

## **New technologies in the ESP class for mechanical engineers<sup>1</sup>**

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### **ABSTRACT**

A substantial reform of Spanish universities and consequent adaptation of the teaching methods has been brought about by the European Higher Education Area. The central role of students, the importance of competences and skills as well as the eruption of technology in education finds a useful ally in Project Based Learning (PBL).

This paper concentrates on the teaching of English for Specific Purposes (ESP) and aims to show the potential of digital devices, new technologies and audiovisual texts and translation to provide the practical instruction on technical English by creative and motivational activities that engage students in practical learning. The study focuses on mechanical engineering students and presents the activities that revolve around the main task: to design and sell a hybrid car.

*Keywords:* ESP; mechanical engineering; new technologies; PBL; audiovisual texts.

### **RESUMEN**

El Espacio Europeo de Educación Superior ha traído una reforma sustancial de las universidades españolas y la adaptación de los métodos educativos. El papel central del estudiante, la importancia de las destrezas y competencias y la irrupción de la tecnología en la educación encuentra en el Aprendizaje Basado en Proyectos un valioso aliado.

Este artículo se centra en la enseñanza del Inglés para Fines Específicos (IFE) entre estudiantes de ingeniería mecánica y tiene como objetivo mostrar el potencial de los dispositivos digitales, las nuevas tecnologías, los textos audiovisuales y su traducción, a través de actividades creativas y motivadoras. El estudio presenta actividades que giran en torno a la tarea principal: diseñar y vender un coche híbrido.

*Palabras clave:* IFE; ingeniería mecánica; nuevas tecnologías; aprendizaje basado en proyectos; textos audiovisuales.

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THE CLEAR PREFERENCE that teenagers and young adults show for digital entertainment and devices observed in recent years is worth mentioning. This fondness leads us to reconsider the ways of teaching as well as the materials and tools used in teaching, especially in the case of languages. As a consequence, this paper attempts to present the potential of digital devices and new technologies when teaching English for Specific Purposes (henceforth, ESP), in particular ESP for mechanical engineers.

This research presents a model based on the teaching method of Project Based Learning (henceforth, PBL) and on the use of a wide variety of different digital resources that are combined with a common aim. The current study, firstly, explores the possibilities and benefits of new technologies in PBL. Within the context of PBL, the study moves on to a specific proposal of a project to be developed in the ESP classroom for the development of different skills. Then it analyses the project proposal that relies on free educational technology tools which range from websites to mobile apps and which allow both lecturers and students to be active participants throughout the entire teaching and learning process. It offers a sample of activities to utilise in which students become creators in the process taking a centred-position under the lecturer's supervision and guidance. These activities revolve around the topic of hybrid cars and are designed around authentic audiovisual texts that work as core instructional materials in the ESP classroom. And, finally, the project is accompanied by evaluation tools that may help lecturers and students in the assessment stage.

### **Literature Review**

PBL is defined by Thomas (2000) as a group of tasks which engage students in “design, problem-solving, decision making, or investigative activities” (Thomas, 2000, p. 1) with the aim of responding to a challenge and solving a problem. According to him, a project is considered an instance of PBL whenever it meets these five criteria: 1) being central to the curriculum; 2) being focused on driving questions; 3) engaging students in a constructive investigation; 4) being student-driven to some significant degree; and 5) being realistic. Ravitz (2008, p. 2) complements this list of criteria with the following characteristics: being an extended student investigation; conducting an in-depth inquiry into a topic; involving some degree of student self-direction or choice; and making students deliver a presentation of their findings, results or conclusions.

In the case of engineers, the need for extremely effective communication skills, as well as specialist technical knowledge, can be observed as part of the demanding requirements for gaining access to the labour market. In order to succeed, there are various core skills that will help our students. An example of this is the capacity for critical thinking as well as the ability to show they are able to think critically. The way to do this is to develop structured arguments and to have an extensive bank of expressions to express agreement and disagreement. In addition, students have to learn to communicate clearly and

appropriately according to the audience they are talking to or writing for. Not only do they have to be proficient in the use of language in a formal register, but also they have to demonstrate a high degree of technical expertise. In the pursuit of developing techniques to reinforce these skills, PBL can be considered a tremendous asset.

The aforementioned characteristics make PBL a practical and positive approach to engineering education. Recent studies such as the ones conducted by Lehmann, Christensen, Du, and Thrane (2008), Zhou, Kolmos and Nielsen (2012), Edström and Kolmos (2014) and De los Ríos-Carmenado, Rodríguez and Pérez (2015) have proven the effectiveness of the application of PBL to this discipline. The shift from chalk and talk to PBL in engineering courses is justified by the industry's requirements. At present there is a growing demand for professionals with both technical and personal abilities and PBL allows engineers to develop communication skills as well as providing teamwork and practical experience relating theory to practice.

From an engineering perspective, the term project is regarded as a unit of work with different levels of complexity. For example, large projects tend to be multidisciplinary, involving several areas of specialisation, not only of engineering but also of other disciplines, and its success will be based on self-direction and collaboration, which implies the implementation of cooperative learning strategies. Other important issues are the effective management of time and resources by students and the incorporation of reflection, critical thinking and adult skills. As a whole, the beneficial effect of using PBL is that it offers the chance for students to face authentic situations and this authenticity is observed in both content and assessment.

Furthermore, as far as English language is concerned, the key role of communication in PBL makes students aware of the importance of becoming proficient in its use. As Jaleniauskiene (2016) states PBL is an approach that allows the achievement of the goals of present university foreign language courses which are not limited to the learning of languages but also include “the development of the most important skills of the 21st century –higher-order thinking, problem-solving, self-directed learning, communication and collaboration with the ability to demonstrate these skills using a foreign language” (Jaleniauskiene, 2016, p. 265).

Likewise, PBL is aligned with the postulations of communicative approaches that stress the importance of using authentic materials when learning. In PBL, students get the necessary information from authentic English resources, they have to share it and negotiate with the other members of the team in English, and finally, they have to deliver the presentation of the project in the foreign language as would happen in a real-life scenario. All this implies a combination of oral and written proficiency in English with a good command of engineering contents. The value of communicative skills is underlined by Mills and Treagust (2003) in their research into the application of PBL for engineering education. They conclude that although the understanding of engineering fundamentals may be less

rigorous, in PBL the students “are generally motivated by it and demonstrate better teamwork and communication skills. They have a better understanding of the application of their knowledge in practice and the complexities of other issues involved in professional practice” (Mills and Treagust, 2003, p. 12).

Finally, the PBL approach has incorporated the use of technology due to the benefits it offers for EFL learning. In virtual learning environments, the advantages of implementing PBL has been pointed out by numerous researchers. For instance, Foulger and Jimenez-Silva (2007) conclude in their study that the integration of technology in PBL contributes to the enhancement of the skill of writing. The potential of PBL in virtual educative contexts is also observed by Russell (2019) who attributes it to

1. An increasing need to correlate theoretical models and practical realities into varied educational settings,
2. Increasing information accessibility and the resulting knowledge age,
3. The increased use of multidisciplinary approaches to problem simulations,
4. Emphasis on multi-dimensional modelling and virtual reality, and
5. New developments in cognitive science (Russell, 2019, p. 431).

Russell (2019) shows how to develop advanced skills in multiple educational settings and thanks to her research it is proven that the implementation of a PBL design model in virtual learning environments improves both the motivation and the results of learners.

### **Methodology**

Within the context of PBL, this study moves on to a concrete proposal of a project to be developed in the ESP classroom for the development of communicative skills in technical English. The study is carried out in a university class of technical English where 50 students from the degrees of engineering and architecture are gathered together. A total of 20 participants are selected for this research. All of whom belong to the speciality of mechanical engineering and are in their final years.

The ultimate goal of this study is to provide mechanical engineering students with practical instruction on technical English by means of creative and motivational activities that engage them in practical learning. In order to succeed, the lecturer has to present explicit goals and perform the role of facilitator rather than of guide. In PBL, the project is the dominant activity and students access content when required, but the lecturer prepares much of it. The input materials offered to the students are either authentic or created by the author (the lecturer), which has a twofold function: 1) reflect real-life communication and 2) motivate students by focusing on their interests. The lecturer forms 5 groups of 4 students and in each group the participants have to work in pairs. By doing so, negotiation starts from scratch.

As far as the use of technology in the project is concerned, the lecturer relies on Google applications (apps), mobile apps, audiovisual materials and subtitling software. Regarding Google apps, we relied on Google docs, forms and spreadsheets which were stored in Google drive. Among the advantages of using Google drive, one can highlight the fact that it allows self-access working and the storage of all types of files without a storage space limit. In addition, the project is presented through a HyperDoc, which can be defined as a document that integrates interactive features and linked content for engaging and promoting inquiry-based learning. Its conception as a digital worksheet where critical thinking and problem solving skills are developed through linked tasks makes it perfect for our purposes achieving a deeper engagement and cooperative learning. HyperDocs offer the opportunity to include all kinds of multimedia and to insert different types of files such as those created with Google forms. In order to build our HyperDoc, we follow four basic steps. Firstly, the identification of the area of learning which, in our case, is ESP for mechanical engineers and in particular, the topic of hybrid cars. Secondly, the choice of a structure; in this case three stages preceded by an introductory stage. Thirdly, the incorporation of different materials, the choice of Youtube clips, power point presentations, quizzes, and so on. And, finally, the hyperdoc is published, sharing the access link with the students.

With regard to mobile apps, the project makes use of Kahoot (<https://kahoot.com/>) and Trello (<https://trello.com/>). Kahoot is a game-based learning and trivia platform that allows one to design quizzes or use others previously created and classified according to topic, level and target users. The quizzes can be organised as a group or individual competition and, apart from answering correctly, the time factor also counts; whereas, Trello is a virtual noticeboard where the lecturer can upload tasks, images, links, etc. It allows for the distribution of tasks for teamwork, the collection of ideas or pictures for a poster and the organisation of class materials.

The project also relies on audiovisual materials, which become a valuable resource in learning languages as has been proven in numerous studies (Caimi, 2006; Sokoli, 2006; Incalcaterra and Lertola, 2011; Talaván, 2017). In order to make the most of their potential, the introduction of free software like Aegisub ([www.aegisub.org/](http://www.aegisub.org/)) is essential. The lecturer shows students how to use it, how to edit subtitles and introduces the basic conventions for subtitling. By means of this tool, the lecturer attempts to improve students' listening and writing skills as well as to incorporate the learning of digital skills.

### **Project proposal**

The central topic of this project is hybrid cars and the title of the project is "A new hybrid car comes on the market". The driving question is "What's the best hybrid car on the market?". In order to answer it, students are asked to undertake three main tasks: 1) design a hybrid car, 2) describe its main features in an attractive way and present them for its launch

and, 3) deal with potential clients for its sale, explaining key features and what makes their cars different from other products on the market, which use traditional technology and combustion engines, negotiating prices and methods of payment and the delivery to the dealerships.

### Project tasks and procedure

First of all, before undertaking the activities that make up these three stages, a section called “engage and explore” (Figure 1) with two questions prepares the students. Students are asked to explain what they understand by hybrid cars. Their response, which must be no longer than 32 words, has to be given in on an answer sheet which is created with Google forms by using the option “short answer”. Once they submit their answers, they have to undertake a second activity that involves watching a video, whose route access is contained within the hyperdoc. The clip entitled “Five things you should know about hybrid vehicles” (Voelcker , 2010) lasts four minutes, a length which, according to Talaván (2013), matches the information density that students are able to process so that a loss of concentration is avoided. This listening activity contributes to students’ learning in four ways: cognition, efficiency, utility, and affectiveness (Gary, 1975; Vandergrift, 1999; Oxford, 2013). Cognitively, listening becomes a more natural way to learn a language and therefore, it should be placed before speaking. This is the reason why this activity is chosen for the pre-task stage. Likewise, language learning can be more efficient if learners are not immediately required to produce all the language material to which they are exposed. This clip can help the students in their later task of preparing their oral presentation, as they are exposed to good and realistic language models that could be imitated. Because of all this, students can realise the usefulness of this receptive skill (utility advantage). The clip about the five things one should know about hybrids is divided by five introductory subtitles. This division is used to design a listening comprehension test with Google forms. The test consists of five questions whose answers can be found in each of the sections introduced by the subtitles so that the students find therein an aid that leads their comprehension process. In both activities the use of Google forms allows the lecturer to have all the answers collected and presented in graphs, which may help to reveal tendencies.

***What’s the best hybrid car on the market?***

***Engage and Explore***

*What do you understand by hybrid cars?*

1. *Type a response in this Answer sheet. Make sure your response is no longer than 32 words.*
2. *Watch this Video and answer the following questions in this Test.*

***Task***

***What’s the best hybrid car on the market?***

*You have to design your ideal hybrid car to be launched on the market and be placed on the*

*market. In order to do that, each group has to undertake three main tasks. Design, Launch and Sale.*

*Figure 1. Introduction to the three main tasks.*

## **Design**

The first stage of the project is comprised of a group of tasks that revolve around the design of a hybrid car (Figure 2).

### **1. Design**

- a) *Look at the following word cloud.*
- b) *Take into consideration the different types of hybrids and their characteristics described in this presentation.*



- c) *To access the PPT presentation go to <https://tinyurl.com/ycoys96j> or scan the following QR code with your phone.*
- d) *Discuss their advantages and disadvantages. Take a look at this video where you will find useful expressions. You can play it with English subtitles.*
- e) *After watching the video of useful expressions, please take the following test to check your understanding.*
- f) *Look at the different car parts and the materials they are made of.*
- g) *Now, it is your turn to choose the best type and materials to build your hybrid car and justify your choices to the group.*
- h) **Assessment:** *Kahoot tests:*
  - *Properties of materials.*
  - *Car parts.*
  - *Expressions in business negotiations.*

*Figure 2. Hyperdoc: Design stage.*

Students are asked to negotiate and decide on the design of their new hybrid car. Each pair in the group is required to prepare the design of the different parts of which the car is constructed. In order to do this, the lecturer creates a word cloud that will be distributed among the groups. The word cloud can be generated by using Internet tools such as <https://worditout.com/word-cloud/create> or <https://www.wordclouds.com/>, as in this case:

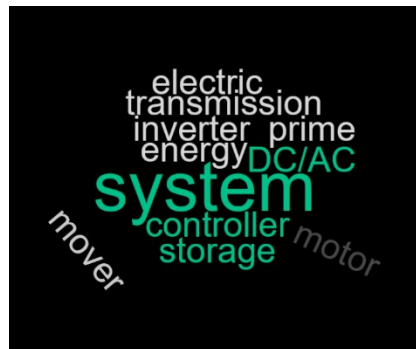


Figure 3. Word cloud: components of hybrids.

This word cloud (Figure 3) comprises key words that will guide the students' research. They refer to different components of a hybrid car such as prime mover, electric motor with DC/DC converter, DC/AC inverter, and controller, energy storage system, and transmission system. Apart from this word cloud, the lecturer encourages students to take into consideration the different types of hybrids and their characteristics as described in the slide-share ppt "Hybrid car options for you" (Jeff's Mercedes Auto Service, 2015). In order to access the ppt, the students have two options; they can either go to a shortened url or they can scan a QR code generated by the lecturer.

After watching the video, the group has to make another choice: choosing the type of hybrid they want to build. In order to make this decision, the members of the group have to extract the advantages and disadvantages of the different types from the clip, which must then be discussed with the other members of the group. To do this, the lecturer offers original input of vocabulary to express advantages and disadvantages which is found in the video "Vocabulary: how to talk about advantages and disadvantages" (Emma, 2015). In this video that lasts six minutes and gives the option of subtitles in English, a native speaker presents the expressions in a visual way, organising the expressions into two columns and explaining the differences between their uses by means of examples. Once the students view the clip, they can take a multiple-choice test on the same website which provides them with the feedback that allows them to assess their understanding of the clip. In order to take the test, they have to click on the hyperlink found in the hyperdoc.

This first stage finishes with the selection of the materials used for constructing the car. The vocabulary related to the various car parts is given in a cheat sheet where students can find pictures of cars where their parts and anatomy are shown. In addition to this, another cheat sheet includes information relating to the materials with which these parts are fabricated. Thus, students have to refer to the car parts alluding to the materials used for their production and justify their use by making reference to the properties of these materials.

The evaluation of this stage is commented on in section *Evaluation*.



## Launch

The second group of activities that cover the launch stage (Figure 4) begins with the viewing of the clip “2016 Chevy Volt: Almost Everything You Ever Wanted to Know” (Hall, 2015). It presents the launch of the 2016 Chevy Volt at the 2015 Detroit Auto Show and includes automatically generated subtitles. Although there are some mistakes, they are not serious and students can find some help to extract specific vocabulary related to hybrid cars and to reproduce some language patterns.

### 2. *Launch*

- a) *You are going to attend the launch of 2016 Chevy Volt @ the Detroit Auto Show. Watch the following video choosing the option of automatically generated subtitles.*
- b) *Download the clip and save it as .mpg or .avi*
- c) *Re-edit the subtitles following the basic subtitle guidelines here included. **Watch out!** Remember that the subtitles provided are automatically generated and contain errors.*

*For subtitling the clip use the software Aegisub.*

*Save the subtitles as .srt and exchange your file with the other groups for peer-review.*

*- To download Aegisub go to: [www.aegisub.org/](http://www.aegisub.org/)*

*- For peer-assessment use the following rubric*

- d) *Take the clip used as a model and re-voice it as if you were the host of the programme and the executive chief engineer. Exchange your clips with the other groups for peer-review. - For peer-assessment use the following rubric.*

Figure 4. Hyperdoc: Launch stage.

The first task they have to undertake is to download the clip and re-edit the automatic subtitles with the aid of Aegisub. This activity requires them to listen to the original version, find the mistakes in it and rephrase the original oral message according to the basic subtitle guidelines. Once the new version of the clip is completed, the students have to exchange their subtitle files in order for them to be peer-reviewed. In this assessment they will have to pay attention to accuracy, the number of characters in the subtitles created, the segmentation of the lines and the reading speed (Figure 5). By doing this, students work on their listening and writing skills.

	<b>Excellent 25 pts</b>	<b>Good 15 pts</b>	<b>Sufficient 5 pts</b>	<b>Insufficient 0 pts</b>
<b>Accuracy:</b> The subtitles are grammatically correct (spelling, punctuation, grammar, syntax)	1-2 errors	3-6 errors	7-10 errors	More than 10 errors
<b>Condensation:</b> The number of words in subtitles does not exceed the limit of 42 characters per line (default in AEGISUB)	95%-100% of subtitles do not exceed limit	80%-95% of subtitles do not exceed limit	70%-80% of subtitles do not exceed limit	More than 25% of subtitles exceed limit
<b>Segmentation:</b> The text in the subtitle is appropriately segmented (no break between a determiner and the noun it accompanies in two subtitles nor in two lines)	95%-100% of lines are appropriately segmented	80%-95% of lines are appropriately segmented	70%-80% of lines are appropriately segmented	More than 30% of lines are inappropriate
<b>Synchrony:</b> There is synchrony between the duration of each subtitle and the duration of the actor's corresponding utterances	95%-100% of subtitles are correctly synchronised	80%-95% of subtitles are correctly synchronised	70%-80% of subtitles are correctly synchronised	More than 25% of subtitles are incorrectly synchronised
<b>Total (out of 100)</b>				

Figure 5. Rubric for the assessment of the subtitling task (Proyecto SONAR - Subtitulación sOcial para proporcioNar Accesibilidad audiovisual en la universidad. 2017).

The same clip is used to develop both writing and speaking skills. Taking the clip as a model, students are encouraged to re-voice it as if they were the host of the programme and the executive chief engineer who introduces the new model in the show. In order to do so, they have to write their own script as if they were at the launch of this new model. Once they have finished, students have to re-voice the clip. Re-voicing allows them to copy and reproduce pronunciation and intonation patterns by imitation. It also gives the students the opportunity to use expressions previously seen in the clip and combine them with their own invented discourse and technical words that refer to the distinguishing features of the car. The assessment of this task is performed following the rubric in Figure 6.

	<i>Poor (5%)</i>	<i>Average (10%)</i>	<i>Good (15%)</i>	<i>Excellent (20%)</i>
<b><i>Synchrony</i></b>				
<b><i>Pronunciation</i></b>				
<b><i>Intonation</i></b>				
<b><i>Creativity</i></b>				
<b><i>Vocabulary used</i></b>				
<b><i>Total (out of 100%)</i></b>				

Figure 6. Rubric for the assessment of the re-voicing task.

## Sale

In the third stage, the sale of hybrid cars, the students have to play the roles of either the sales department staff or potential clients (Figure 7).

3. ***Sale***

a) *Watch the following business conversation. The context of the conversation is provided as well as the English subtitles.*

b) *Here you can find 10 useful business expressions.*

c) *At this stage you have to deal with a potential client in order to sell your new hybrid model. Use these cards to play your roles in this commercial transaction.*

Figure 7. Hyperdoc: Sale stage.

Negotiation techniques and business expressions are presented in two videos in order to prepare the deal making process. The first one, “Business English conversation / Sales meeting” (Crown Academy of English, 2017), presents a six-minute business conversation between two native English speakers, both the context of the conversation and subtitles are provided. After that, the video includes six more minutes of explanations about useful vocabulary. The second video clip, “10 Business English expressions you need to know / Vocabulary” (Emma, 2018), focuses on ten business orientated expressions, which have to be integrated into the students’ conversation.

Once basic vocabulary and expressions are introduced, the lecturer distributes different role-play cards created for this purpose which will lead the conversation between the two parties in each group. However, these cards (Figure 8) only provide a template for the conversation and again, it is the students who have to take on the responsibility of completing the information required by searching the Web. Initially, the role play takes place within the group itself but subsequently there is an exchange of cards and roles between the groups, which allows students to have a wider scope for the development of negotiation

techniques. As a whole, this activity attempts to achieve realistic communication and it involves the type of business negotiation that will be of use to them in their professional life.

**Role A.** You work for the sales department of a company that makes hybrid cars. You have to introduce your make and your hybrid models to prospective customers. Then, you have to make your offers and try to reach a deal.

Name of the make: Your position in the company: Hybrid car model(s) you have: Car features: Advantages of your model(s): Drawbacks of your model(s): Prices and special offers: Warranty:	
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**Role B.** You have car-dealerships around the world and you are interested in introducing hybrid cars in your business. You get in contact with a new make of hybrid cars in order to know more about its cars and offers.

Name of your company (dealership): Your position in the company: Ask for hybrid car model(s) they have: Ask for their car model's features: Ask for the advantages of their model(s): Ask for the drawbacks of their model(s): Ask for their prices and special offers: Ask for their warranty:	
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Figure 8. Role cards exercise.

**Evaluation**

As has been shown throughout the different stages of this project, the students make use of different assessment tools for their activities ranging from rubrics to tests on their mobiles. The project combines self-assessment and peer-review with assessment carried out by the lecturer.

Apart from the aforementioned rubrics, students carry out their self-assessment thanks to the activities found in the mobile app Kahoot. The lecturer designs two quizzes for the first two stages (design and launch), and for the third one (sale) the lecturer relies on previously created quizzes relating to business communication from the app. All the quizzes

are presented as a challenge for the students who have to sign in and enter the pin provided by the lecturer so that the results of all the students are collected (Figure 9). Besides, these quizzes are performed against the clock so that students do not have time to look for the answers.

In the first quiz (Figure 10), students are asked about different properties of materials. They are given definitions and examples and they have to choose between the different options they are offered. The second quiz (Figure 7) concentrates on the parts of a car, following the same pattern as the first quiz. And finally, the third group of quizzes focuses on expressions used in business negotiations (Figure 8). In this last case, the app has a wide variety of previously designed questionnaires. Thus, the lecturer may take advantage of these and select those considered more useful for their aims.

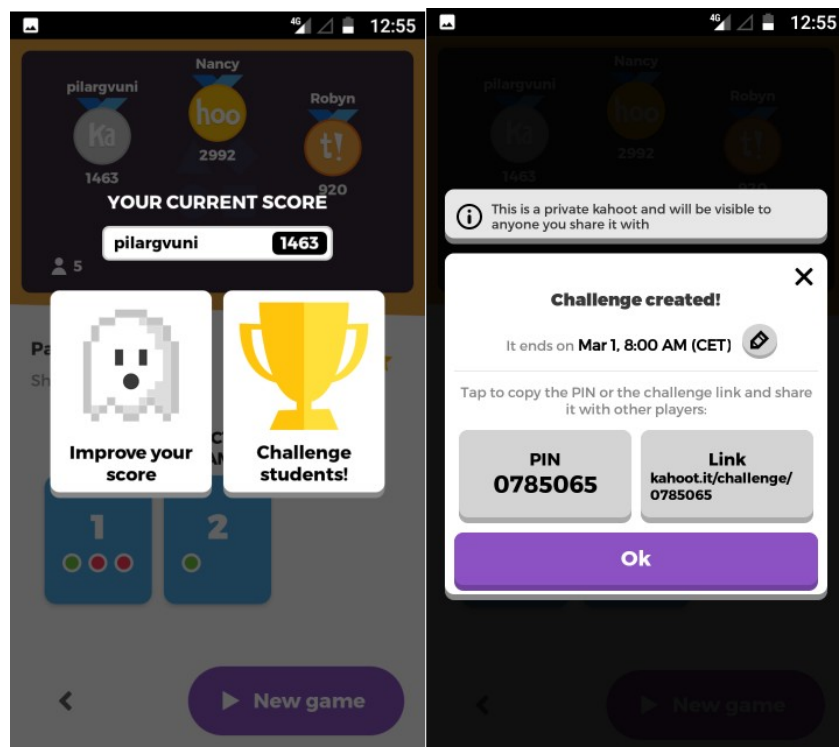


Figure 9. Kahoot app.

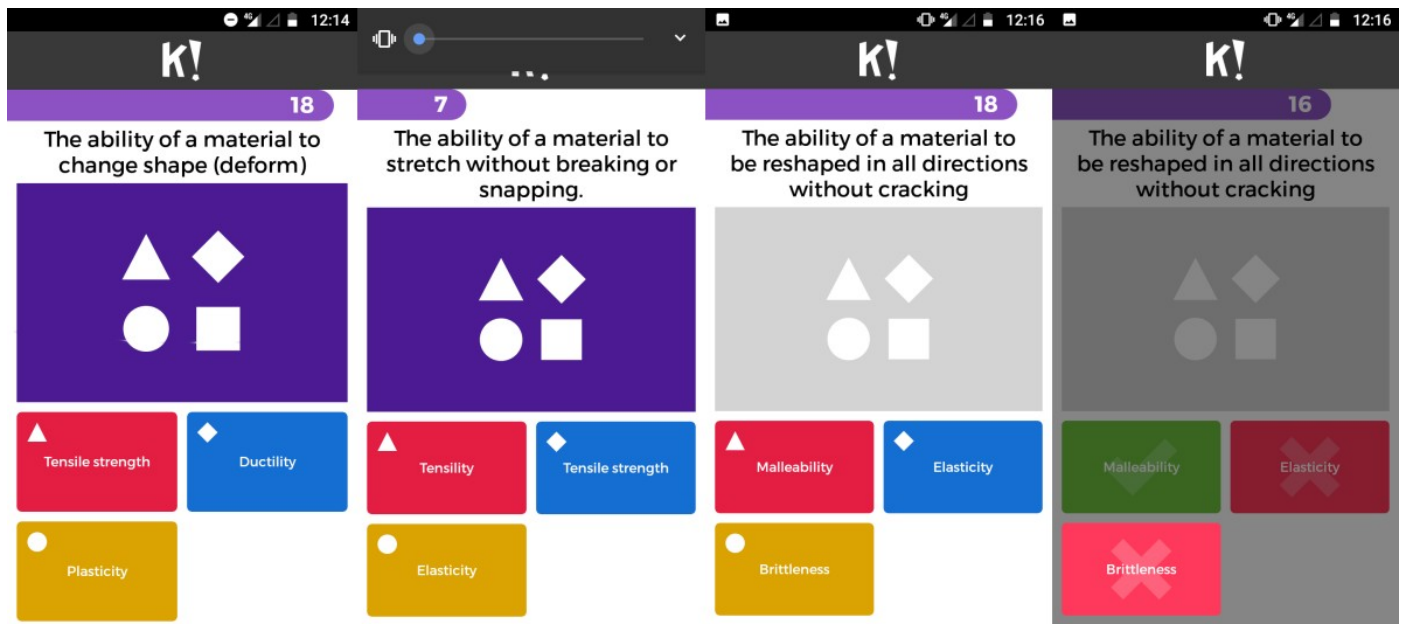


Figure 10. Kahoot quiz: "Properties of materials".

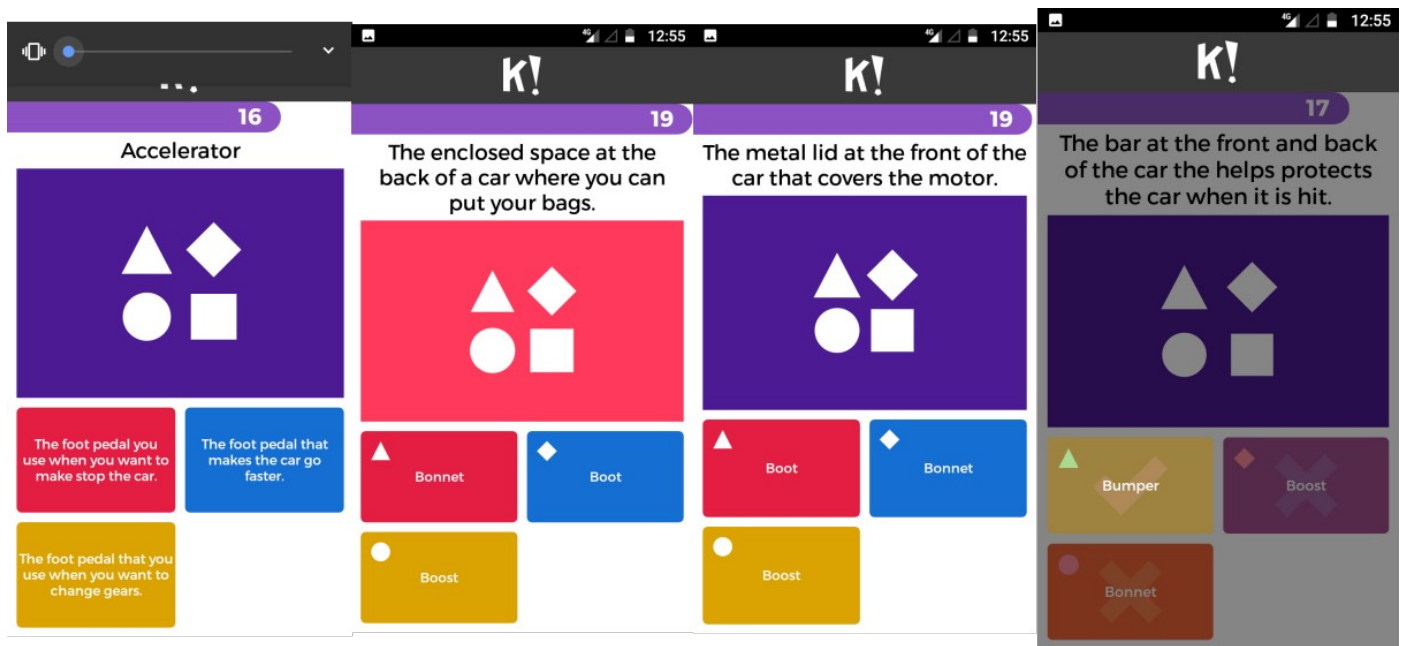


Figure 11. Kahoot quiz: "Parts of a car".

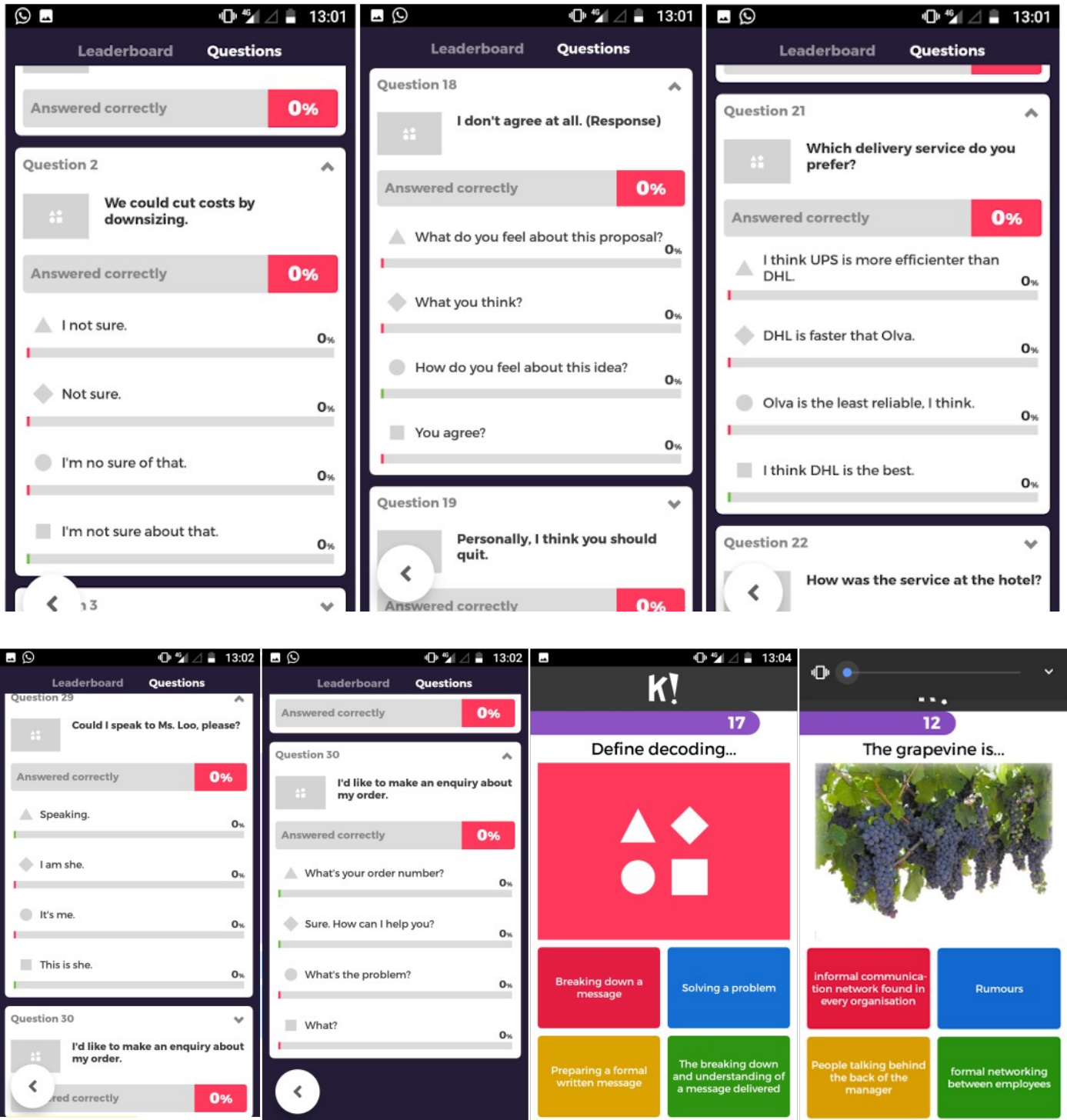


Figure 12. Kahoot quiz: “Expression in business”.

At the end of the project, the members of each of the teams are assessed (Figure 13) with the following rubric adapted by the lecturer in the free Internet tool Rubistar (rubistar.4teachers.org) (Figure 14). A double review takes place, both the lecturer and the student’s teammates being involved.

**Team assessment**

Assess the work of each of the members of the team filling in this form.

Figure 13. Hyperdoc: Team assessment.

<b>Contributions</b> 30%	<b>Routinely</b> provides useful ideas when participating in the group and in classroom discussion. <b>A definite leader</b> who contributes a lot of effort.	<b>Usually</b> provides useful ideas when participating in the group and in classroom discussion. <b>A strong</b> group member who tries hard!	<b>Sometimes</b> provides useful ideas when participating in the group and in classroom discussion. <b>A satisfactory</b> group member who does what is required.	<b>Rarely</b> provides useful ideas when participating in the group and in classroom discussion. <b>May refuse</b> to participate.
<b>Quality of work</b> 30%	Provides work of the <b>highest quality</b> .	Provides <b>high quality</b> work.	Provides work that <b>occasionally needs to be checked/redone</b> by other group members to ensure quality.	Provides work that <b>usually needs to be checked/redone</b> by others to ensure quality.
<b>Time-management</b> 10%	<b>Routinely</b> uses time well throughout the project to ensure things get done on time. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	<b>Usually</b> uses time well throughout the project, but may have procrastinated on one thing. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	<b>Tends to</b> procrastinate, but always gets things done by the deadlines. Group does not have to adjust deadlines or work responsibilities because of this person's procrastination.	<b>Rarely</b> gets things done by the deadlines and group has to adjust deadlines or work responsibilities because of this person's inadequate time management.
<b>Problem-solving</b> 30%	<b>Actively looks for and suggests</b> solutions to problems.	<b>Improves</b> solutions suggested by others	<b>Does not suggest</b> or refine solutions, but is willing to try out solutions	<b>Does not try to solve</b> problems or help others solve problems. Let's others do the work.



*Figure 14. Rubric for the assessment of the student's work in the project.*

The evaluation of the project is supplemented by a final test designed according to the traditional format. It includes a reading and listening comprehension section, another of use of English and a writing exercise. The idea behind making an assessment based on traditional models is to check and verify the results achieved in the project.

### **Results**

All of the students passed the different tests they had to take throughout the project. Although there was a variety of marks, the average mark of our students was high ranging from 80 to 90 out of 100; and the percentage of students who got 50 to 60% was low at 20%. In addition, we observed that the marks obtained in the traditional format were nearly identical to those obtained by the other EFL students from other engineering degrees. Differences range between 0.5 and 1 point and in no case was there a difference in the number of failures.

However, it is noteworthy to mention that there was a big difference in terms of motivation. Students expressed in a final questionnaire about the way of approaching the subject their preference for the PBL format in 90% of the cases. Most of them declared that they were satisfied (60%) and 30% were very satisfied. Only 10% of students still estimated that this was not enough, missing the traditional vocabulary lists. Conversely, all of the students confirmed an enhancement of their communicative skills and they associate their improvement in communication to the type of activities and tasks put forward in the PBL project.

### **Conclusion**

This example of PBL reveals that not only can this type of methodology be applied to the teaching of ESP for mechanical engineers but it also makes it more attractive for university students. The variety of tasks prevents the students' loss of motivation since they are constantly challenged by new and different types of exercises that contribute to their skills' training. Things like the introduction of QR codes make this project more appealing for the students who are familiar with the act of scanning these codes as part of their daily activities. In all cases, the students deal with realistic situations where problem-solving is required, as will happen in their future professional lives.

This study has proven how PBL fosters a more real-life and meaningful way of learning that helps students create connections to life outside the classroom and become aware of the usefulness of classes for their future success. Not only does it improve language skills but it also provides professional skills such as collaborative working, the abilities of decision making and problem solving. In a final questionnaire the students highlight the importance of taking initiative and responsibility achieved by this project. In addition to this,

they admit that their knowledge of new technologies was lower as they were not aware of the full potential of mobile apps and audiovisual materials.

Finally, it has to be said that when the project was introduced to our students, they were initially reluctant as they were not used to learning on a project-based basis. Their fears were related to the lack of lists of specific vocabulary to memorise and exercises designed around traditional methodologies. However, they became easily engaged in the project as, firstly, it revolved around a topic of their interest; secondly, they benefitted from the possibilities offered by new technologies and audiovisual materials; and thirdly, they realised the activities proposed could be tasks they would have to carry out in their future jobs. Students' motivation and the appealing nature of the tasks have been decisive in the standard of results obtained in both the assessments undertaken throughout the project and the final individual test designed in a traditional format.

### Endnote

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