TRANSDISCIPLINARY ENGAGED LEARNING:
Upskilling with Communication Strategies in Bioinformatics

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ABSTRACT

This study highlights an innovative educational project entitled 'Dynamic Teaching through Communication Skills' as well as forming part of joint initiative for Erasmus + Communities and Students Together (CaST) 2019-1-UK01-KA203-061463. The pilot study shows that there are many ways to approach teaching across the disciplines with Engaged Learning. The proposal includes discussions on the practical methodology of integrated content and language in higher education. While bringing real world problem solving into the Health Engineering degree, the chapter underscores aspects of persuasion and pitch development within the paradigm of English as a Lingua Franca.

RESUMEN

Este estudio destaca un proyecto de innovación educativa (PIE19-006) Dinamización de la docencia a través de las competencias de idiomas asimismo forma parte de Erasmus + Communities and Students Together (CaST) 2019-1-UK01-KA203-061463. El estudio de caso muestra que hay numerosas maneras de enseñar de manera interdisciplinar. La propuesta incluye debates prácticos de la metodología de integrar contenidos y lengua extranjera en el espacio superior con inglés como lengua franca. Dentro del grado de Ingeniería de la Salud, el Proyecto inserta estrategias de comunicación y la persuasión, enmarcado con el aprendizaje de servicio.

1. Introduction

This study will focus on an Engaged Learning initiative called 'Real-world solutions for doctors, patients.' It forms part of an innovative educational project entitled 'Dynamic Teaching through Communication Skills' as well as a joint initiative for Erasmus + Communities and Students Together (CaST). The proposal includes discussions on the practical methodology of integrated content and language in higher education (ICLHE). While bringing real world problem solving into the Health Engineering degree, the presentation underscores aspects of persuasion and pitch development in within the paradigm of English as a lingua franca and intelligibility (Yazan, 2015; Griffith, 2021).

The University of Málaga's (UMA) team developed a project-based learning initiative which aimed to better prepare students for the workplace as they searched for answers to real-world problems. The plan took place in the Health Engineering (Bioinformatics degree) programme, where communication strategies were coupled with Engaged Learning workshops in a two-year project in which students produced apps designed to benefit their target stakeholders (Griffith, Santos Diaz, Lechuga, 2022).

The Health Engineering degree integrates many aspects into a cohesive learning paradigm based on real-world applications. Bioinformatics is a multi-disciplinary field that creates methods and software tools to better interpret large sets of biological data. As an interdisciplinary field of science, bioinformatics combines biology, computer science, information engineering, maths and statistics to analyse biological data as well as cross referencing multiple data base sources. The initiative focuses on Biological Database Management within the degree of Health Engineering and is set in a time frame of a two-year educational innovative project co-funded by the UMA and the European union.

The focus of this case study is how we incorporated pitch development into a project based learning initiative. A pitch is a brief, persuasive speech used to incite interest in an idea. Not only should they be interesting and memorable, but also they need to be persuasive. Research has shown, the entrepreneurial pitch has well-marked structural features, specific themes and figures of speech, and it is manifestly persuasive in intention. Students were asked to create a data management project as related to healthcare and present it using a pitch. Several support workshops were offered to aid them in their pitch development to support their technical design presented in writing.

This chapter will examine students' app development together with their pitch presentations. The research purpose opens the discussion to key contrasts for Engaged Learning (EL) across the disciplines. The methodological approach is a pilot study as to how to best address the trans-disciplinarity of EL through a project based initiative. What this means is that the project will be approached from multiple perspectives. The technical skills are coupled with communication skills in a purposeful upskilling. Employability skills are not only fostered but specifically inserted with the EL workshops and the careful consideration of community partners and final users of the students' projects.

1.1 Multiple perspectives lead to multiple contexts

Our first perspective is upskilling which refers to soft skills or those that relate to how people work together. Soft skills include interpersonal (people) skills, communication skills, listening skills, time management, and empathy, among others. They are among the top skills employers seek, because soft skills are essential for many jobs. We begin the discussion with the inclusion of soft skills in two subjects in Engineering and will center on communication and intelligibility.

Intelligibility is a highly relevant concept for multilingual communication and, in particular, with users in lingua franca contexts. However, it has proven difficult to define and measure (Yazan 2015). With more and more non-native speakers using English across the world Jenkins (2000) has called attention to the 'non importance' of pronunciation. It is with this perspective that we will approach communicative competence. The context of the classroom discourse is the ideal frame to explore how language and meaning work together in second language (L2) contexts. What is salient is how multilingual users compensate to get their message across.

In real communication, we may find a miscommunication clarified by an image or even a key pause when speaking. Any utterance most assuredly must be inserted into a whole context to truly measure intelligibility. Comprehension then becomes intriguing because the non-linguistic as well as the linguistic features come into play. We may find an argument intelligible but not comprehensible because of the way it was structured, or even grammatical, but not natural (Griffith, 2021).

The second perspective to consider is the real-world outside the Engineering classroom as defined by Engaged Learning. Engaged Learning (EL)has evolved from Service-Learning and in its origin was based on the model of experiential learning. However, where Service-Learning is defined as being course-based and credit bearing, we have adopted the term Engaged Learning as a broader, more inclusive term for the pedagogical approach that enables students to derive learning from meaningful community engagement whilst working on real world problems. Our context is higher education combined with social responsibility.

A 2011 literature review indicated that, despite an increased awareness of social responsiveness in Higher Education, the practices of engaged scholarship and community engagement need to become more entrenched into university curricula for universities and communities to recognize the necessity of integrating research, teaching, learning and civic engagement (Penfold & Goodman, 2011). By creating institutional structures which are more supportive of interdisciplinary and transdisciplinary approaches, we are nurturing a culture of co-creation and knowledge exchange, leaving our institutions better placed to address society's more pressing problems. This is known as the third mission.

Engaged Learning enables students to apply theory to a context outside of the University by addressing societal concerns, challenges or needs, while producing knowledge in an equitable, mutually beneficial partnership. Through participating, students develop self-efficacy and enhance their employability, while local communities benefit from the skills and knowledge of a supervised student researcher. (Figure1 provides a definition.)

Figure 1. What is Engaged Learning?

Source: Anderson, CaST Multiplier Event, University of Málaga, April 2022, unpublished.

The EU project Erasmus + Communities and Students Together (CaST) 2019-1-UK01-KA203-061463 looked at 28 separate examples of Engaged Learning across the six countries, to take an in depth look at examples of Engaged Learning from within each of the six universities represented throughout Europe (Anderson, 2022). Highlighted is the diversity and flexibility to be found within EL initiatives specifically in the higher educational institutions (HEI). The examples provided range rather widely in their structure and intended outcomes. However, the one constant is each initiative's commitment to a concept where reciprocity between the students, universities, and communities, is prioritized.

The benefits of the EL approach are well documented and 'reciprocity' is a fundamental feature of all the initiatives. Students gain an enriched education which provides them with new competencies and prepares them for their future career, while increasing their sense of civic responsibility. Many initiatives also enable students to produce an impactful project that provides useful knowledge to the community. Embedding EL in a credit-based module overcomes the issue of reward and incentivisation. Ideally, it would include some of the theory that underpins EL pedagogy, as well as an element of reflection, and would allow students to work with a community partner, researching a real world problem, or evaluating a service, testing an idea, etc. (Anderson, 2022). The context of EL is complex and it is important to understand it globally as seen in Figure 2, as well as from the bottom up as in the case of this pilot study and its multiple aims.

Figure 2. Engaged Learning Overview

- ❑ Diversity
- ❑ Flexibility
- ❑ Adaptation
- ❑ Dedication
- ❑ Funding

GHENT
UNIVERSITY
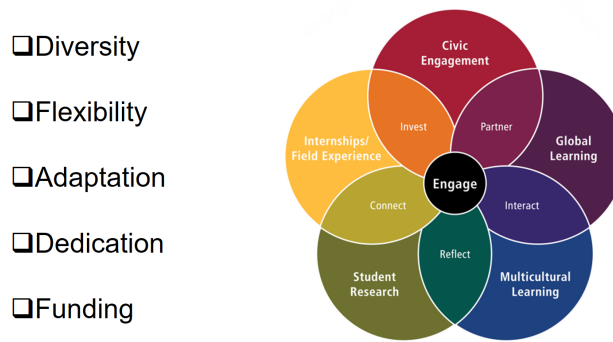
Source: Marsh, CaST Multiplier Event, University of Málaga, April 2022, unpublished

There are multiple aims to consider for this pilot study: (i.) Can we foster greater awareness in App design for Engaged Learning through project-based learning in Bioinformatics? (ii.) Can learners explore communication strategies in both English and Spanish as well as discovering real world applications for their project design? (iii.) Can community partners can gain technologically skilled workers and share expertise? (iv.) How can we make this more sustainable overtime?

2. Approach and Objectives

Engaged Learning across Europe is diverse and mutually beneficial partnerships among universities, students, and communities can be incorporated into a wide range of disciplines with an even wider range of benefits and/ or services provided to the communities in which they are situated. Engaged learning means not only looking outside the university, but also forging new relationships among departments. In this way, the collaboration between Education and Engineering fell into place in this pilot study in search of transdisciplinary perspectives.

In fact, we chose this initiative, because we felt it was necessary to include STEM (Science, Technology, Engineering and Maths) subjects in our Engaged Learning framework for the EU project to explore a learning environment different to what we would normally encounter as linguists. The initial goal was to bring English into a subject otherwise taught in Spanish and provide students with this key skill. The idea included fostering interdepartmental relationship between education and the technological degrees for future collaborations. So, indeed there was a dual objective: Communication skills and App design to include Engaged Learning.

What makes the initiative stand out is the project based learning format to encourage Engaged Learning. Students were to create apps that carefully considered their final users: patients and their families many of whom are vulnerable and less 'techno-savvy'. At the same time, they were provided with structural feedback on their performance in English and created a new understanding of English as a lingua franca

The initiative, 'real world solutions for doctors and their patients' differed from those offered in social sciences as the main topic at hand was data bases and integrating data bases for the health care industry was firmly embedded in the engineering degree. Additionally, students would be guided in communication strategies and encouraged to consider the stakeholders or final users of their projects (patients, their families, doctors and administrators). Engaged learning and involving community partners, a priori, was more challenging.

Each stakeholder in the project sought different goals. The main professor was looking to create utility in the students' final projects. The two linguists wanted to explore pitch development in the technological field. The students benefitted from not only the previous two goals, but ultimately from their interest in professional development and employability. The community partner shared his expertise for App development, but also offered an internship. His goal was one of recruitment.

2.1. Transdisciplinary approach

It is necessary to clarify terminology given the wide range of contexts involved and each discipline tends to view this from the prism of their own area of expertise. 'Multi-disciplinary' approaches include combined expertise and is more common to the sciences. For example, with the degree of Health Engineering, the medical profession relies on technical support and proper management of large sets of data, while the engineers in this degree must consider not only data, but doctors, patients, administrators and research hospitals as well. The context is multi-disciplinary as each field works independently coming together for specific projects, meaning: doctors are doctors and engineers are engineers. However, the term 'interdisciplinary' tends to meld certain fields together and is common to the humanities and social sciences. Sometimes this trend combines hard skills with soft skills

or several disciplines overlap. A good example is taking communication skills in English to subjects normally taught in Spanish. Integrated Content and Language in Higher Education (ICLHE) is commonly referred to as interdisciplinary. What this means is that within a specific subject, multiple disciplines overlap.

However, a new term 'transdisciplinary' is what we will be using to frame this project. In transdisciplinary initiatives the lines between the fields blur together, the perspectives look outside the university context into to community, the approach actively seeks stakeholders and the impact projects can have in local communities. Crucially, their gaze moves outside the university (figure 3).

Figure 3. Definition Transdisciplinary Concept
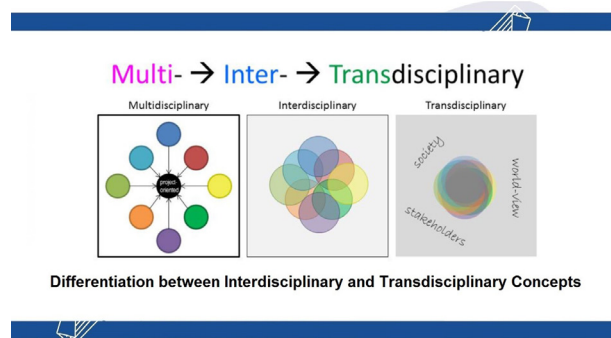
Source: Awan, 2022.

There are stakeholders and experts with different fields expertise that come together with a shared community interest or specific problem to solve. The doors of universities, representing a boundary between the relatively safe and autonomous academic institutional world, and the complex, multi-stakeholder society, literally have to be opened (Oonk et al. 2020). So, indeed, Engaged Learning reaches beyond the university.

Increasingly, higher education institutions are expected to be relevant to and engaged with society (OECD-IMHE, 2012). Society benefits from knowledge created in academia, whereas higher education students and staff benefit from working on real-life projects to gain key professional skills and enrich their practical experience (Jacoby, 2014). However, partnerships and collaborative learning between higher education institutions and society are challenging from an institutional perspective, as well as for stakeholders, students and academic staff involved (Coates and Goedegebuure, 2012). There are rewards, but not without effort and, certainly, not without limitations.

2.2. Upskilling

The main pedagogical approach has been project-based learning as well as a decidedly humanistic approach to STEM. Innovation can be a deviation, an alteration, even a permutation, but clearly innovation is built on many pillars. In the case of this project, innovation comes with the trans-disciplinary approach. Using Engaged Learning in project-based learning allows for a range of outlets. Communication skills and Engaged Learning are added to the standing technological curriculum to provide students with greater employability together with an awareness of the community that their projects can serve.

We aim to combine hard skills with soft skills. In turn, a second part of this initiative is making students more aware of how their technological skills can be of use to the greater community. Seven of the eight apps created included a purposeful connection to community needs. In this way, their projects were framed by Engaged Learning. Students had to write up a technological report of their projects and present these projects orally. Learners were supported during both the project design as well as in their oral presentations or pitches.

Pitch may be defined as an oral presentation which provides a brief description of the value of an idea or project to potential sponsors or partners. Daly and Davy (2016), among others, have shown that the entrepreneurial pitch has well-marked structural features, specific themes and figures of speech, and it is manifestly persuasive in intention (Díez-Prados, 2019). Learners gain key skills for their professional futures, effectively combining soft skills with their hard skills.

But when you take this into the paradigm of English as a lingua franca, new patterns and discussions arise as to the ultimate goal of communication. Of all the English spoken or published in the world today approximately two-thirds is produced by non-native speakers. It is changing the very fabric of communication models to include proper messaging despite imperfect performances.

Worthy of note is the adaptation of our model for the context of English as a lingua franca. We did not expect these engineers to understand the extensively descriptive discourse analysis of persuasive language and decided that a simplified model applied specifically to what they were trying to convey was the initial framework. We focused on communication with these main features: i. Body language, ii. Visual support, iii. Key structural

elements, iv. Clues to better word choice and pronunciation. We simply instructed them to 'engage, inform and add value' in their oral presentations and then proceeded to aid them in the drafting process.

3. Methodology

Pilot studies, as with case studies, are established research designs that are used extensively in a wide variety of disciplines, particularly in the social sciences. This research approach is used to generate a multi-faceted understanding of a complex issue in its real-life context. The multiple contexts allow for a holistic perspective, though not without limitations. So the analysis will not go deeply into linguistic features, it will not uncover new technical skills for engineers and it will not provide an exhaustive definition of Engaged Learning. It will, however, explore the unique combination of these features.

Pilot studies are commonly used within quantitative and qualitative studies. Van Teijlingen & Hundley, (2001) found that the two main types of pilot studies used in social science are (i) smaller versions of studies, called feasibility studies, and (ii) the pre-testing of a particular research instrument. Our approach is systematic, but exploratory and quite particular to our context. Five other European Universities used a similar format in presenting their cases for Engaged Learning in higher education (Marsh & Kilma, 2021). Although each case is unique, what is common is the need to explore an event in depth and in its natural context. The main idea being the utility and implementation of the initiative must be measured in context with our research questions framing the process.

The purpose of a pilot study is to make details explicit, to focus on stakeholders' needs, and draw up an action plan to obtain rich data Indeed, the goal is to examine the degree to which objectives have been met and explore ways to improve and adapt to new initiatives. As previously mentioned, there are multiple aims to consider:

(i.) Can we foster greater awareness in App design for Engaged Learning through project-based learning in Bioinformatics?

(ii.) Can learners explore communication strategies in both English and Spanish, as well as discovering real world applications for their project design?

(iii.) Can community partners can gain technologically skilled workers and share expertise?

(iv.) How can we make this more sustainable overtime?

3.1 Sample

The initiative focuses on Biological Database Management within the degree of Health Engineering and is set in a time frame of a two-year educational innovative project at the University of Málaga. Over two different subjects, more than twenty students were presented with opportunities to integrate their subject knowledge using English[1]. As the project advanced, there was an additional focus on Engaged learning to make key connections with the final users of their project design. The results presented in this study will be eight pitches developed by sixteen students. Crucially, there were many actors involved in the project based learning initiative.

The best way to describe this initiative is seen in Table 1 where the overall format is described. There are several stakeholders and each will play a different role as the project is developed in sequence. Learners are encouraged to look beyond the university to where their specific skill set can make a difference. Community partners included local hospitals and the Institute Biomedical Informatics of Malaga (IBIMA) and brought an enormous input of reality into the final projects. A doctoral candidate assisted in the workshops and the drafting of the pitch development.

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1   The two subjects were offered in Spanish, and the additional workshops added activities in English as well as Engaged Learning.

Table 1. Overview: Trans-disciplinary Active problem solving in Health Engineering

| Student projects	-Credit bearing and embedded in 2 different subjects with same students. -Workshops offered to foster communication skills and insert awareness about community needs and final users culminating in the creation of 8 Apps.
Number of students	-16 + 1 -16 undergraduates in their third year. -1 doctoral candidate involved in these workshops.
Trans-Disciplinary	-Language skills, Informatics, Health care, Third mission
Added value	-Key skills for employability, student recruitment, shared expertise, support for local hospitals and their patients.
Partners	-University: Professors: Informatics, Biology and Education, involved in a 2-year project. Main professor gives content; secondary professors give workshops. -Community Partner: Instituto biomédico de Málaga (IBIMA): involved in planning, in final evaluation and with internship offered Biomedical Research Institute of Málaga (IBIMA) »IBIMA's Own Plan 2021 Local Hospitals, initially involved in planning, will become potential partnerships in a post COVID context
Placements	-Internship IBIMA
Brokers/steering	-Co funded supported by CaST. Erasmus + Communities and Students Together (CaST) 2019-1-UK01-KA203-061463. -Institutional support UMA_PIE 19 006, limited funding -Computer Science Dr Ismael Navas, -Biology Dr Elena Rojano -Education Dr Mary Griffith, -IBMA Andrés González Jiménez

Source: adapted from Griffith, Santos Diaz, Lechuga, 2022

Students were asked to create a data management project as related to healthcare and present it using a pitch. Several support workshops were offered to aid them in their pitch development. A pitch is a brief, persuasive speech used to incite interest in an idea. Not only should they be interesting and succinct, but also they need to be engage and add value. Research has shown, the entrepreneurial pitch has well-marked structural features and it is manifestly persuasive in intention. The focus of this case study is how we incorporated a pitch into a project based learning initiative and how this was coupled with a greater awareness for social responsibility in project design.

3.3. Procedure: Engaged Learning workshops

Project based learning has a final product in mind, but the sequence is grounded in the process. As learners were developing the technical aspects of their projects, they were simultaneously thinking about how to present this to potential investors, how to communicate efficiently and how to overcome some of the challenges to doing this through a second language. At the same time, they were receiving workshops to frame their project design with Engaged Learning. They were encouraged to look outside the university to seek out final users who might be at risk of exclusion, due to age, illness or even just the Covid context we were living at that moment. In Figure 4 the project based structure is highlighted

Figure 4. Action research procedure applied to this project
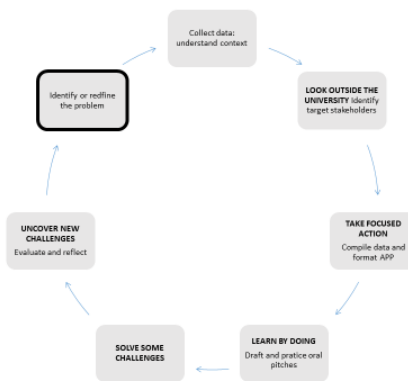
Source: author

The process begins by identifying a problem within a specific context. Learning by doing is key in the instructional model for project based learning. Worthy of note is the adaptation of our model for the context of English as a lingua franca. We did not expect these engineers to understand the extensively descriptive discourse analysis of persuasive language and decided that a simplified model applied specifically to what they were trying to convey was the initial framework. We focused on communication with these main features: i. Body language, ii. Visual support, iii. Key structural elements, iv. Clues to better word choice and pronunciation. In figure three we can see a simple focus from one of the workshops.

By using real examples, we discussed the importance of pausing and segmentation of the ideas in units that are particular to each language. Written discourse varies from spoken discourse and there are key features of delivery that are best examined with examples In Figure 5 there is a sample pitch that was in the process of drafting to improve spoken delivery. Key pauses were marked and features that exemplified engaging and adding value were highlighted.

Figure 5. Example from communication workshop.

Source: Matieral used in workshops to draft pitch and work with communication strategies, unpublished

The pilot study explores the unique combination of these features. When communication through a second language the productive skills of both speaking and writing oftentimes prove challenging. The two linguists participating in the study helped with the drafting process. It is not the goal to analyze the learning process, but, in fact to highlight that all results are part of a careful process design in project based learning. As previously mentioned, the analysis will not examine all linguistic features, it will not uncover new technical skills for engineers beyond the goal of App design; and it will not provide an exhaustive definition of Engaged Learning, though findings indicate that 7 out of 8 groups considered specifically community targeted stakeholders.

4. Findings

In Tables two, three and four, seven of the eight apps are summarized. Students focused on different patient types and organized their apps following the technological aspects indicated by the lead professor. What is salient from these students' app design is that two of the main objectives were met. The EL initiative succeeded in leading students in their project design.

Objective 1 suggested that Bioinformatics could foster greater awareness in project design for Engaged Learning through the creation of apps. Learners received additional workshops and qualitative feedback during their normal course time over two subjects. Seven of the eight apps created were decidedly catered to community needs or final users. Their perception of patients at risk is noteworthy in the project designs.

Three projects catered to patients suffering from mental illness and their families (Table 2); two projects focused on children or neonatal babies (Table 3), while the last two considered at-home monitoring for patients with long term care during the Covid crisis (Table 4). Each group was specifically targeted and the app created with the final users in mind. Clearly, the students' projects can be considered as engaging with the final users.

Objective 2 encouraged learners to explore communication strategies that are key to future employability and discover real-world applications for their project design. Workshops provided students with pitch structures and allowed students to draft and work on their oral presentation skills. Each group presented their projects both in writing and orally and thus promoted skills for greater employability. The students' descriptions follow the key pitch structure in its simplified version. Students were asked to engage, inform and add value.

Table 2 Neurological and Mental Illness Project Design and Target Stakeholders
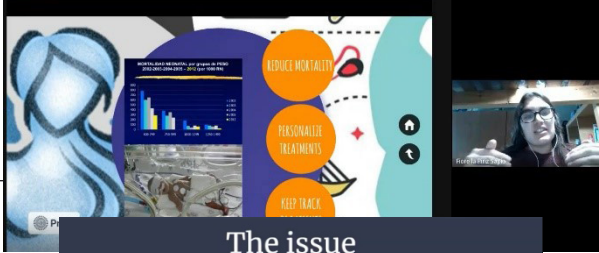
Students' App Design	Students' perspectives as presented in their pitches
	1. Patients suffering from mental illness Neurological and Mental Illness Project Design and Target Stakeholders Our web application focuses on this set of challenges in order to provide some solutions for patients suffering from mental illness. We aim first to improve data collection and data processing through a more focused perspective that is able to consider aspects specifically related to psychiatry.
	2. Alzheimer Patients and their families: With our app, families of people with Alzheimer can track the patient's behaviour and share this information with their doctor. The app can facilitate treatments that best suit them according to their medical history.
	3. Neurological Disease: How many people suffer from neurological diseases in the world? And how much useful neurological medical data is not accessible or even understandable for patients? Our project is about them. Nowadays, we find hundreds of million people that need information in this health field. With our web application we can provide essential information to patients who really need it.

Source: Griffith, Santos-Diaz, Lechuga, 2022

Students were encouraged during the drafting process to engage, inform and add value. Using their words, they wanted to create 'a platform to make a difference.' By purposefully working with persuasive language features students were able to successfully present their projects, not only with technical viability but with a

proper persuasive structure. They did not limit their app designs to doctors or hospitals, but rather made many decisions based on patients, as the final users.
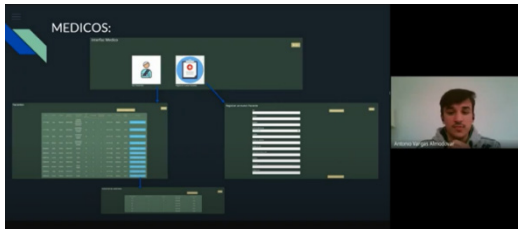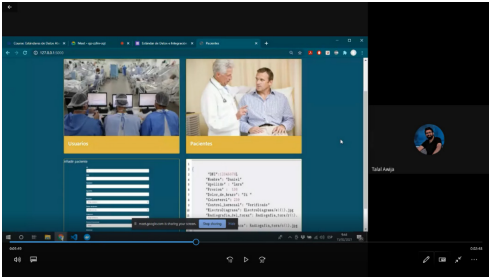
Table 3. Children at Risk: Project Design and Target Stakeholders

Students' App Design	Students' perspectives
	4. Neo natal data for premature infants: We have developed a Web application where health professionals can register new-borns' parameters, not only in order to evaluate their health condition, but also to contribute to research as well. This Web application is designed with four different types of users in mind: doctors, nurses, researchers and parents or legal guardians.
	5. Paediatric scoliosis patients and their families: Our team is determined to make a difference in their lives, by creating a platform for orthopaedists, technicians and patients.

Source: Griffith, Santos-Diaz, Lechuga, 2022

What is interesting about project based learning is that students are immersed in the context they are living at that moment. In our case we are in 2020 and 2021 and Covid forms a big part of two of the App designs (Table 4). Chronic patients or those needing monitoring were told to not go to hospitals making these apps particularly engaged with a read need for a specific context. This, indeed, is a key skill for their professional future. And although these two projects went through the drafting process in English, they chose to present their final projects in Spanish, their native language. The key features of pitch were maintained. Table 4 presents their versions from the drafting process.

Table 4. Home monitoring in Covid context: project design and target stakeholders.

Students' App design	Students' descriptions
	6. Glycemic data management for diabetes patients: Our project consists of a mobile app synchronized via NFC with a sensor, that helps doctors stay updated in real time through medical monitoring of a patient. The 8-hour memory saves all the glucose information and also offers a diagnosis tool and immediate medical prescriptions to help patients directly from their homes.
	7. Cardiology patients during COVID: This tool expedites diagnostic time and allows for a personalized treatment for each patient. Without a doubt the best feature is the easy access to information for patients. In the context of a pandemic, it is crucial to know if one should go to the hospital or not. It could be a question of life or death.

Source: Griffith, Santos-Diaz, Lechuga, 2022

We have yet to mention the App that will not form part of our data set. One group decided to create an App for proper data base administration for an orthodontic clinic. Not only did they not choose a particularly 'engaged' focus for their project, they also did not show key features of proper communication and opted for a presentation in their native language Spanish that was read out loud. Their presentation offered few features highlighted in pitch design such as shorter sentences, engaging or adding value. Instead, the projects presented an overly informative structure not adapted to spoken discourse. The lead professor said that this was, in fact, how most of his students presented projects in the past and was visibly satisfied with the other projects' presented in this pilot study in 2021. We mention it here briefly to establish the contrast; while stating that the overall grades were only slightly different from previous years (Figure 6), the lead professor clearly observed qualitative improvement.

Figure 6. Final grades Standards for Data base management, 2021
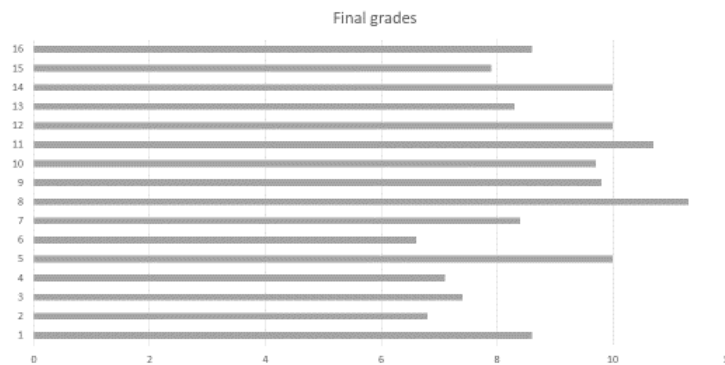
Source. Navas, 2021, anonymized evaluation results unpublished.

Objective 3 dealt with partnerships. For EL to take place there must be some actors from outside the institution actively collaborating. Originally, the project began with two doctors, who later would drop out due to the strain of Covid and their increased work load at the hospital. Moving forward, these potential partnerships would have given the final projects a much better grounding for the reality of the doctors' needs.

We did have great success with our community partner at the Institute of Biofinformatics in Malaga (IBIMA). This organization gained not only technologically skilled workers, but workers with a true sense of purpose for their professional futures. An internship has been offered at the IBMA where students can fulfil practical requirements for their degree and we are exploring how to make this more sustainable in the future. We consider this objective only partially met, but feel that community partners bring an enormous wealth of knowledge and expertise to the project design. In order for EL initiatives to be fully successful, community partnerships must be sought out and maintained and there are not always key actors (brokers) to make these partnerships continue in the long term.

Objective 4 focused on new directions and collaboration between departments that do not normally collaborate. These are in process at this time. What is clear is that partnerships mutate into new projects focused on specific problem solving and new inter-departmental collaborations. It is the goal for the next two years to continue working with professionals from Education, from the Health Engineering degree as well as seeking out new community partnerships. These indeed are new directions born from this initiative. Sustainability is measured by these new and ever-changing collaborations.

5. Discussion

What we have found after comparing our context to other EU partners is that brokerage becomes necessary. Other authors have referred to these partnerships between the university and the community as Regional learning Enviornments. "From an educational design perspective, the RLE provides an authentic multi-stakeholder learning environment for students as well as for teachers from multiple educational programmes simultaneously" (Oonk, et al. 2020, p. 704). The educational broker is a facilitator who connects people, networks, organizations and resources to support change. The process is key to creating new innovative capacities involving partnerships that are now required of a socially attuned and continuously adaptive mass system

In this section, we will discuss challenges, longer term impact, evaluation, and some caveats as we move forward from this pilot study. Broadly speaking, challenges will cover limitations and are grounded in reality. Impact will consider the continuity or evolution of the initiative for upskilling and Engaged Learning in STEM

subjects. Evaluation will consider the multiple perspectives involved when integrating content and language learning in higher education. Caveats will point to existing limitations.

5.1 Challenges

Each EL initiative has a different set of challenges. For Real world solutions in the Health Engineering Degree, the challenges are threefold. First is the aim to establish partnerships outside the university. This was achieved only partially with the internship offered at the IBIMA and with this partner actively participating in the final evaluation. Hospital partners initially showed interest but given the COVID-19 context they had other, more pressing issues to solve. Real patient data is privacy protected, but doctors and hospitals consult open source data bases on a daily basis to assess patients, diagnosis and treatments. A caveat to this is that partnerships are project-specific in this context of this pilot initiative, which was limited in time with specific objectives.

Second, students did not take a research-based approach to discovering real-world problems, by surveying doctors or patients. However, they did create their final projects with these specific communities in mind. As a caveat, we cannot pretend to convert engineers into social scientists; they will follow their own road towards Engaged Learning. Future research should incorporate marketing students who would bring a wealth of social research data to target stakeholders and not just investors. EL as a research construct does not always work as across the disciplines.

Third, the challenge within the higher education institution (HEI) is that most research is discipline-specific, making the trans-disciplinary approach so vital to Engaged Learning much less feasible. Research must consider added value within each field. A caveat: while there is much overlap between the humanities and the social sciences, there is less overlap in STEM. STEM disciplines need to be approached from a different angle. We have approached this using soft skills, reskilling, upskilling within their more technological framework. The participating doctoral candidate has begun to create new partnerships for his field study where again Engaged Learning is a secondary aim for the main research construct, contrastive communication.

5.2 Longer Term Impact

The pilot project in bioinformatics will continue, but with no real mechanism to assess Engaged Learning. The lead professor continues to be interested in working on his students' soft skills and it would seem that employability and soft skills continue to hold his attention. However, it has inspired new connections between language specialists and engineering and several follow-up workshops are planned for the upcoming course. Sustainability within technological fields begins with a specific project design and usually mutates into fostering partnerships for new directions. Crucially, the linguists go to the engineering degree to work within their context, rather than having the engineers take communication classes outside of their specific needs.

This research underscores the importance of language issues in higher education at a time of internationalisation and applies linguistic research to communication workshops. Future research should continue to explore interaction in the classroom as the negotiation of meaning to measure the impact that this has on foreign language learning as well as on content learning.

Within the engineering degree, contacts have been made and a small grant has been awarded to create a leadership course in Telecommunications. So indeed, we must discuss new directions. Future participation with the Telecommunications Faculty at the University of Málaga in the recently awarded grant "Key aspects for communication, leadership and entrepreneurship in technology" is just one example. Initial funding comes from the K skills internal plan at UMA and the acting director in Telecommunications is willing to set aside funds for five different degrees offered to approximately 300 students over the next four years. We are in the design stage right now and establishing when and where we can find funding or use student-created initiatives to continue to encourage multilingualism and Engaged Learning in these more technological degrees. As with most initiatives, time and funding play a role in making or breaking the project.

5.3 Evaluation

The projects were assessed using both their written project designs as well as their oral presentations. The videos, live-streamed, formed part of the final evaluation and were assessed using technological viability, impact in the community and pitch delivery. The weight of this assessment, as is logical, was towards the technological viability of the project. Engaged learning was a secondary goal as were the communication skills that were both encouraged through the workshops.

The IBMA outside community partner was involved in the final assessment and posed questions to learners after their presentations. He was pleased to have an inside look into their skills as project designers and willingly offered his expertise.

Results: Of the eight apps created, seven have purposefully addressed technological needs for final users. However, the projects remain hypothetical and would require additional support from community partners i.e., hospitals or doctors to be considered as viable projects. The lead professor was particularly pleased with the final versions and felt that there had been a degree of 'quality' inserted into this years' apps.

5.4 Caveats: Contextual elements in HEI

We have included some caveats in this discussion section as we continue to develop Engaged Learning initiatives within our university. The pilot study gives us a unique opportunity to uncover challenges as we move forward. We close this segment with three driving questions that persist within our HEI.

i.Are there resources available for brokerage? Most of the initiatives at UMA are tied into employability, sustainability and inclusion. Engaged Learning as a construct is absorbed by other 'missions' within the HEI. As promoters of Engaged Learning, we must be aware of how to make it work in existing projects, seek out feasible community partners and be willing to forge new relationships within our HEI.

ii. Are professors supported in these 'tangents' from their curricular contents? Research is discipline specific and Engaged Learning is more suited to the interdisciplinary benefits. Matching community interests and research will continue to be a challenge. There is little support for tangents from an institutional standpoint and working across the disciplines continues to present challenges. The 'elephant in the room' is time itself. University staff have time constraints when they start to move outside their departments, while maintaining teaching and research demands. Students have time constraints from their degrees and community partners have a complete different time perspective based on projects themselves and not on academic calendars.

iii. Do administrators and professors see eye to eye on Engaged Learning as a key competence or does it get lost in employability, inclusion, or even 'sustainability' from an environmental standpoint? Engaged Learning does not seem to work top down, but cannot survive without institutional support. Perhaps one way to get around this conflict is for key stakeholders to target department heads so that solutions can begin at a context specific and more medial level (see more on institutionalization of EL by Anderson et al, forthcoming in 2022).

6 Conclusions and Lessons Learned

Drivers of Engaged Learning vary. Globally, there is renewed impetus in the "third mission" and social responsibility across higher education. However, lack of formal national networks for this pedagogy, has meant that Engaged Learning has yet to become embedded across curricula. Engaged Learning initiatives in most countries are most often instigated by individual academics, while some larger models offering an Engaged Learning approach have emerged through participation in national, or internationally funded projects. Such is the case presented in this chapter.

The purpose of a pilot study is to make details explicit, to focus on stakeholders' needs, and draw up an action plan to obtain rich data. Indeed, the goal is to examine the degree to which objectives have been met and explore ways to improve and adapt to new initiatives. We have found that Engaged Learning in engineering looks different from the initiatives in the humanities or social sciences. Community partners were quite elusive without the specific project-based or problem-based approach and these relationships need to be fostered. Time for seeking out partnerships is more of a factor than anyone is willing to admit and without brokerage, this time commitment proves to be a daunting task.

There have been multiple aims to consider for this pilot study. The first research question asked if we could we foster greater awareness in App design for Engaged Learning through project-based learning in Bioinformatics. Through project based strategy and four workshops over two subjects, students responded well to these 'tangents' and practical applications for their project designs. Results show that seven of the eight App fulfilled the expectations for engaged learning in project design.

The second research question asked, 'Can learners explore communication strategies in both English and Spanish as well as discovering real world applications for their project design?' We observed mixed results. Five of the eight apps were presented in English and showed key features of persuasive language, two were presented in Spanish and also showed many of the structural features covered in the workshops, while one project demonstrated that not all students gained the same awareness for engaged learning and pitch development.

The third question: 'Can community partners can gain technologically skilled workers and share expertise,' was met only partially. Hospital partners initially showed interest, but given the COVID-19 context, they had other, more pressing issues to solve. This objective was achieved with the internship offered at the IBIMA and with this partner actively participating in the final evaluation and willingly offering his expertise.

The final question: 'How can we make this more sustainable overtime' will point us in new directions. The stages of implementing Engaged Learning are on an ongoing continuum and lean towards sustainability in bottom-up initiatives that mutate to fit the specific context, which is why we find the project based structure so useful. Sustainability for Engaged Learning is more of a mindset in administrators and professors. Perhaps these are the real targets within the HEI that will begin to embrace Engaged Learning within their specific contexts. Findings show that EL is ubiquitous, hard to measure, more useful to students than to the community, more sustainable in the social sciences, more project based in the hard sciences.

The main pedagogical approach has been project-based learning as well as a decidedly humanistic approach to STEM. In the case of this project, innovation comes with the trans-disciplinary approach. Using Engaged Learning in project-based learning allows for a range of outlets. Communication skills and Engaged Learning are added to

the standing technological curriculum to provide students with greater employability together with an awareness of the community that their projects can serve.

This pilot study has been embedded into existing subjects and actively explored a student-centred approach. As we weigh the advantages of a top-down or of a bottom-up approach, successful Engaged Learning should never stray too far from its specific context. We tend to focus on students within the prism of our own subject, but ultimately Engaged Learning must be addressed from within the institution itself. Moving forward, these key issues and ongoing challenges need addressing.

7. Acknowdedgements

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