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Building an Educational Platform Using NLP: A Case Study in Teaching Finance

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Abstract: Information overload is one of the main challenges in the current educational context, where the Internet has become a major source of information. According to the European Space for Higher Education, students must now be more autonomous and creative, with lecturers being required to provide guidance and supervision. Guiding students to search and read news related to subjects that are being studied in class has proven to be an effective technique in improving motivation, because students appreciate the relevance of the topics being studied in real world examples. However, one of the main drawbacks of this teaching practice is the amount of time that lecturers and students need for searching relevant and useful information on different subjects. The objective of our research is to demonstrate the usefulness of a complementary teaching tool in the traditional educational classroom. It is a new educational platform that combines Artificial Intelligence techniques with the expertise provided by lecturers. It automatically compiles information from different sources and presents only relevant breaking news classified into different subjects and topics. It has been tested on a Finance course, where being continually informed about the latest economic and financial news is an important part of the teaching process, specially for certain key financial concepts. The utility of the platform has been studied by conducting student surveys. The results confirm that using the platform had a positive impact on improving students' motivation and boost the learning processes. This research provides evidence about effectiveness of the new educational complement to traditional teaching methods in classrooms. Also, it demonstrates the improvement on the knowledge transfer within an environment of information overload.

Keywords: Higher Education, Information Retrieval, NLP techniques, Autonomous learning, Student Motivation, Independent Learning, Personal Autonomy, Information Systems
Categories: H.3.1, H.3.3, J.0, L.3.0, L.3.2, L.3.6

1 Introduction

The Internet has grown quickly over the years and it has become the main source of disseminating information, without limitation of time and space. Internet penetration is increasing every year. According to Internet World Stats1, in December 2017 it has

[1] https://www.internetworldstats.com/stats.htm

reached 54.4% of the world's population. In the case of North America and Europe, the highest worldwide use of the internet it reachs more than 85%.

In higher education, the Internet has become the major source of information, since being connected is the common way of life for most of higher education students all around the world. Most students use this technology to access information, both related or not to a course [Bashir, 2008]. The academic use of the Internet by students has been present in different studies. For example, [Chen, 2008] analyses the relationships between university students' Internet use and their academic performance, interpersonal relationships, psychosocial adjustment, and self-evaluation. A study at a local university in Malaysia on how undergraduate students use the Internet for academic purposes is presented in [Muniandy, 2010]. [Sahin, 2010] studies the way university students gather their course project requirements during the project elicitation phase, how they access the Internet and other resources, and their trends in the literature review using the Internet. [Selwyn, 2008] addresses students' engagement with the Internet as a source of academic information for their studies. It explores how academic use of the Internet is patterned by a range of potential influences such as students' wider Internet use, access and expertise, year of study, gender, age, ethnic and educational background. [Torres-Díaz, 2016] presents the influence of Internet use on academic success of students from five universities in Ecuador.

Increasingly, Internet search engines are the first option for people looking for information. Some studies have suggested that when students need to search for information, they usually prefer to use search engines instead of e-libraries to review the literature. According to [Griffiths, 2005], Google is often the main choice. They also conclude that students that have difficulty in locating information and resources, may trade quality of results for effort and time spent searching.

According to the Bologna Declaration on the European Space for Higher Education (ESHE) and the subsequent adaptation to the European Educational Space System (EESS), different European countries have modified some of their higher education practices to adopt the European Credit Transfer System (ECTS). This new educational practice implies new roles for students and lecturers [Laguna, 2016; Palomo, 2017]. The former must learn more autonomously and creatively, whereas the latter must be more focused on guidance and supervision. The traditional approach of suggesting reference text books and scientific papers is lost on young students as these methods bear no resemblance to their usual ways of finding information. Therefore, there is a clear need for an alternative; one that combines the traditional education system with a novel approach adapted to the information society, new technologies and globalization. In this sense, the use of Internet is crucial, but lecturers must properly guide their students.

Different studies confirm that using real life examples in teaching stimulates learning and motivates students [Arnold, 2007; Chick, 2010; Neumann, 2013]. In this sense, the news media are accessible sources of information from which real examples may be obtained. Teaching theoretical concepts using real examples is highly positive, since students can relate them to the subject matter covered in class. They can link the contents of the course with the current sociological, cultural, economic and political environment. However, although it is easy to access a large variety of information using different type of devices, selecting the right/meaningful

information has become a major issue. The freewheeling nature of publishing on the WWW is a blessing for the flow of ideas, but it has also complicated the process of retrieving relevant information for a particular purpose [Tang, 2003].

In this paper, we propose a new complementary teaching tool in the traditional educational classroom. It uses news media in the learning process to motivate higher education students. This tool also enables students to appreciate the relevance of the theoretical topics, covered in class, through real world examples. In particular, it is used: (1) to assist the search for relevant news, (2) to gather information from different online sources, and (3) to create educative resources that are classified by topics and subjects and are posted into a website or eLearning platform. Stemming from the news, the actual examples used in class allow lecturers and students to connect and relate the contents of the course with events as they unfold in the real world. The educational objective is to create automatic educative resources for students and lecturers in order to assist the search of relevant information.

To pilot test the teaching experience based on the proposed tool, a successful case study in teaching a Finance course is presented along with the results of a survey performed to 138 students in an undergraduate Degree in Business Administration in Spain.

The remainder of the paper is structured as follows. Section 2 presents the background and related work. Section 3 reviews the educational NLP techniques and Section 4 describes the different modules of the *iNotitium* platform. Section 5 presents the case study. Finally, we end up with some conclusions and future work.

2 Background and related work

The evolution of technology has eased and enhanced the access to online information. In education, lecturers can provide added value to their students and institutions by incorporating different kinds of tools into the learning environment, e.g. blogs, wikis, online social networks, and virtual worlds [Friedman, 2013].

Every day, a great amount of online news is published, and young people are specifically targeted to receive this information as they positively value their reading in civic terms [Casero, 2012]. In order to motivate students, by showing them the application of their studies, [Delgado, 2011] confirms that debates about news related to the legal domain and its practice caused students to have a better understanding of the subjects and increased their attention and motivation. [Bellows, 2011] shows that the newspaper is a valuable complementary educational resource that can be used in all levels of education. Furthermore, there are studies that reveal the positive impact on the learning process of the use of multimedia, interactivity, and hypertext in Internet news reports [Opgenhaffen, 2011].

Currently, in addition to online newspapers, there are different websites that aggregate online content from different media sources, e.g. Google News[2] (banned in Spain since 2014) or Yahoo News[3]. There are other similar websites that provide

[2] https://news.google.com/

[3] https://www.yahoo.com/news/

daily news summaries, analyses across languages and over time, and which compile information about the most mentioned people and organizations in the published media [Steinberger, 2009]. However, they have limited number of users. Usually, these websites present the news classified by general topics: Sports, Science, Politics, etc., and, often, also geographically. All these websites could serve as sources of information for teaching. However, their content is too general for a course of a degree or masters program; both students and lecturers could filter the sources or search for a keyword, but still too much time would need to be devoted to screen the information.

To tackle the problems and limitations mentioned above, there are several computational techniques that support the analysis of news content. However, little research has been devoted to applying these methods for screening information within a learning environment, specifically to improve students' motivation in higher education.

3 Educational Natural Language Processing

Techniques based on NLP (Natural Language Processing), a branch of Artificial Intelligence, have been extensively used to efficiently access information. Educational Natural Language Processing (e-NLP) is a field of research exploring the use of NLP in educational contexts. It represents interdisciplinary research on automatic text analysis applied to research questions and applications in the domain of education. [Litman, 2016] gives an overview of the research in NLP and educational technology, where the three major roles of NLP in educational research are assessing, using and processing language.

The NLP community has continued to improve the existing capabilities and to identify and develop innovative and creative e-NLP approaches. As a consequence, the number of shared-task competitions and conferences was increased in the past few years. Some examples are the Workshops on Innovative Use of NLP for Building Educational Applications hosted at NAACL-HLT 2013[4]; ACL 2014[5]; NAACL-HLT 2015[6]; NAACL-BEA 2016[7]; EMNLP-BEA 2017[8]; and NAACL HLT 2018[9]; the 10th

[4] See the 8th Workshop on Innovative Use of NLP for Building Educational Applications (http://www.cs.rochester.edu/u/tetreaul/naacl-bea8.html)

[5] See The 9th Workshop on Innovative Use of NLP for Building Educational Applications (http://www.cs.rochester.edu/~tetreaul/acl-bea9.html)

[6] See The 11th Workshop on Innovative Use of NLP for Building Educational Applications. (http://www.cs.rochester.edu/~tetreaul/naacl-bea10.html)

[7] See the 11th Workshop on Innovative Use of NLP for Building Educational Applications. NAACL 2016 Workshops. (https://www.cs.rochester.edu/~tetreaul/naacl-bea11.html)

[8] See the 12th Workshop on Innovative Use of NLP for Building Educational Applications. EMNLP 2017 Workshops (http://www.cs.rochester.edu/~tetreaul/bea12.html)

[9] See the 13th Workshop on Innovative Use of NLP for Building Educational Applications. NAACL HLT 2018 (https://www.cs.rochester.edu/~tetreaul/naacl-bea13.html)

National Natural Language Processing Research Symposium, NNLPRS 2014[10]; or the XXX Congreso de la SEPLN[11], where one of the topics was the application of NLP techniques for generating educative resources.

Different works have applied NLP in educational contexts aiming the improving the students' results. However, the best of our knowledge, none have aimed at increasing their engagement and motivation.

Some examples of e-NLP techniques are the following. [Aldabe, 2014] proposed the automatic generation of Multiple-Choice Questions (MCQ) by means of Natural Language Processing (NLP) techniques. [Koukourikos, 2012] proposed the introduction of sentiment analysis techniques on user comments regarding an educational resource to extract the opinion of a user about its quality, and accounting for the user's perception before proposing the resource to another user. [Munezero, 2013] presented a functional system for analyzing and visualizing student emotions expressed in learning diaries. [Romero, 2013] investigated how different data mining approaches can be used to improve the prediction of first-year computer science university students' final performance based on their participation in an on-line discussion forum (classification and clustering techniques were compared). [Yang, 2013] investigated automatic text summarization to provide a toolset that reduces the amount of textual content for mobile learning support. [Cañas, 2015] proposed a recommender system for non-traditional Educational Resources through a semantic approach.

Specifically, when applying NLP to news, e.g. [Chaojun, 2011] introduced a topic specific web crawling system that integrates a fuzzy rule-based algorithm and Vector Space Model text analysis technology. As a result, it predicts the relevancy of each Uniform Resource Locator (URL) and only retrieves and stores highly relevant URLs. However, the amount of news to be crawled through could be highly affected by errors in the measurement of the relevance of an URL. In [Premlatha, 2011] a query method for searching documents from the Web is proposed. It is based on domain ontology concepts and a term based ranking system for obtaining the ranked seed documents, which is then used by a concept focused crawling system. The inputs of the first phase are ontology concepts, which serve as queries to the search engine. However, the size, the generality level, or the concepts used to search the Web are not specified.

The lack of applications of NLP for gattering relevant real-life examples from the news motivates this work.

4 Enhancing the traditional teaching approach

Although students perceive the Internet as a reliable source of information, it can be misleading, contain mistakes or be outdated [Andrade, 2011]. Therefore, students and

[10] See the 10th National Natural Language Processing Research Symposium. NNLRS 2014. (www.dlsu.edu.ph/conferences/nlp/2014/)

[11] See The XXX Congreso de la SEPLN (http://www.taln.upf.edu/pages/sepln2014/es/index.html)

lecturers must process the obtained results to filter out relevant information. Then the questions are: how many results must be reviewed? How to evaluate the quality of each result? In the end, both users could end up spending more time searching and screening information than perusing it. Consequently, it is important to facilitate the task of news web searching; especially considering the new educational way of learning, where the emphasis is put on students learning autonomously, guided by lecturers.

In [Rieger, 2009], the use of Web search engines by faculty and students to support learning, teaching, and research is examined. The conclusion of the study is that, although there are variations in search engine usage among the surveyed faculty, graduate and undergraduate students, in general, they are satisfied with the output of the searches. They trust search engines to support their studies and research. However, unguided web searches have some difficulties, since search engines return more results than those that can be reasonably reviewed. Each result has the potential to be useful or useless, and reviewing them have a cost. Moreover, the reliability of the information obtained by some results of the web search can also be an issue.

To overcome the problems and restrictions mentioned above, we propose a teaching tool that complements the traditional approach. It relies on a platform that shows relevant, up-to-date and real examples classified by topics and subjects of different courses [Palomo, 2011]. In the present work, the platform has been updated and extended. From a technological viewpoint, the access to a wiki source has been removed, since it was not always useful for the lecturers. It is now easier link to an eLearning platform. In addition, we have included a new core to compile news that no longer uses RSS feeds. From an informational viewpoint, to increase the coverage of relevant results, we have improved the module that summarizes information and automatically groupes related news from different sources. The platform now supports additional languages, currently: Spanish, Italian, Finish, Dutch and French. Therefore, lecturers can select sources of information in any of these languages, giving students real examples in different languages and from different parts of the World. This is particularly important in courses with international students. Finally, a management tool to allow lecturers to easily configure each course in the platform has been added.

4.1 iNotitium platform

The platform combines NLP techniques with the expertise provided by lecturers to process information and generate knowledge. Figure 1 presents the architecture of the proposed teaching tool, along with the information flows between the different modules. The management module receives information from lecturers (key concepts and URLs), that will be used by the crawler and eNLP system. The former uses it for downloading the contents of news items, and the latter for screening relevant information. Only relevant news is showed through the iNotitium's website.

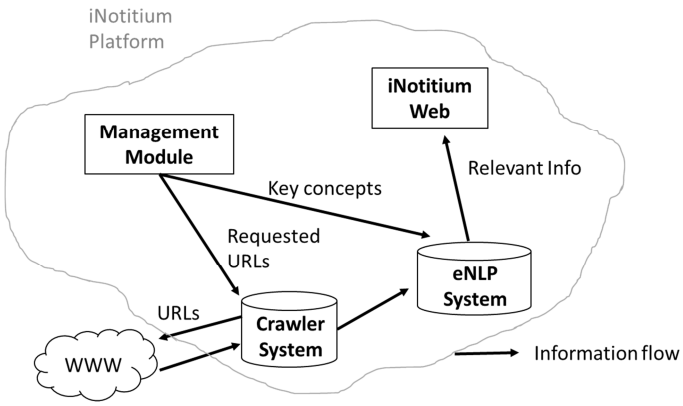

Figure 1: Architecture of the iNotitium teaching platform.

Figure 2 shows the actors involved in the system and how the knowledge flows among them. The *iNotititum's* website is used by both lecturers and students for retrieving relevant information about the topics of their course. In addition, the *iNotitium's* website could be connected to an eLearning platform, e.g. Moodle or Blackboard, to be linked to the rest of the contents of the course.

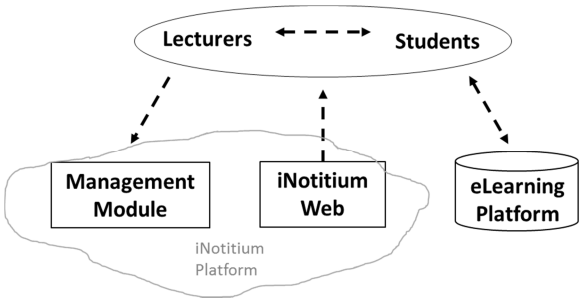

Figure 2: iNotitium exchange of knowledge.

The *management module* is used by lecturers to dynamically configure the information related to their courses. The lecturers decide upon the available sources of information, i.e. the URLs where they believe relevant information for their courses could be retrieved since the courses are divided into topics, lecturers propose different URLs and a set of key concepts for each topic. This information is used to pinpoint relevant news on the Web. In this way, *iNotitium* is flexible enough to incorporate the teaching criteria into the news search. Lecturers can update the structure of their courses, adding or removing topics, and updating URLs and key concepts for each topic. The interface of the *management module* is simple and intuitive to facilitate lecturers the configuration of their courses. Figure 3 presents a screenshot of the management interface. It shows how to configure a course, adding sources of

information to the sections (topics) of the course, the key concepts definitions and how to combine keywords for later searches.

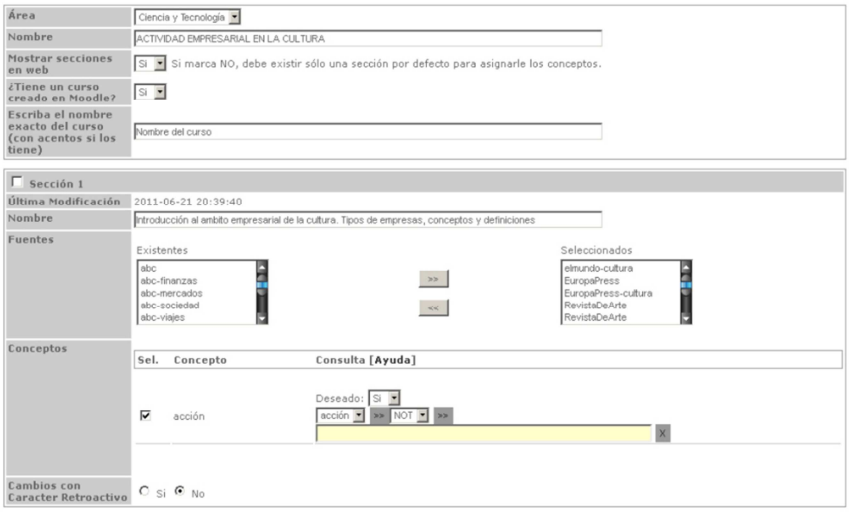

Figure 3: Configuration of a course in management module.

For instance, for the course "International financial markets" course and the topic "International capital markets", lectures provide several sources of information and key concepts, such as "FED", "London stock market", ... In addition, they can include Boolean connectors in the queries, for example "FED AND London stock market" or "FED OR London stock market", and so on.

Once the parameters are set, a crawling system is triggered to gather breaking news items from the specified sources every 12 hours. The system first verifies whether or not a website has already been visited to avoid duplicates news.

The eNLP system is composed of two modules: Information Retrieval (IR), that processes and stores the news contents (for later search and relevant news filtering); and the unsupervised learning module, that clusters similar contents before they are showed on iNotitium website. The module based on IR has been built on Lucene[12] technology, an open source search engine developed by Apache. The eNLP system analyses and indexes downloaded news contents. First, it processes the texts, tokenizing and removing puntuaction symbols and stopwords; normalizes the tokens to lower case; and, finally, it finds the stems of the tokens, for indexing only the stems. The key concepts defined by lecturers are used to build queries for searching into the indexed news. Notice that the same news item can be relevant for different topics and courses. The unsupervised learning module uses a novel clustering algorithm based on Named Entities (NEs) for grouping news items about the same topic for each course. Phrases that contain names of persons, locations, organizations,

[12] http://lucene.apache.org/

times and quantities are considered NEs [Sang, 2002]. News items usually contain NEs, and they appropriately describe the matter of the news. Hence, for grouping similar news, we use a clustering algorithm that computes the number of NEs shared by the documents, and it considers the category of the shared entities, to decide whether to group two documents into the same cluster [Montalvo, 2015]. The documents are represented using the Vector Space Model (VSM) applying a binary term weighting function. To evaluate the similarity among news documents, both the presence of common NEs and their categories are considered. To know if two NEs are common (i.e., "Ben Bernanke" and "Bernanke", "FED" and "Federal Reserve", or "UN" and "United Nations") two orthographic similarity measures are used: Normalized Edit Distance (NED) [Levenshtein, 1965] and Dice coefficient [Adamson, 1974]. A set of different rules compare the orthographic similarity between NEs, considering the category of the NEs (person, location, organization, …). The clustering algorithm is composed of seven stages, and each one of them defines different percentages about the common NEs shared by news items and, also, the categories of the common NEs, see [Montalvo, 2015] for more details.

Finally, *iNotitium*'s website presents only relevant news (those returned and top-ranked by the IR engine) classified according to the topics of the different courses. The platform sorts decreasinlgy the news by relevance and date. The users of the platform can select the course and the topic for which they want to see relevant news. Due to the volume of relevant news collected over time, the users can scroll through the website to reach older news. Figure 4 shows the iNotitium's website for the course "International financial markets", which belongs to the Finance area, and introduction topic. The above-mentioned clustering algorithm improves the visualization of the news. This algorithm groups similar news into the same cluster. The news in the same cluster are collapsed in the website for better visualization purposes.

5 Case study: a course in Finance

In Finance, the impact of the news on market prices, volatility and risk has been studied extensively [Tetlock, 2007; DiBartolomeo, 2005; and Mitra, 2009]. A key concept to instil into students is that the arrival of news continually updates an investors' knowledge and their sentiment about the financial market. Hence, being continually informed about the latest news is crucial for any investor and creating such routine is key for students of a Finance course [De la Orden, 2017].

During the Course 2014-2015, we tested the proposed teaching approach using *iNotitium* with students of a Corporate Finance course, within the Degree of Business Administration at the Rey Juan Carlos University in Madrid, Spain. Students read news gathered by the platform –previously programmed by lecturers with the appropriated general, economic-financial and other-related news filters. Clearly, the number of news items depend on the volume of daily published news, and its relevance.

Figure 4: iNotitium's website.

Students were asked to participate in a survey performed at the beginning, during and at the end of the course. The questionnaires contained two sections with responses on a Likert scale from 1 to 5. The first section focused on the importance of being informed (5: very important, 1: not so important), the frequency of reading news before the course (5: daily, 1: few times a year) and after the course (5: daily, 1: never), the subject (general, economic-financial and others) and the main support (paper, laptop, mobile phone-tablet). The last section focused on the performance of the teaching innovation tool (updating of contents, speed of web downloading, accessibility of the specific section that the student were interested in, number of specialized news presented, perception of the web visited, image quality, etc.) and the impact of *iNotitium* on the students' learning experience (habit of reading news before and after the activity, to what extent reading news allowed the student to better understand the theoretical contents, student's satisfaction with the experience, etc.). Since the purpose of the questionnaire was to evaluate the teaching innovation tool, it did not include answers such as "don't know" or "non-available". Therefore, obtaining the opinions of the 138 surveyed students were, somehow, compulsory for them with no impact whatsoever on their grades.

6 Results

Over the period of the course, we witnessed an increasing interest on being informed. At the beginning, only 40.6% of the students considered that being informed about the news today was not important (3 or less), with mode equal to 4 ('quite important') and a mean of 3.628. We refer to these students as the not concerned group. However, as the course progressed, 85.7% of the not concerned students changed to consider that being informed was 'quite important' or 'very important' (4 or 5), reaching 83.9% by the end of the course.

When considering how long it took to start reading the news, the not concerned students at the beginning of the course changed their opinion as follows: 72.1% started reading the news after several classes and 16.3% from the first class. Only 11.6% started reading the news when motivated by a class assignment.

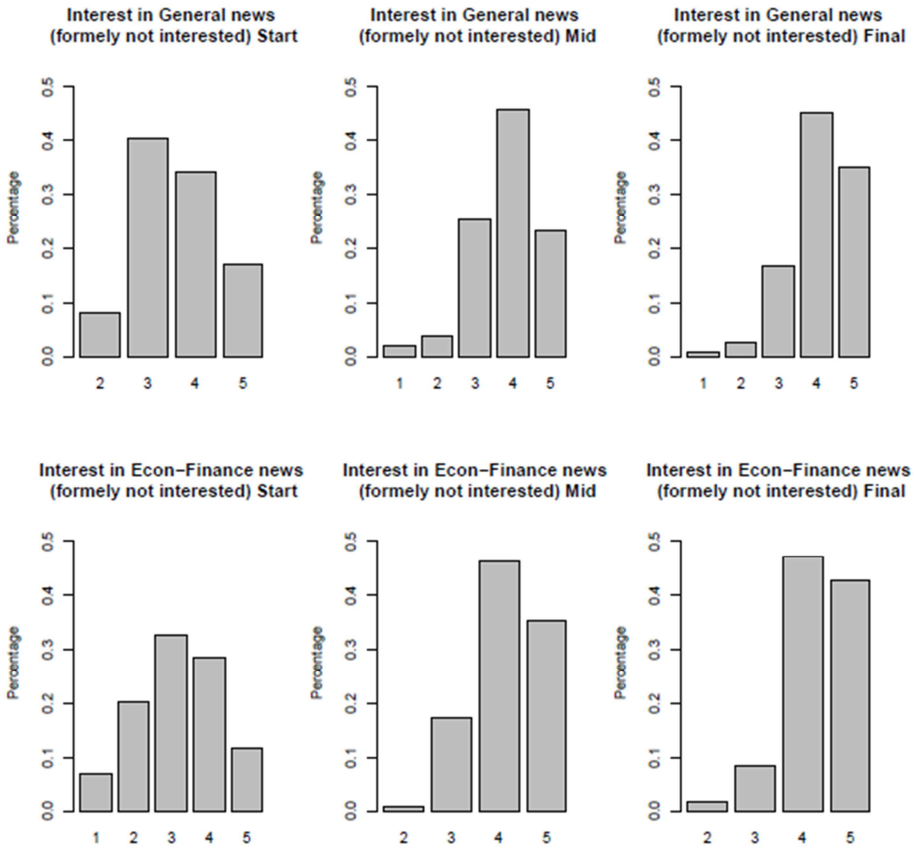

Figure 5: Effect of the motivation on being informed: Total group.

Figure 5 presents the evolution of the interest on being informed as the course progressed. In the case of General news (top row) 51.5% found it 'interesting' and 'very interesting' (4 or 5 in Figure 5) at the beginning of the course, 69.1% during the course and reaching 80% at the end of the course. In the case of Economic and Finance news (bottom row) the evolution of the percentages for 'interesting' and 'very interesting' was 40.3%, 81.8% and 89.9% at the beginning, during and at the end of the course, respectively. It is also remarkable to note the evolution of the mode towards 'interesting' (4 in Figure 5) and how fast the motivation provided in class caused the change in the students.

Figure 6 presents the motivational change experienced by the not concerned group. For example, in the case of General news (top row) 56% found it 'interesting' and 'very interesting' (4 or 5 in Figure 6) at the beginning of the course, 68.3% during the course and reaching 81.4% at the end of the course. In the case of Economic and Finance news (bottom row) the evolution of the percentages for 'interesting' and 'very interesting' was 25%, 86.04% and 92.9% at the beginning, during and at the end of the course, respectively.

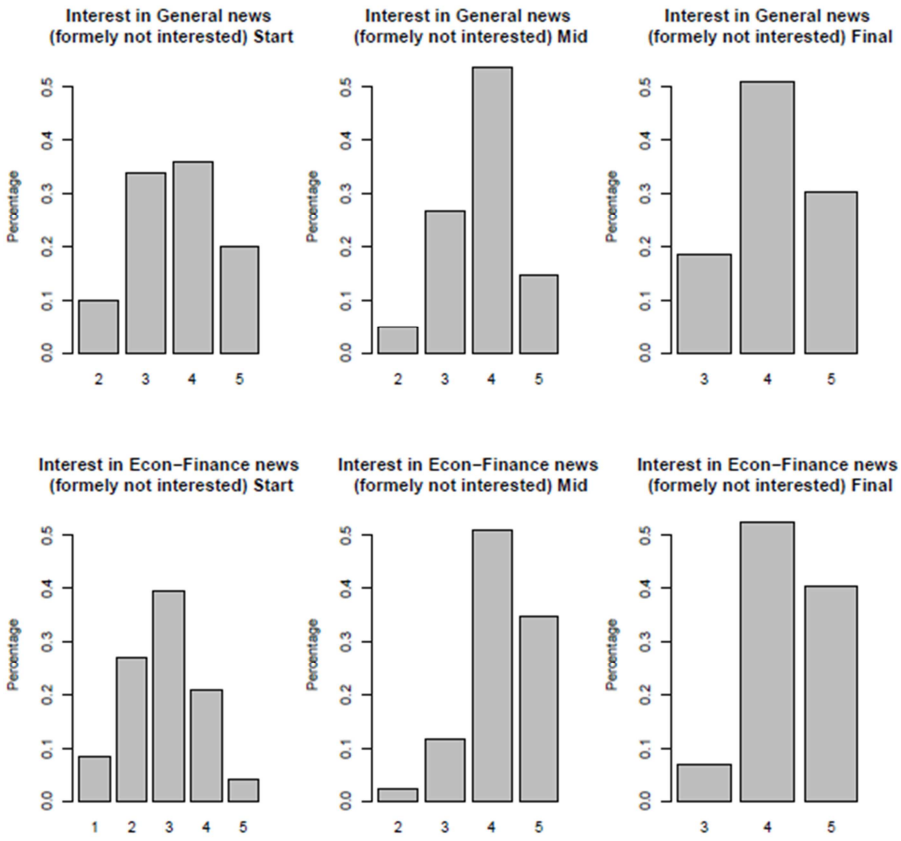

Figure 6: Effect of the motivation on being informed: not concerned group.

Regarding the general routine of reading the news, it was found that at the beginning, 72.5% of the students read the news mainly on a computer and 71.7% on a portable device, whereas only 9.4% read a newspaper. At the end of the course, these percentages basically remained as 88.2%, 83.8% and 15.04%, respectively. Notice that paper support increased during the course, and this could have an impact on the shallow level of comprehension, see [Chen, 2014] for more details, when compared with computer-based supports.

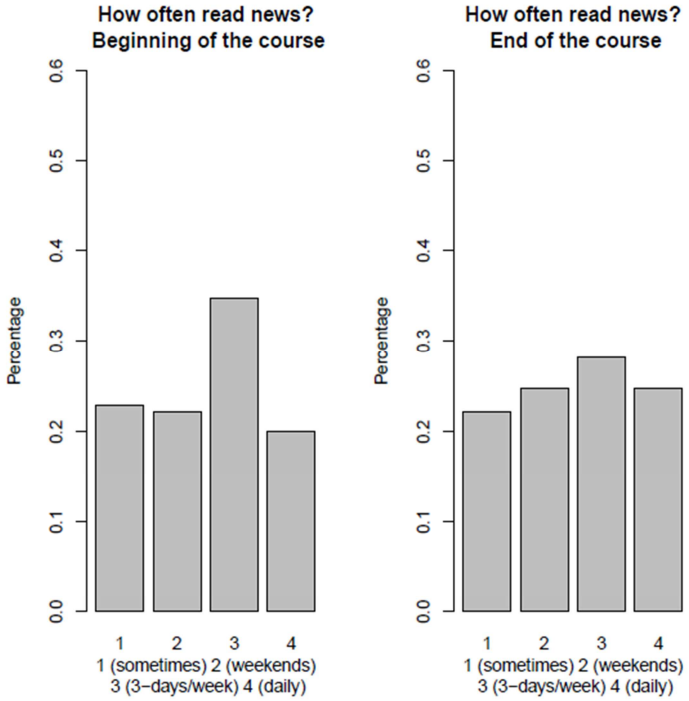

Figure 7: Reading news frequency at the beginning and at the end of the course.

Figure 7 presents the evolution of the frequency of reading news during the course. It is significant that at the beginning of the course only 24.6% confirmed to reading the news with a frequency of less than once a week. We will refer to these students as the sporadic readers group. At the end of the course, 70.6% of the sporadic readers increased reading frequency to reach once or more times in a week. The increase in the frequency was from the first class (15.4%) and after several classes (84.6%). It is significant that the frequency increase was not due to a class assignment in any single case. The final motivation for the sporadic readers group was that *iNotitium* motivated them to start reading news (68.75%) and to read more news (25%), which confirms that *iNotitium* was the main motivation for them to read more news. Also, 67.7% of the students confirmed that reading the news had a 'considerable' or 'extreme' impact on helping them to understand the concepts in class. For the sporadic readers group, Figure 8 presents the evolution of the reading

habits by type of news. For example, in the case of General news (top row) 23.5% found it 'interesting' and 'very interesting' (4 or 5 answered) at the beginning of the course, 53.8% during the course and reaching 76.5% at the end of the course. In the case of Economic and Finance news (bottom row) the evolution of the percentages for 'interesting' and 'very interesting' was 33.3%, 92.3% and 87.5% at the beginning, during and at the end of the course.

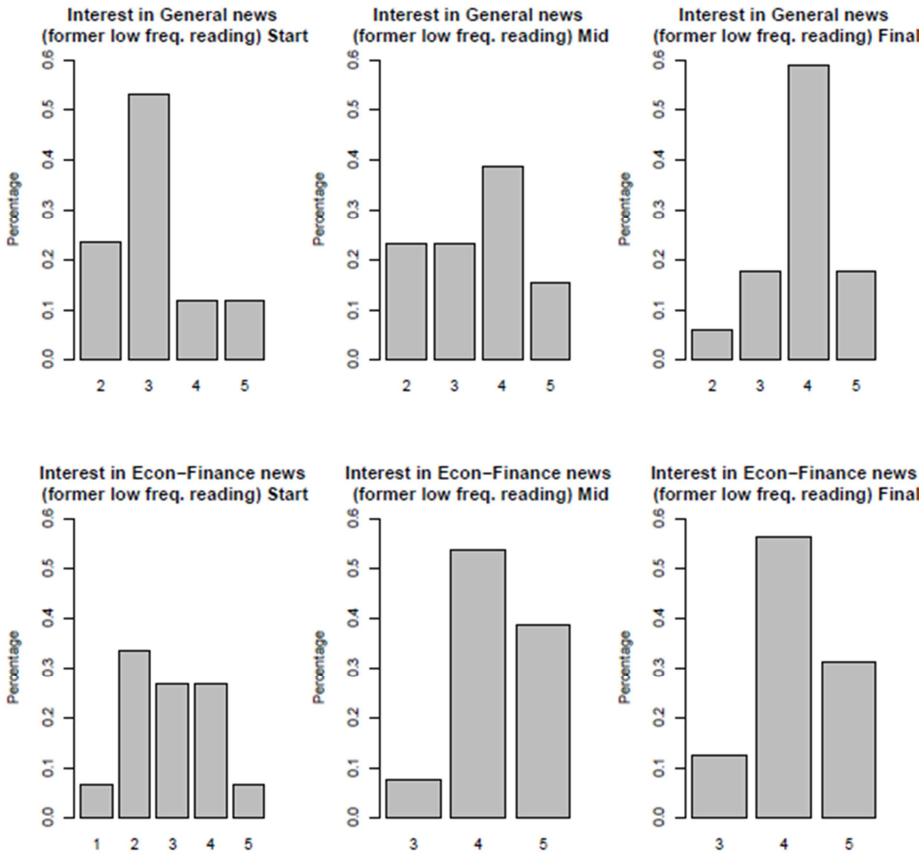

Figure 8: Effect of motivation on the frequency of reading news (by type): sporadic readers.

As a final evaluation of the use of *iNotitium,* Figure 9 presents the motivation obtained where most of the students (92.6%) acknowledged that *iNotitium* motivated them to 'start reading' or to 'read more news' (3 and 4, respectively, in Figure 9). Furthermore, 85.7% of the students considered *iNotitium* useful in general, and 78.2% considered the experience to be interesting. Regarding the impact on understanding the content, 83.9% considered it a good or very good complement to the learning process and 75.8% considered that it has increased interest in the subject in general.

Finally, analyzing the most important characteristics of a platform such as *iNotitium*, they are: updated contents (mean 4.4 and mode 5), quick web load (mean 4.1 and mode 4), accessibility to relevant news (mean 4.3 and mode 5), amount of relevant news (mean 3.9 and mode 4), and specialization on the subject of the newspaper (mean 4.2 and mode 4). Other factors such as web design and number of web visitors show indifference with most of them having a mode of 3. It is important to highlight how these 'ornamental' characteristics were not considered important, with more attention paid to content.

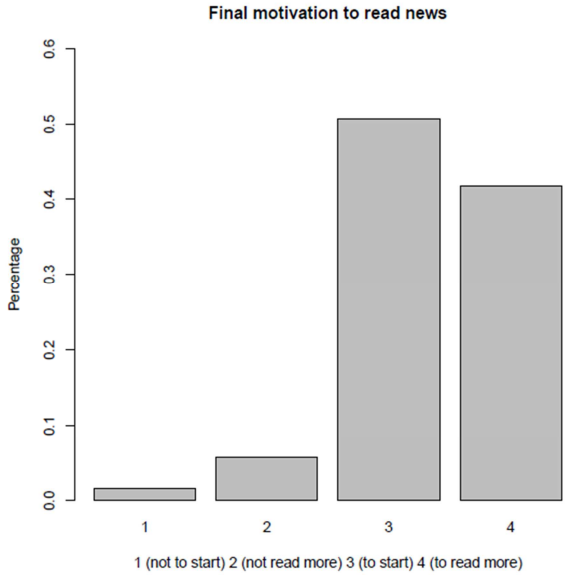

Figure 9: Final motivation to read news.

6.1 Knowledge transfer

An important goal of every educational innovation proposal is to measure the level of knowledge transfer between lecturer and the student. It is important to link the proposed educational innovation and student achievement. To evaluate the impact of the proposed teaching tool, we measured the grades obtained by students in different activities performed in class. In Table 1, summaries (standard deviation is presented in the last row) and the weight on the final grade are presented.

	News Exam	Oral. exp. (individual)	Oral exp. (group)	Final Grade
Weight	10%	7%	3%	100%
Min.	3.0	5.0	6.0	2.561
1st Qu.	6.0	7.0	7.0	5.222
Median	7.0	8.0	7.0	6.0
Mean	6.863	7.691	7.417	6.147
3rd Qu.	8.0	8.0	8.0	7.226
Max.	10	10	10	9.970
Sd.	1.521	1.074	0.999	1.499

Table 1: Summary of the evaluations performed to the students

Over the course, students presented projects in class based on selected news both individually and in groups. The weights of these activities in the final grade were 7% and 3% respectively. A traditional final exam with 40% theorical exam and 40% practical exam was also considered. We were aware that final exams had a weight that was four times bigger than the weight of grades of the educational experience, but as innovation practice in a single course we could not depart further from the grading structure stablished in other similar courses. Furthermore, in doing so, we considered that there would be no interference between grades. Also, to evaluate the level of knowledge acquired through the news, an exam was taken with a 10% impact on the final grade. We denote this variable as news exam. The correlation matrix of the grades of the different activities is reflected in the Table 2. As can be seen in Table 2, the oral individual activity has greater relationship with final grade than the news exam, despite its lower weigth in the final grade. This denotes that students had better performance in the individual activity than in the news exam, as can be seen in Table 1.

	News exam	Oral exp. individual	Oral exp. Group	Final Grade
News Exam	1.00	0.26	0.19	0.37
Oral ind		1.00	0.31	0.44
Oral grp			1.00	0.08
Final				1.00

Table 2: Correlation matrix of the grades

In order to measure the impact of *iNotitium* on the students' achievements, we focused only on those students that passed the course (final exam equal or higher than 5) since it was only in this case that the activities related to reading news were considered in order to compute the final grade. We developed the regression model 1

$$final \sim \omega_1 Exam + \omega_2 Oral + \varepsilon \quad (1)$$

where *final* represents the part of the final grade due to the knowledge acquired through the *iNotitium*. We define final by subtracting from the final grade of each student the average grade on the final exam (only those students that passed this final exam); in this case, we eliminated the effect of the final exam on the final grade. The *Oral* variable represents the weighted sum of the Oral presentations that individuals and groups performed in class, i.e. $Oral = 0.07 \times Oral\ exp.personal + 0.03 \times Oral\ exp.group$ The results of the estimation are as follows in table 3.

	Coef. est	**Coef. se**
Exam	$\omega_1 = 0.19$	*0.07*
Oral	$\omega_2 = 0.03$	*0.07*

Table 3: Results of the estimation

with *n = 107, k = 2, residualsd = 1:12 and R-Squared = 0.66, F-statistic*: 102.3 on 2 and 105 DF, *p-value*: < 2.2e-16. The estimates of the regression model confirm the impact on the students' achievements, positively in both variables although with higher impact in the case of the exam. Notice that this impact $\omega_1 = 0.19$ is higher than the 10% established by the lecturer, indicating a knowledge transfer due to the activities based on reading the news. Figure 7 presents the regression models for the marginal impact of the *Exam* and *Oral* variables, respectively, on the final grade of the course.

The grey lines in Figure 10 represent the uncertainty in the estimates of the coefficients. Notice the positive impact of *Exam*, whereas the *Oral* variable had almost no impact on the final grade. This may be due to the marginal weight in the final grade. Also, those students that obtained a higher final grade in the course (blue dots) tended to perform well (higher or equal to 8) on the exam; however, on the oral presentation, these students were more spread out.

7 Conclusions and future work

Higher education in Europe is now characterized by greater student autonomy and creativity, while guided and supervised by lecturers. Both demands require the development of new tools that assist the knowledge transfer, while increasing the motivation and engagement of the students. This paper presents a teaching approach that bridges this gap by empowering the utility of being well informed and the advantage of the use of the *iNotitium* platform.

Based on the experience gathered, following relevant news in class facilitates the understanding of the key concepts taught in a course. This educational experience has been tested and evaluated its convenience on a Finance course, since inversors need to be continually informed about the latest news. Also, the effectiveness of having access to a tool that links to relevant information both to students and lecturers was explored. A survey was performed on more than a hundred students of a Corporate Finance discipline, where being duly informed and properly briefed is particularly crucial to understanding the financial markets and the so-called market sentiment.

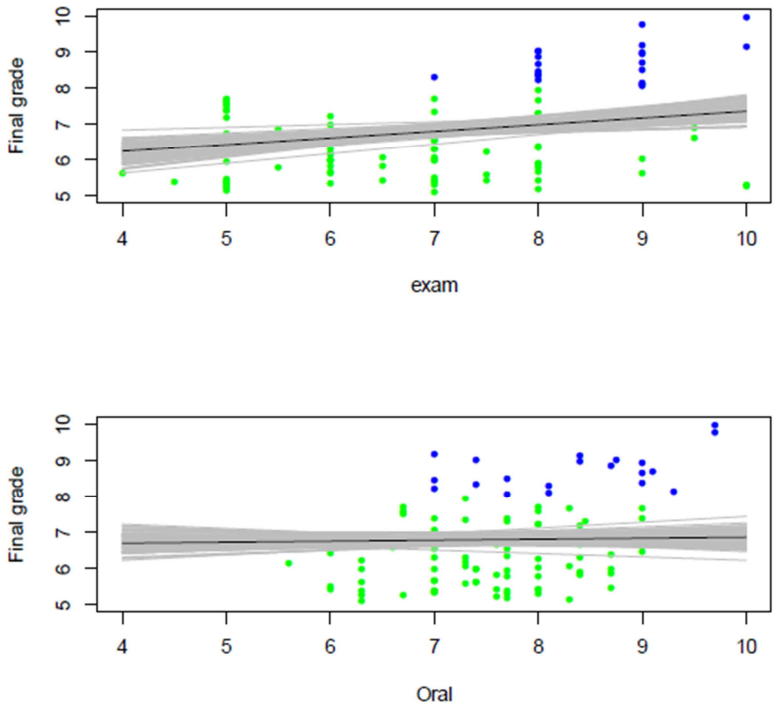

Figure 10: Top: regression model for the impact of the Exam on the final grade of the course. Bottom: regression model for the impact of the Oral on the final grade of the course. Blue dots indicate students with final grade higher or equal to 8.

The analysis of the results of the survey shows the positive impact on both the learning proces and on the motivation of the students. Furthermore, after using the *iNotitium* platform, the interest on being informed increased considerably led by the habit of reading the news more frequently and from the proper sources. In this sense, the results of both the positive impact of being well informed by using a suitable tool, and the improvement in the knowledge acquisition of the subject matter were found to be significant.

The proposed educational complement to traditional teaching methods in class has been proven effective to assist in knowledge transfer in a Finance course. Linking *iNotitium* with eLearnign platforms would be also useful for the organization of tasks within a course.

The proposed educational complement to traditional teaching methods in class has been proven effective to assist in knowledge transfer in a Finance course. In any case, there are several limitations to this study. First, it was only tested in a Finance course, a Business discipline, and the potential of achieving improvement in other subject areas would be interesting to test, although, a priori, we expect similar results. Second, larger sample groups probably would be necessary and/or with students from

other countries. Third, to avoid potential bias from those students that do not want to participate in the survey, it could consider answers such as "don't know" or "no answer". Furthermore, it could be implemented a new module that capture statistics of the use so, for example, number of cliks on a news could be registered for further analysis.

It is expected that linking *iNotitium* with eLearning platforms would be useful for the organization of tasks within a course.

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