

Original scientific paper

DEVELOPING A HYBRID DIDACTIC COURSE IN ESP

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Abstract. *This paper proposes a hybrid didactic ESP course, which comprises Blended Learning, Flipped Classroom and Project Based Learning with adequate activities. The paper shows that most of the proposed activities stipulate a high fulfilment indicator, and a correlation between a proper selection of didactic materials and the degree of students' achievement and satisfaction at the end of each course.*

Key words: *English for Specific Purposes, Blended learning, Flipped Classroom, Project Based Learning*

1. INTRODUCTION

This research comes from the intention to improve the current training offer of English language at the National Reference Centre for Chemistry of Cartagena (Spain) and adapt it to new realities and needs. In order to do that, an analysis of the situation of the sub-sectors of Chemistry regarding their training offer in English was implemented. Starting from that, several steps were followed:

- Determination of those sub-sectors in which there are important needs of English language.
- Evaluation of the current training offered and if there is an external and certified evaluation.
- Analysis of the present and future situation concerning demand of the English language in the occupations of Chemical industry.

To determine aforementioned sub-sectors, we analysed all the universe subject to scrutiny. Once we had all companies and associations we prepared a questionnaire which we placed in a web page to be able to collect data from the questions. This questionnaire was posted to mentioned companies. This questionnaire included questions on identifying characteristics of the company, questions on the use of the English language and on training. From gathered data we obtained indexes of dispersion / centrality according to answers, by applying simple statistical criteria, giving rise to statistical indexes such as median, standard deviation and relative standard deviation. From that study we achieved some relevant information concerning on the English language profile of the workers, sub-sectors in which English language was a demanding feature, those linguistic

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competences requested by the jobs and significant areas of usage, quality of the training offer, and obviously some keys to improve training on the English language.

Then, a hybrid approach in the teaching-learning process was prepared, including a complete revision of the offer of ESP courses at the National Centre resulting in this proposal, which was tested in the implementation of five courses.

2. LITERATURE REVIEW

Blended learning is a pedagogical hybrid approach defined by a series of varied processes. Graham (2013) defines blended learning as face-to-face teaching (or synchronous) with online teaching being (asynchronous). Research developed on this has reinforced the idea of students' improvement (Dziuban and Moskal 2011; Dziuban, Hartman, Cavanagh, and Moskal, 2011; Means, Toyama, Murphy, and Baki, 2013). It is important to stress that there have been five meta-analysis studies in the last decade on the impact of blended learning related to its efficiency (Zhao, Yan, Lai, & Tan, 2005; Sitzmann, Kraiger, Stewart, and Wisher, 2006; Bernard, Abrami, Borokhovski, Wade, Tamim, Surkes, and Bethel 2009; Means, Toyama, Murphy, Kaia, and Jones 2010; Bernard, Borokhovski, Schmid, Tamim, and Abrami 2014), having results favouring the introduction of blended learning in contrast to face-to-face teaching.

Margulieux, McCracken and Catrambone (2016) define blended learning courses using the following categories:

- Location: the specific place in which it is developed.
- Distribution media.
- Learning system: traditional, active, etc.
- Synchrony: simultaneous activities developed at the same time.

The implementation of teaching using this methodological approach boosts the self-regulated learning process, following Whiteside, Dikkers and Lewis' (2016) considerations. The introduction of this type of learning methodology gives rise to the usage of new elements and technological tools (Sife, Lwoga and Sanga, 2007). In this didactic intervention, the following have been introduced:

- A system of learning management.
- Tools of virtual communication, such as electronic mails and forums.
- Documents and manuals to be downloaded.
- Flipped classroom.
- Project based learning.

In this hybrid experience, the flipped classroom has been introduced. Olaizola (2014, p.1) states that «the flipped classroom is a specific way of blended learning, a model integrating face-to-face and on-line learning». Walvoord and Johnson Anderson (1998), proposed a model of a flipped classroom in which students, before going to class, have a first approach with contents, and it is in the classroom where the comprehension of the content is achieved (synthesize, analyze and resolve problems). Lage, Platt and Treglia (2000) applied a methodology of flipped classroom to a university course on economy. These authors prepared some didactic materials to be worked on before going to class. Time in class was devoted to explaining activities, debates and discussions in which economic principles were analysed and applied. Crouch and Mazur (2001) proposed a methodology in which the materials are worked on by students before actually going to

class, and class is devoted to mini-lessons and conceptual questions on the materials. Bergmann and Sams (2012), together with Fornons and Palau (2016) also applied the flipped classroom, achieving an evident improvement regarding students' participation as well as their attitude, favouring a positive working atmosphere. Marlow (2012) implemented a didactic experience with university students, noticing an important decrease in the students' stress levels. On the other hand, Flumerfelt and Green (2013) applied this technique to secondary students with learning difficulties, resulting in an increase of online participatory processes out of the classroom. Roach (2014) and Elliott (2014) obtained positive results when applying this methodology, observing a rise in activities outside the classroom. It is also important to stress O'Flaherty and Phillips' work (2015) exposing multiple synchronous and asynchronous activities. The results of this experience demonstrated the great motivation developed by students, as well as an increase in students' learning efficiency. Cieliebak and Frei (2016) and also Jonsson (2015), evaluated non-technical competences in Engineering students using a flipped classroom, observing better results compared to those obtained using traditional methods. Perdomo (2016) stated that the application of the flipped classroom develops assertive communication, significant learning and students' motivation.

PBL is one of the resources mentioned for blended learning. In this model, students plan, implement and assess projects applied to different environments beyond the classroom (Blank, 1997, Dickinson, et al, 1998, Harwell, 1997). Currently, we are attending to the development of teaching methodologies focused in students' learning and showing a greater involvement of the students in the teaching and learning process (Vega et al., 2014). With this we are introducing active methodologies and, among them, PBL. In this methodology, students play the main role in the educational process; the teacher being a mediator (Vizcarro et al., 2008). It is worth mentioning that this method has been widely used in university teachers' training (Benitez et al, 2013). PBL encourages students to learn, as well as working in a collaborative way in groups searching for solutions to a problem posed by teachers. It is also an extraordinary help in the acquisition of self-paced learning (Saverv, 2006) with students being able to learn autonomously and reaching far better results (Thomas et al., 1999). PBL can be a key tool to develop some competencies, such as working in a collaborative way, using social networks, motivation, creating and problem solving. Students working in PBL environments are able to express a major problem-solving capacity (Finkelstein et al., 2010).

In accordance with the present experiment on the use of Blended learning in ESP courses, including flipped classroom and PBL, bearing in mind the previous research on the sub-sectors in which a training need in English language is needed, the following research question is formulated: can this hybrid approach improve the students' results in terms of the European Framework of Reference for Languages?

3. METHODOLOGY

3.1. Analysis of the current situation of the sub-sectors in which training in English language is needed

The methodology used to carry out this analysis was a descriptive analysis with a qualitative approach. To have precise knowledge of the situation (Montalbán, 2019), a questionnaire was created on a web page, with the aim of collecting data. This questionnaire was posted to companies and associations belonging to FEIQUÉ (Federación Empresarial de

la Industria Química Española), in September 2012. In accordance with its web page, FEIQUE represents the majority of the chemical sector, «a strategic sector for the Spanish economy, comprising 3,300 companies, with an annual invoicing of 65,647 million Euros, generating 13.4% of the Gross National Income, and 670,000 jobs in Spain. The chemical sector is the second major exporter of the Spanish economy, and the first industrial investor of R+D and environmental protection». In addition, the aforementioned questionnaire was also posted to companies, business partnerships and technological institutes, not belonging to FEIQUE.

An analysis of the questions on training states that only 12% of the companies have a specific offer on English language training and 58% of those companies consider the implementation of training courses on English language to be urgent, as the training offer of 32.56% is insufficient. It is worth mentioning that almost 100% of the answers express the conviction that the labour horizon in the chemical sector is directly dependent on the knowledge of the English language. Regarding the external certification of the English language, the vast majority of companies rely on the Official School of Languages. Nevertheless, Cambridge ESOL Examinations and Trinity College London are also used. We could also infer from the study the following results:

- The main workers who need the English language belong to the following departments: Purchase, Sale, Administration and R+D, representing 41%. Analysis and Control is 36%, and Production and Training 23% (Fig. 1).
- The subsectors of Pharma chemistry and Basic Chemical Products are the most demanding concerning the English language.
- The average needed level is «independent» with 50%, representing the «basic» and «proficient» 25% each one (Fig. 2).
- The quantity of business in English language is 85-95%.
- From all answers, only 4.5% have an external accreditation (Fig. 3).
- Writing business documents in English (Report, Invoices, Budgets, emails, etc., are 33% (Fig. 4).
- Speaking English in personal interviews and phone contacts is 50%.
- 70% of the companies have a web page in English.
- The following factors should be improved: Communication and oral expression (60%), Development of specific texts (29%), Lexis and Grammar knowledge (8%) and Motivation (3%) (Fig. 4).

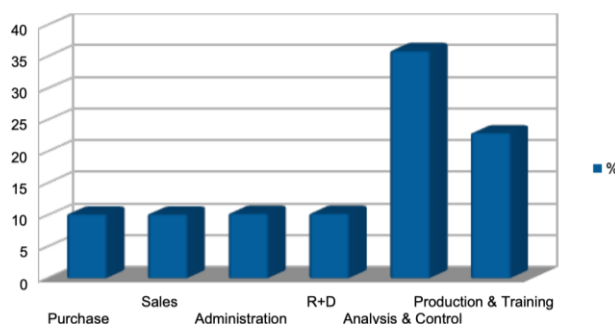


Fig. 1. Distribution of workers using English in departments

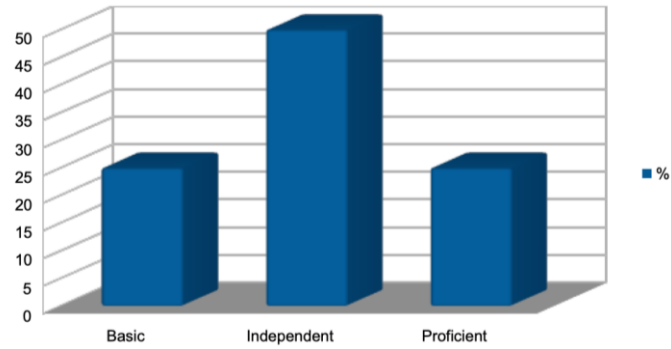


Fig. 2. Most demanded levels of English

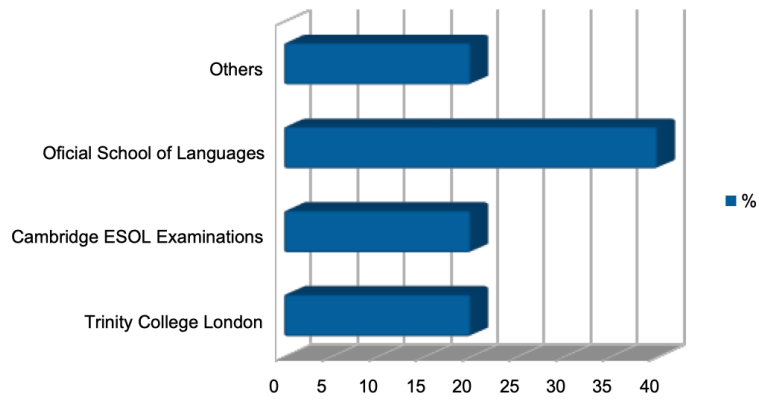


Fig. 3. External certification of the English level

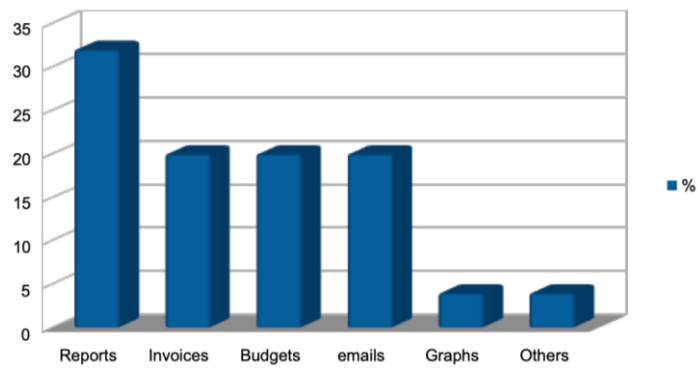


Fig. 4. Documents written in English

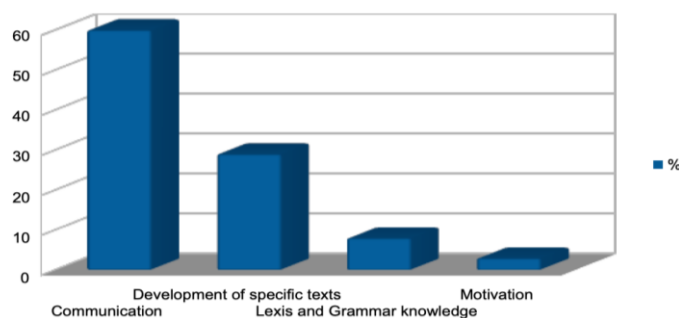


Fig. 5. Factors to be improved

3.2. Contextualization

To implement this didactic experience, five two-hundred-hour courses with 15 students in each one were used. These courses were implemented at the National Reference Centre for Chemistry of Cartagena (Murcia, Spain) from 2013-2018 and were on the following subjects:

- English for Quality Control (developed three times)
- Technical English for the Chemical Industry
- Technical English for the Chemical Laboratory

These students were attending a course on non-destructive testing in Spanish at the same time, and some of them hold a university degree in engineering or chemistry. They also took a placement test including the four skills (speaking, writing, listening and reading) at the beginning of the course to know their levels in accordance with the Common European Framework of Reference for Languages. Bearing in mind the importance of interactive teaching and obviously the need to promote that interaction, and that learners' attitudes towards the subject content of the texts should be taken into consideration, the teacher prepared some materials. The contents of this course were decided after discussions with the teachers who developed this course in Spanish, and always bearing in mind the contents previously studied. These contents were as follows:

Table 1. Contents of the course

English for Quality Control CONTENTS	
What is NDT?	NDT Certification Levels
What is NDE?	Certification Requirements
Some NDT/NDE Technologies	Certification Examinations
Ten Good Reasons to Consider a Career in NDT	Glossary of Terms for PT
What Do NDTers Do?	Glossary of Terms for MT
Where do people in the NDT industry work?	Glossary of Terms for UT
What do people in NDT do?	Glossary of Terms for RT
NDT Certification	Glossary of Terms for ET
Technician versus Engineer	Glossary of Terms for VT
The Science of Nondestructive Testing	General Nondestructive Resource Books and links
What to Study in Preparation for an NDT Career	N.D.T. Bilingual Dictionary
NDT Methods	

3.3. Design and development of the didactic experience

This project consisted of five stages:

- Initial evaluation to assess students' knowledge of English language using the European Framework of Reference for Languages.
- Implementation of synchronous and asynchronous activities.
- Final evaluation to assess students' knowledge on English language using the European Framework of Reference for Languages and to observe students' improvement.
- External evaluation with Trinity GCSE Examination.
- Final questionnaire on the whole course.

3.2.1. Initial evaluation

To properly assess students' initial stage on English language in the four competences, the receptive ones (listening and reading) and the productive (speaking and writing), students took a placement test calibrated between A1 and C2.

3.2.2. Implementation of synchronous and asynchronous activities

To develop the above courses, a series of sequenced activities orientated to a final project were implemented. Those materials were introduced in the tool MALTED and consisted of:

- Audios.
- Videos.
- Specialized texts.
- Web pages' links.
- Associated exercises to the materials (crosswords, writings with different typologies such as summaries, descriptions, reports, grammar exercises, etc.).

For this work, some didactic materials have been elaborated with the computer tool, Multimedia Authoring for Language Tutors and Educational Development (MALTED Project). This tool, developed specifically for teaching languages, allows students to do practices outside the classroom using TIC's. MALTED is the result of a project by an Educational Multimedia Task Force, supported by the European Union within the framework of Telematics Applications programmes, Socrates and Leonardo da Vinci, within the framework in the learning of languages assisted by computers. It is important to stress that this tool has involved the participation of qualified experts in multimedia programming and education in the U.K, France, Ireland and Spain. In MALTED there are two integrated working environments, the Editor MALTED (DVE) and the Browser MALTED (RTS). The Editor MALTED is really a visual developer for the exercises, as well as work units automatically generated by the XML code. It presents multiple templates that generate exercises for the teaching of languages, as well as text, images, graphs, audio and video, to record the voice by means of an external microphone. In addition, this browsing environment allows students to visualize and complete the exercises and it also offers marks. MALTED received technical support from the Ministry of Education, which managed its maintenance. MALTED provides students with the following advantages:

- It supplies a simple, intuitive and attractive learning environment.
- It does not have a cultural orientation and it is open to multiple didactic approaches.
- It has the necessary flexibility to adapt multimedia materials in different formats.
- It is easy to use.

In addition, Google sites were created with the following options:

- Documents and assignments, with relevant information for the development of the course (texts and a daily program including tasks with deadlines).
- Videos, podcasts and multimedia, with associated videos and audios.
- References, with links to online dictionaries, related pages, etc.
- Forum, in which permanent discussions were organized around the basic contents of the subject, with questions which triggering students' debates.

It is important to highlight that, to implement this didactic experience, some written didactic resources in English coming from an educational web page (NDT Resource Center) were introduced. To analyze the characteristics of this ESP and take that into account in students' written and oral productions, a tool called Coh-Metrix was used. In accordance with its web page, Coh-Metrix is a tool which produces indexes in linguistic and discourse representations in a text. An important point to comment on is that these indexes are used in different ways to study cohesion of a text and coherence in the mental representation. In the following tables we can see the most important indexes of Coh-Metrix.

Table 2. Indexes of Coh-Metrix

Number	Label	Document
13	PCNARp	3,75
15	PCSYNp	94,95
17	PCCNCp	27,09
19	PCREFp	5,26
21	PCDCp	52,79
23	PCVERBp	1,5
25	PCCONNp	3,14
27	PCTEMPp	86,86
104	RDFRE	32,939
105	RDFKGL	10,622
106	RDL2	17,848

In the following table, each index is explained:

Table 3. Explanation on the indexes of Coh-Metrix

Number	Label	Document
13	PCNARp	Narrativity expressed in percentage. It advises us on how familiar words used in English are.
15	PCSYNp	Syntactic simplicity in percentage. It is saying how small are the nominal phrases.
17	PCCNCp	Precision in percentage. It offers the incidence of common words, to avoid abstract terms.
19	PCREFp	Referential cohesion in percentage. It says in which way the same idea is referred in two close sentences.
21	PCDCp	Deep cohesion in percentage. It expresses the incidence of use of intentional connective or causal phases.
23	PCVERBp	Referential cohesion in percentage. It is informing in which way the same verb is referred to in two close sentences.

Number	Label	Document
25	PCCONNp	Connectivity in percentage. It expresses the incidence of connectors which communicate sentences in an adversative, additive or comparative way.
27	PCTEMPp	Temporality in percentage. It informs on the incidence of temporal connective phrases.
104	RDFRE	Flesch Reading Ease. Easability of reading in English in percentage.
105	RDFKGL	Flesch kincaid. Technical grade of academic difficulty in English.
106	RDL2	Readability for non-native speakers.

From the analysis of the above Tables 2 and 3, the following conclusions can be reached. The didactic resource has sentences with a high simplicity, a large number of scientific terms of a very high level, which is observed in the low narrativity. Nevertheless, the concepts used do not have a significant concreteness because there are many abstract terms. Moreover, it can be observed that there are not many causal connective sentences, and as there is no reference to concepts (neither nouns nor verbs), it means that it is not characterized by its argumentations. Another feature that should be highlighted is that there is a significant number of temporal connective sentences, in line with texts showing procedures. As referential cohesion of verbs is not stressed over the referential cohesion in general, the didactic materials corresponds with a glossary of terms.

In accordance with the theoretical framework developed before, the characteristics of the ESP to be studied in the didactic materials, the didactic guides of the aforementioned courses (English for Quality Control, Technical English for the Chemical Industry and Technical English for the Chemical Laboratory) were improved and updated. The following series of tasks were developed in all courses:

- Group discussion. Teacher starts interaction by asking students about the importance of NDT, the role played by technicians and engineers in society, and their areas of special expertise and interest in NDT. This task facilitates interaction among all members of the group and content generation.
- The following task is comprehensive reading. Students read a text and learn vocabulary related to NDT.
- After that, students watch a video during which they take notes around the different NDT methods and their importance in industry.
- The next task improves the development of language, allowing students to become familiar with the meaning of specific words, link words with their meanings, use words in sentences and develop a bilingual dictionary (English-Spanish) on NDT.
- Then students prepare a report, organizing ideas with this outline: Aim, Equipment, Procedure and Conclusions. At this stage, students simulate a real situation in which they have to deliver a report to the chemical industry they are working for.
- Now, the class is divided into pairs, starting with an interaction between an NDT technician and a worker, to whom precise instructions should be given on how to proceed when a bridge is damaged. In this situation, vocabulary learned in class is practised. This activity is particularly interesting for students since it is a link with the real world.
- Finally, preparation for Trinity GESE Examination, considered as a final project, triggers interaction among candidates and the examiner.

Table 4. Series of tasks in all courses

Tasks	Type of interaction
1) Group Discussion	Group Work
2) Reading Comprehension	Individual Work
3) Watching – Listening Comprehension	Individual Work
4) Language Development Activities: a. Matching words with meanings b. Using words in sentences c. Creating a bilingual dictionary on NDT d. Writing a Report	Pair/Group work
5) Roleplay	Pair/Group work
6) Final Project: Preparation for Trinity GESE Examination	Individual and Group work

3.2.3. Final evaluation to assess students' knowledge on English language using the European Framework of Reference for Languages and observe students' improvement

To assess students' level of English, the same placement test was taken a second time.

3.2.4. External evaluation with Trinity GESE Examination

Following Trinity College <https://www.trinitycollege.com/> web page, «Graded Examinations in Spoken English (GESE) are individual exams, face to face with the examiner, evaluating speaking and listening abilities». This exam comprises the following points:

- Conversation: it is a real opportunity to exchange information.
- Defence of the topic: previous to the exam, candidates prepare a topic to be defended.
- Interactive phase: the examiner starts the interaction with the candidate by making a suggestion.
- Listening: so that the candidate demonstrates predictive, deductive and inference skills.

3.2.5. Final questionnaire on the whole course

A Likert or psychometric scale was used at the end of the course with a questionnaire of twenty-three questions by means of Google forms, divided into four sections: conclusions of the analysis of the current situation of English language in the chemical sector and included in the ESP course (questions from 1-17), flipped classroom (questions from 18-20), PBL (questions from 21-22) and external certification (question 23). Students responded from 1 to 5, where:

- 1 is never.
- 2 is sometimes.
- 3 is often.
- 4 is usually.
- 5 is always.

Table 5. Final questionnaire

Section 1	Does the course meet the demands of the department of Analysis and Control? Does the course meet the demands of the department of Production and Training? Does the course meet the demands of the department of Administration and R+D? Does the course meet the demands of the department of Purchase and Sale? Have you acquired the level of English you desired, from your initial level? Do you prefer the official school of languages as a certification body? Do you prefer Cambridge ESOL Examinations as a certification body? Do you prefer Trinity College Examinations as a certification body? Were your practices good on reports? Were your practices good on invoices? Were your practices good on budgets? Were your practices good on emails? Were your practices good on Graphs, Tables, Images, etc.? Have you improved your abilities on Communication? Have you improved your abilities on the development of specific texts? Have you improved your abilities on lexis and grammar? Have you improved your abilities on motivation?
Section 2	Was your experience good in the flipped classroom? Was your experience good on the tool MALTED? Was the combination of asynchronous and synchronous activities and the direct incidence on your learning process positive?
Section 3	Was working in a collaborative way in groups searching for solutions to a problem posed by the teacher positive for your learning process? Was the final project regarding your learning process good?
Section 4	Do you consider positive your external certification with a Trinity GESE Examination and the direct incidence on your learning process?

4. RESULTS

4.1. Initial evaluation

The evaluation starts with a placement test including the four skills (oral examination, listening test, written test and reading comprehension activity), to be able to know students' initial level in accordance with the European Framework of Reference for Languages. The results are as follows:

- A1.1: 73%.
- A2.1: 20%.
- A2.2: 7%.

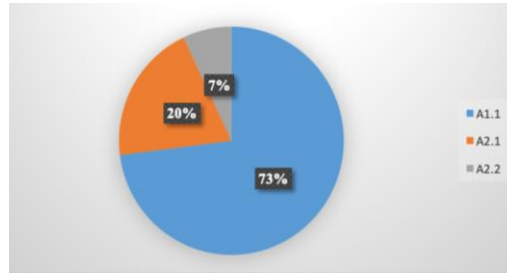


Fig. 6. Results of the placement test

4.2. Final evaluation

In this evaluation, students took the same initial evaluation and the results were as follows:

- A2.2: 80%.
- B1.1: 7%.
- B2.2: 13%.

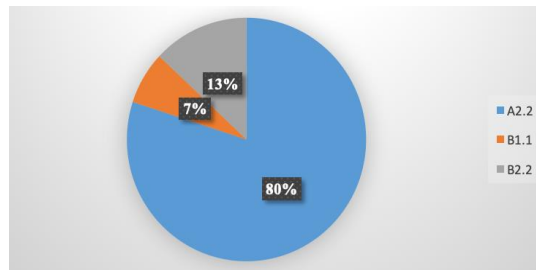


Fig. 7 Results of the final evaluation

4.3. External evaluation

With this Trinity examination, students achieved the following results:

- Grades 3/4 (A2): 47%.
- Grades 5/6 (B1): 53%.

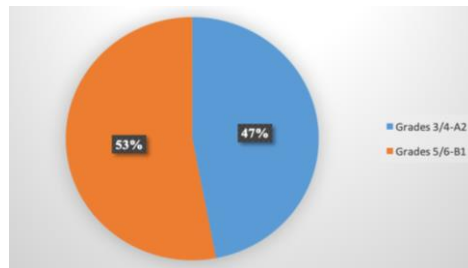


Fig. 8 Results of the external evaluation

4.4. Final questionnaire on the whole course

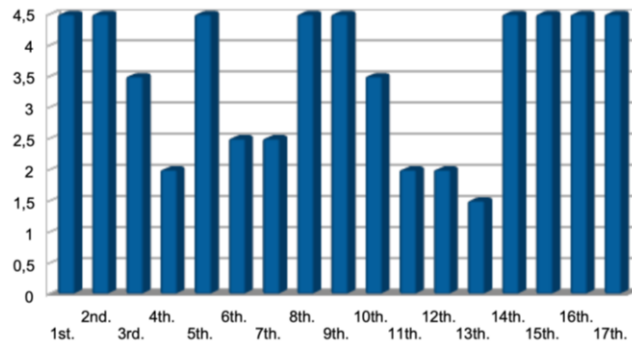


Fig. 9 Questions on the conclusions of the analysis of the current situation of English language in the chemical sector

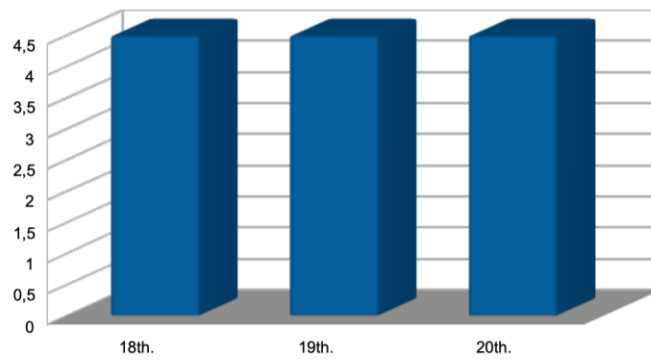


Fig. 10 Questions on the flipped classroom

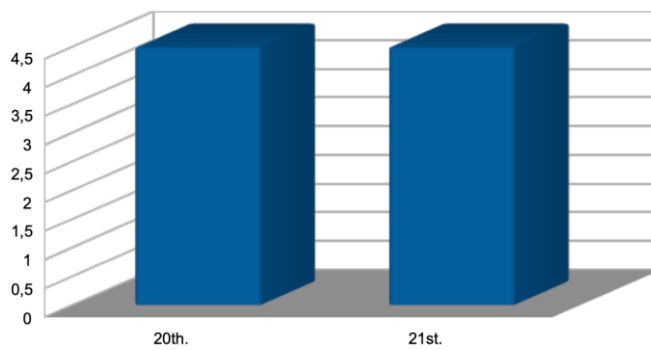


Fig. 11 Question on the PBL

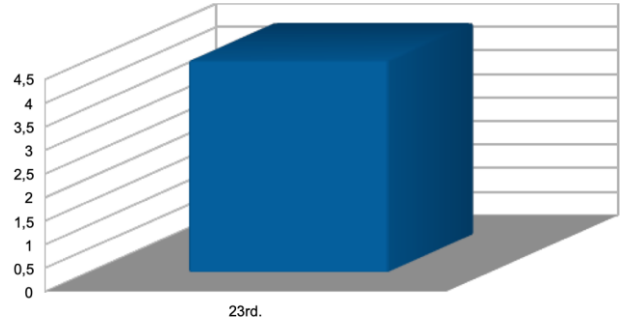


Fig. 12 Question on the external evaluation

4. DISCUSSION

From the above results, the following considerations should be highlighted:

There has been a considerable improvement starting from the initial evaluation in which there was a result of A1 73% and A2 27%, continuing the final evaluation with A2 80%, B1 7% and B2 13%, and ending with the external evaluation of Trinity GESE Examination (A2 47% and B1 53%). Below, there is a Figure explaining this positive evolution in which 1 is the initial evaluation, 2 is the final evaluation and 3 is the external evaluation:

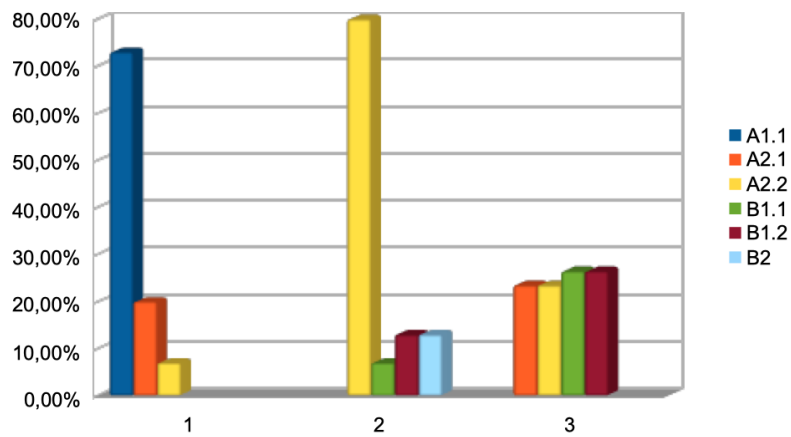


Fig. 13. Students' improvement in the three evaluations

Referring to the final questionnaire based on a Likert scale from 1-5, fifteen questions achieved 4.5, two questions 3.5, two questions 2.5, three questions 2 and 1 question 1.5.

Consequently, most questions achieved an excellent result, except for questions 13 (1.5), questions 11, 12 and 4 (2) and questions 6 and 7 (2.5). Question 13 referred to practices with graphs, figures, etc. Budgets and emails are other aspects which were probably not dealt with in enough depth. Another aspect which does not have definitive or clear results is that of the certifications bodies preferred by students.

5. CONCLUSIONS

Introducing this hybrid proposal combining blended learning, flipped classroom, PBL, as well as the use of MALTED and a selection of materials, has proved to be a positive and enriching one, in accordance with the results discussed above. Moreover, the series of tasks implemented in all courses with the combination of synchronous and asynchronous activities has resulted in more dynamic classes (outside and inside the classroom). The final project is a bridge to the real world by offering students the possibility to apply everything they have learned in a task (GESE Trinity Exam) involving conversation, defence of a topic, interaction and listening.

It is worth mentioning the possibility of introducing blogging, which has resulted in improvements based upon empirical research (Yakut and Aydin, 2017; Sauro and Sundmark, 2018; Fithriani, Rafida and Siahaan, 2019; Montaner-Villalba, 2019) at tertiary level, and Montalbán (2019), who explored blogging in the teaching of ESP, in a learning framework based upon projects (PBL) done with university students, resulting in positive results.

In answer to the research question on whether this hybrid approach improved the students' results in terms of the European Framework of Reference for Languages; from the data obtained, a significant improvement in results can be observed. Therefore, it seems reasonable to conclude that the hybrid approach explained above is worth considering when choosing didactic proposals for ESO courses.

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