93	0.87

Note: Ranges of the scales were 1-7.

#### 5. CONCLUSIONS

In an undergraduate course of Corporate Finance, we were looking for a practical activity that could help students to review the concepts, terms and linkages of the course in an innovative way. Our goal was also to stimulate students' curiosity and interest about financial subjects.

Basing on literature about the benefits of creating games and puzzles as a learning tool, we designed an assignment consisting in creating a crossword puzzle. Students had to think of several clues-and-word pairs concerning course material and use them build a crossword with some computer-based program.

We carried out a survey in order to assess students' perceptions of the experience of working the crossword puzzles. Results on a sample of 84 students are very encouraging. Most students considered this activity as enjoyable and useful for learning.

In this study we have found that the students' perceived value of crosswords for their learning are positively correlated with both their perceived learning in the course and their attitude toward the course. These results support literature

which suggests that the use of educational games can help to generate more positive feelings about the subject matter and to enhance learning outcomes.

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