Exploring the nuances of scientific communication for French-speaking English learners and researchers

Explorando los matices de la comunicación científica para estudiantes e investigadores francófonos que aprenden inglés

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ABSTRACT: As the global scientific landscape continues to embrace English as its lingua franca, the impact of language on the accuracy and comprehension of scientific terminology is becoming increasingly important. This paper explores the relationship between English use and scientific communication accuracy, highlighting challenges non-native (French) English learners face. It considers the nuances that arise from linguistic differences and examines instances where subtle linguistic differences can lead to misinterpretation and misunderstanding in scientific discourse. Based on the experience teaching English for specific purposes to postgraduate students in France, this exploration extends to common linguistic hurdles, highlighting language-specific structures and some cultural influences faced by both students and researchers. Focusing only on the complexities these learners face in science (mathematics, engineering) sheds light on the potential barriers that impede the clear and precise articulation of scientific ideas. The arguments presented seek to demonstrate the impact of English on the interpretation of scientific terms, using real-life examples (classroom activities) to illustrate these challenges, which are commonly faced and affect the teacher's approach to teaching. Finally, the paper argues for a conscientious approach to language use in scientific discourse. It highlights the need for research into accommodative approaches that facilitate clearer understanding among researchers, regardless of their linguistic backgrounds.

KEYWORDS: English for Academic Purposes, English for Specific Purposes, English as a Foreign Language, Scientific communication, Scientific English

RESUMEN: A medida que el panorama científico mundial sigue adoptando el inglés como lengua franca, la repercusión del idioma en la precisión y comprensión de la terminología científica adquiere cada vez más importancia. Este artículo

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explora la compleja relación entre el uso del inglés y la precisión de la comunicación científica, y destaca los retos a los que se enfrentan los estudiantes de inglés no nativos (franceses). Tiene en cuenta los matices que surgen de las diferencias lingüísticas y examina casos en los que sutiles diferencias lingüísticas pueden dar lugar a interpretaciones erróneas y malentendidos en el discurso científico. Basándose en la experiencia de la enseñanza del inglés con fines específicos a estudiantes de posgrado en Francia, esta exploración se extiende a los obstáculos lingüísticos comunes, destacando las estructuras específicas del idioma y algunas influencias culturales a las que se enfrentan tanto los estudiantes como los investigadores. Al centrarse únicamente en las complejidades a las que se enfrentan estos alumnos en el ámbito de las ciencias (matemáticas, ingeniería), arroja luz sobre las posibles barreras que impiden la articulación clara y precisa de las ideas científicas. Los argumentos presentados pretenden demostrar el impacto del inglés en la interpretación de términos científicos, utilizando ejemplos de la vida real (actividades en el aula) para ilustrar estos retos a los que se enfrentan habitualmente y que también afectan al enfoque de la enseñanza por parte del profesor. Por último, el artículo aboga por un enfoque concienzudo del uso de la lengua en el discurso científico y subraya la necesidad de investigar enfoques acomodaticios que faciliten una comprensión más clara entre los investigadores, independientemente de su origen lingüístico.

PALABRAS CLAVE: inglés con fines académicos, inglés con fines específicos, inglés como lengua extranjera, comunicación científica, inglés científico

1. Introduction

What is the best approach to teaching English to a group of science students?

English language skills have become essential for researchers, especially in today's globalized world. As a result, universities and language institutions offer a variety of courses to meet the needs of students in different fields of study. Common approaches include English for Academic Purposes (EAP), English for Specific Purposes (ESP), and English as a Foreign Language (EFL). While they focus on different objectives and methods, all three approaches share the common goal of teaching English.

English for Academic Purposes (EAP) is closely linked to the specific language features, discourse practices, and communication skills required in academic settings. According to Hyland (2006), EAP is designed to equip students with the language needed for academic contexts such as universities or research institutions. It prepares students for activities such as academic writing, reading academic texts, giving presentations, and participating in discussions. The main aim is to help students succeed in their academic studies by providing them with the necessary language skills to understand and produce academic content (Hyland, 2006).

On the other hand, English as a Foreign Language (EFL) is a more general approach, often taught in countries where English is not the native language. Nordquist (2020) explains that EFL is not tailored to a specific academic or professional context but aims to cover a wide range of language skills. The aim is to provide learners with English skills they can use in everyday situations, whether for communication, academic purposes, or cultural exchange. EFL programs typically focus on developing the four core language skills: listening, speaking, reading, and writing (Nordquist, 2020).

Finally, English for Specific Purposes (ESP) is an approach in which all decisions about content and method are based on the learner's specific reasons for learning (Hutchinson & Waters, 1987). This approach grew out of the recognition that many learners of English need the language for specific instrumental purposes related to their field of study or occupation (Broughton et al., 2003). ESP programs typically begin with a needs analysis in which practitioners identify students' language needs, academic and career goals, and the discourse and cultural contexts in which they will be working or studying - this is known as a target situation analysis (Johns & Dudley-Evans, 1991).

English for Specific Purposes (ESP) focuses on developing the communication skills needed to succeed in specific professional or academic contexts. For science students, ESP courses often include scientific articles, technical reports, scientific posters, and discipline-specific vocabulary. Student activities may include practical tasks such as writing reports, reading and translating technical documents, participating in simulated workplace communication, and giving presentations related to their field of study. This specialized form of English, often called scientific English, is designed to meet the specific needs of students in science, technology, engineering, and mathematics (STEM) disciplines (Dudley-Evans & St John, 1998).

All three approaches - English for Academic Purposes (EAP), English as a Foreign Language (EFL), and English for Specific Purposes (ESP) - aim to improve student's English language skills while recognizing the importance of contextualized language for effective communication. These approaches, in line with the objectives set out in the Common European Framework of Reference for Languages (Council of Europe, 2020), emphasize the integration of language input (listening and reading) with language output (speaking and writing). This promotes overall language development while ensuring learners are prepared for academic and professional communication.

Given the nature of these approaches, teaching scientific English to non-native speakers would most appropriately fall under the umbrella of ESP. It would focus on developing language, social, and vocabulary skills specific to science, taking into account the level of the students. For example, the curriculum might include instruction in writing scientific papers, understanding and producing technical reports, presenting research findings, and the accurate use of scientific terminology. Linguistic components such as discourse analysis, distinctions between written and spoken English, tone, and grammar - especially correct punctuation - would also be integral to the curriculum.

According to Larsen-Freeman and Anderson (2011), linguistic elements such as form, meaning, and function are essential to effective communication. Students need a solid foundation to communicate well in the target language. While ESP, EAP, and EFL approaches differ in emphasis and content, their boundaries are flexible, and the skills taught may overlap. Language teachers, who are often trained in pedagogy and language teaching methodology, adapt the content according to the specific needs of the learners and the field of study (Basturkmen, 2010). Consequently, the curriculum design within these approaches can vary depending on the educational context, the learners' objectives, and the resources available. This flexibility is essential as it allows language teaching to be tailored to the specialized needs of students in STEM fields, where discipline-specific discourse skills are vital for academic and professional success (Anthony, 2018).

2. Teaching of ESP to groups of MSc students in mathematics and civil engineering

Who is an ESP teacher?

First, it is essential to emphasize that an English for Specific Purposes (ESP) teacher is not a substitute for a subject specialist, such as a science or engineering teacher. Students often expect ESP teachers to master the technical aspects of their subject area, overlooking that the main aim of ESP teaching is to develop language and communication skills in a specialized context, not to teach the technical content itself (Belcher, 2012). According to Sarré and Whyte (2016), most ESP teachers, especially in France, often lack formal training or background in their discipline. They acquire their expertise over time through experience and interaction with the content and their students. This learning process is reciprocal, as ESP teachers become more familiar with the subject-specific language and context through continuous exposure.

There is a clear distinction between the role of ESP teachers and subject teachers using English as a medium of instruction (EMI). Both are essential in equipping students with the skills they need in their subject areas. However, their focus, expertise, and approach are different. ESP teachers often focus on teaching English skills relevant to a particular professional context (Hyland, 2019). This includes expertise in language acquisition, pedagogical strategies, and the development of critical language skills such as speaking, writing, and comprehension in a professional context (Anthony, 2018). ESP teachers also focus on discipline-specific vocabulary, terminology, and communication strategies that help students operate effectively in their professional environment - skills that are particularly important for students in professional courses where such content has immediate practical application (Paltridge & Starfield, 2013).

On the other hand, subject teachers who use English as a medium of instruction are primarily experts in their respective disciplines, such as mathematics, chemistry, or civil engineering (Macaro et al., 2018). They are responsible for teaching complex theoretical concepts and practical applications in their disciplines. Although their primary aim is to ensure that students understand the subject matter, they are also expected to communicate this content effectively in English. Although EMI teachers are not language experts, they play a role in supporting language acquisition indirectly, for example, by scaffolding complex ideas or incorporating language support strategies. However, their focus remains on content delivery, unlike ESP teachers, whose role is more explicitly language-oriented.

3. Teaching experience: content, activities, and assessment of the course

Teaching English for Specific Purposes (ESP) to groups of Masters students in Mathematics and Civil Engineering requires a nuanced understanding of their respective disciplines and specific language needs. It may be tempting for teachers to adopt a one-size-fits-all approach or to use a standard syllabus, believing that similar overarching language goals could apply to both fields. However, while the general goals of improving English language skills may overlap, the practical application of these skills and the terminology specific to each discipline can be very different (Anthony, 2018). In ESP, the focus should be on meeting the individual communication needs of students, so it is essential to design tailored lessons based on the specific needs of each group (Dudley-Evans & St John, 1998).

At the beginning of my classes, I often ask students about their future career aspirations or the specific fields they are interested in, such as teaching, working in a bank, or pursuing a career in foreign exchange, which is particularly relevant for mathematics students. This initial survey provides an insight into the students' expectations. It helps me to align the course content with their career goals while balancing the core objectives and expectations of the curriculum. According to Basturkmen (2010), understanding learners' goals through needs analysis is a fundamental principle of ESP teaching. The teacher can tailor the content to students' career goals and interests. Furthermore, involving students in this way can significantly increase their engagement and motivation to learn, which, as Hyland (2019) argues, is helpful for effectively acquiring language skills in specialized contexts.

Appendix 1 provides an example of the course outline I used for the two groups, showing the students' different needs in each area.

Although some topics are similar across the courses, the content and activities are tailored to the specific needs of each discipline. For example, civil engineering students engage in more practical, hands-on activities directly related to their specialization, while mathematics students focus more on analytical tasks such as interpreting graphs. However, both groups worked on research posters and technical reports for practical assignments. There are also moments when they share the same content, such as discussing intercultural communication or learning basic grammar and punctuation.

The teaching resources I use range from podcasts, TED Talks, and other audio recordings to specialist textbooks such as English Communication for Scientists (published by Nature), Cambridge English for Engineers (Ibbotson, 2008), and *Introduction to Technical English for Engineering* (Jaime & Díaz, 2012). I also include scientific articles from open-access journals and insights and contributions from the students themselves. Using authentic resources such as these helps students interact with natural materials and professional discourse, a key component of (ESP) teaching (Basturkmen, 2010).

In line with my teaching philosophy, I use several pedagogical approaches, including the intercultural approach, communicative teaching, action/student-centered learning, and task-based learning. The choice of approach depends on the lesson's objectives and the nature of the classroom activities. For example, if the lesson involves a project or collaborative task, which is in line with the task-based approach, I use strategies from cooperative learning. According to Larsen-Freeman and Anderson (2011), also known as collaborative learning, this approach emphasizes students learning from each other within groups. The above authors state that "it is not the group configuration that makes cooperative learning distinctive, but how students and teachers work together" (Larsen-Freeman & Anderson, 2011, p. 234).

Here is an example of an assignment I gave to a group of 30 first year Masters students in Civil Engineering after a lesson on writing technical reports: (See two examples of the reports in Appendix 2). The students were prohibited from using dictionaries or online grammar correctors such as Grammarly, DeepL Write, etc. The errors they made in their use of English are therefore reflected in their reports. In this way, they would be able to learn about their mistakes, allowing me, as their teacher, to understand where they needed more help.

The following are the instructions for the task:

In this group activity you will design and construct a model bridge using the materials provided. The aim is to work collaboratively to create a functional and aesthetically pleasing bridge while reflecting on the engineering design process.

a) Form groups of five students.
   - You will be provided with a set of rubber bands, a packet of spaghetti, glue, scissors, corks, and sticky tape. You are encouraged to share ideas with other groups to encourage collaboration and problem-solving.

b) Steps to take
   1. Design a bridge model based on your group's collective ideas. Use the materials provided.
   2. Upon completion of the project, each student must complete two tasks:
      2.1. Individual Report
      - Write a report explaining your specific role in the design and construction process.
      - Detail your group's steps and the challenges you faced during construction.
      - Use the appropriate vocabulary and phrases in English.
      - Submit this report for evaluation via the designated platform (Moodle).

      2.2 Group presentation
      - As a group, present your project to the class.
      - Each member needs to explain their contributions and discuss challenges and lessons learned.

c) Report format

To help you structure your report, follow the format below:

1. Introduction
   Explain the purpose of the report and the bridge project. Why is building the bridge important, and what is your report trying to communicate?
2. Methods or procedures
   Describe the design and construction steps your group followed. Include design procedures, calculations, and any engineering considerations.
3. Results
   Present the results of your bridge design, including how well the bridge has met your expectations or the goals of the design.
4. Discussion
   Discuss the significance of your findings and the effectiveness of your bridge design and make recommendations for improvement.
5. Conclusion
   Summarise the main points of your report. Do not introduce new information.
6. References - Cite any sources or materials you have consulted during the project.
   Rationale for the importance of this activity in ESP.

An assignment such as the one described above integrates engineering knowledge with English communication and writing skills, making it highly relevant for students on an ESP course such as Civil Engineering. This is an important skill, as was evident from discussions with students juggling their studies with work in the field. The structured format of the report, while simple and adaptable to different types of projects, encourages students to communicate technical information clearly and logically. This promotes accuracy in language use and strengthens their ability to describe complex processes such as bridge design and construction, which is essential in both academic and professional contexts.

Early development of these skills will ensure that students are better prepared for the demands of the global engineering workforce, where effective communication in English is as important as technical competence. The task also encourages using English in a collaborative context, as it requires students to work in teams. Clear communication is essential for teamwork, especially when explaining technical ideas and solving problems together. However, this is not always an easy task, as the students may revert to their first language (in this case, French) if they cannot express their ideas clearly in English. Research has shown that although this language/code-switching in the classroom can hinder the development of English communication skills, it can help learners understand challenging aspects of the lesson being taught and, therefore, be able to follow the instructions given (Memory et al., 2018).

Besides developing communication skills, the group presentation aspect of the assignment allows students to practice public speaking in English and effectively explain technical concepts to non-specialist audiences. Engineers often must present their work to clients, colleagues, or stakeholders in a real-world setting, which is an important skill to master.

This task also engages students in higher-order thinking by encouraging them to reflect on their roles, challenges, and lessons learned. Reflection (Schön, 1983; Richards & Farrell, 2011) is essential for improving their practice and communication skills in professional contexts. Finally, the constraints of using unconventional materials (such as spaghetti and rubber bands) require creativity and critical thinking, closely mirroring real-world engineering challenges. Explaining this problem-solving process in English helps to develop their engineering lexicon further and their ability to express complex ideas clearly.

4. Specific challenges for French learners of English in science

a) Direct translation

In my experience of teaching ESP to groups of students in the sciences, including cyber-security, and to those in mathematics and civil engineering mentioned above, I face particular challenges due to the specialized nature of their fields. I am focusing here on the French-speaking students whose difficulties with English are often related to the structures of the language. Generally speaking, the class as a whole has different levels of English proficiency. This depends on the students' backgrounds and their exposure to the content of their areas of specialization. Some students are more familiar with technical terminology, while others struggle with basic vocabulary. This diversity challenges teachers to effectively adapt course content to meet the needs of all students (Hyland, 2019).

For French-speaking students—often the majority at undergraduate and some at postgraduate levels—the specific challenges I have observed include difficulties with intonation, stress patterns, direct translation, and cognates, all of which affect their choice of vocabulary. The cultural nuances of the English language might add a further layer of difficulty.

There are also pronunciation errors, such as mispronouncing the 'th' sound, due to differences in phonetics between French and English. For example, the 'th' appears in English but does not exist in French, causing problems for some French speakers. In French, 'th' is pronounced as /t/ (e.g., 'thé' - meaning tea - is pronounced /te/) (Achieng, 2023).

Similarly, many silent letters in English make pronunciation more complex. For example, many science students in my classes struggle to pronounce words like 'iron' correctly because of the silent 'o'. In British English, 'iron' is usually pronounced /ˈaɪ.ən/ or /ˈaɪ.ərn/. Like American English, the 'o' is silent, and the 'r' is less pronounced, especially in non-rhotic accents, where the 'r' is not pronounced unless followed by a vowel. The silent 'o' can be confusing, as many words in French are pronounced more phonetically. Also, the 'r' sound in English differs from the French 'r,' which can cause further pronunciation difficulties.

The choice of vocabulary also significantly impacts the tone of communication. For example, some French-speaking students often translate directly from French. This is the case, for example, with verbs such as 'avertir,' which can mean both 'to warn' and 'to inform.' In an English context, a direct translation might result in a statement such as

1. 'I am ~~warning~~ you that I will not be in class tomorrow for medical reasons.' * Incorrect.
2. I would like to inform you that I will not be in class tomorrow for medical reasons. Correct.

Sentence 1 may sound overly formal or alarming in English, as 'warning' often carries a more severe connotation than intended. This discrepancy is due to the direct style of communication in French, where the use of 'warning' may seem appropriate, but in English, it can be perceived as more severe than simply informing someone.

Another verb often confused by French students is 'to permit,' which they sometimes use instead of the verb 'to allow.' While *permettre* means 'to allow' in French, the English verb 'permit' can have a more formal or official connotation, depending on the context. This association can lead students to choose the word 'permit' when 'allow' would be more appropriate, potentially leading to a mismatch in tone or meaning. For example, in the following sentence written by a student

3. "My parents ~~permit~~ me to go to the party tonight." *Incorrect.
4. "My parents allow me to go to the party tonight." Correct.

In addition to the direct translation, confusion can arise from using the wrong cognate. For example, the French adverb *actuellement* means 'currently,' but students often mistakenly translate it as 'actually,' which in English means 'in fact.' This misunderstanding can lead to miscommunication (Achieng, 2023).

The difficulty of choosing and using appropriate vocabulary is also evident when dealing with scientific and technical terminology. This is particularly true regarding understanding and communicating technical terms within specialized fields. An example that illustrates this difficulty is the term 'machine learning,' a subfield of artificial intelligence that involves the creation of algorithms and statistical models that enable computers to perform tasks without explicit programming, relying instead on patterns and inference (Craig & Tucci, 2024). While the literal translation of 'machine learning' into French would be *machine apprentissage*, the term 'machine learning' is often used as is in French technical contexts. For those who prefer the French terminology, *apprentissage automatique* is often used.

A final example of translation challenges in scientific contexts is the adjective 'null' (/nʌl/). In English, 'null' refers to something without legal or binding force or indicates a complete absence or void, particularly in hypothesis testing. According to the Oxford English Dictionary, it is a neutral and precise term in this context. In French, however, *nul* or *nulle* can suggest something non-existent or zero (Le Robert, 1996), but it can also imply insignificance or unimportance. This subtle difference can lead to misinterpretation. For example, a French researcher who translates ‘null hypothesis’ literally as *hypothèse nulle* might inadvertently convey that the hypothesis is not only without effect but also unimportant or irrelevant. This could lead his listeners to misunderstand the role of the null hypothesis, which is essential for interpreting statistical significance, and potentially undermine the rigor and validity of the research.

Last but not least, grammar and syntax are complex. Unfortunately, many ESP teachers ignore these skills, which students are assumed to have mastered in their previous years of learning English, to focus more on the scientific aspect related to the content and sometimes the professional aspect. The reality is that many students in science courses need help with grammatical accuracy, sentence structure, and the construction of complex sentences, which often leads to difficulties maintaining coherence in their writing.

The following is an example taken from a student’s report on the construction of the bridge referred to above:

a) The structure analysis reveals that the bridge’s design can resist the forces seismic up to 9 on the Richter scale.

There are several grammatical problems with this example. Firstly, the verb ‘reveals’ is incorrect; it should reflect the completed analysis in the past tense (‘revealed’) or use a different verb like ‘to show.’ There are also errors in word order (‘forces seismic’ should be ‘seismic forces’), prepositional usage (‘resist to’ should be ‘withstand’), and awkward phrasing still related to word order (‘analysis of structure’ should be ‘structural analysis’).

Therefore, the correct sentence construction should be

b) The structural analysis showed that the bridge design can withstand seismic forces of up to 9 on the Richter scale.

5. Common challenges for researchers and students in the learning and use of English in the sciences

Discussions with colleagues in the scientific field have highlighted several challenges they face when using English. One significant area for improvement is understanding different English accents, particularly for those not exposed to a wide range of English speakers. Misunderstanding rapid speech or technical terms pronounced with different accents can be problematic, as can adapting presentation styles to fit English-speaking academic or professional norms.

One colleague noted that anxiety often stems from fear of potential misunderstanding or misinterpretation during presentations. Concerns about needing help effectively communicating the intended message due to language barriers are common, particularly in high-stakes academic conferences or professional meetings. According to this colleague, this anxiety stems from issues of self-confidence and fear of making mistakes.

They also emphasized that balancing the cognitive load of presenting in a non-native language while maintaining audience engagement is particularly challenging. Presenters must manage content and language demands simultaneously, which adds to the difficulty of public speaking in English.

As a teacher, I have observed two additional challenges among my students: time constraints and student motivation. Masters programs in sciences such as mathematics and civil engineering are often intensive and demanding, leaving little time for supplementary language learning activities). Teachers must, therefore, find ways to integrate English language instruction into the existing curriculum without overburdening students or detracting from their core academic goals.

Furthermore, some students, particularly those who intend to work locally in an environment where the local language is sufficient, may need help to see the direct relevance of learning English to their field. This can lead to low motivation and commitment to the course. As a result, teachers need to demonstrate the practical benefits of learning English by making the content relevant to students' academic and career goals.

6. Discussion

The relationship between practice and theory is central to advancing research in language teaching. Cummins (2001, p.1) points out, "theory and practice are two-way and continuous: practice generates theory, which acts as a catalyst for new directions in practice, which then inform theory." This dynamic interaction suggests that discussing professional experience or actual teaching practice is acceptable and necessary to develop theoretical knowledge and inform further research. Failure to integrate theory and practice risks creating a disconnect from real-world applications, making it more challenging to translate theoretical concepts into effective language teaching strategies (Cummins, 2001).

In light of the challenges discussed in this paper, English for Specific Purposes (ESP) teachers need to adopt a conscientious and reflective approach to their teaching methods (Richards & Rodgers, 2014; Harmer, 2015). This approach includes careful consideration of each student's individual needs and abilities, explicit instruction, and meaningful practice opportunities. Regular assessment ensures effective learning, allowing teachers to monitor progress and make necessary adjustments. Individualized support and feedback tailored to each student's needs and abilities are critical to successful ESP teaching. Although these strategies may seem simple in theory, they require considerable planning and commitment from educators (Richards & Farrell, 2011).

By adapting course content and teaching methods to meet the unique needs of each student group, ESP teachers can better equip students with the English language skills necessary to excel in their academic and professional fields. In addition, integrating cultural nuances into language teaching helps students understand the expectations and communication styles commonly encountered in English-speaking academic and professional contexts (Deardorff, 2020).

In my teaching experience, I have found that offering a course on intercultural communication towards the end of the semester, although not formally assessed, provides students with valuable insights into working in multicultural contexts (Achieng, 2021). Occasionally, I invite professionals from various fields to share their professional experiences using English in such settings, further enhancing students' understanding.

Encouraging students to critique each other's writing and presentations promotes a collaborative learning environment and encourages constructive feedback. This process helps students improve their language skills and teaches them to accept criticism, cultivate tolerance, and develop a sense of responsibility - essential qualities for success in academic and professional contexts. Teachers must be reflexive practitioners who continually evaluate their methods, classroom interactions, and overall practice to improve their teaching.

Seeking professional development through discussions with colleagues, attending workshops and seminars, and working directly with students helps teachers stay informed about their students' expectations and challenges. Finally, as teaching methods evolve and the demand for ESP instruction continues to grow, more research is needed to explore adaptable approaches, particularly for science-based students in university settings. Ongoing research into these methods will help ensure that ESP teaching meets the evolving needs of students in these specialized fields.

7. Conclusion

This paper has explored different approaches to teaching English to science students, particularly on teachers' experiences and classroom activities that shape language learning in these specialized fields. It has shed light on the realities of teaching and learning in the context of English for Specific Purposes (ESP) by examining the challenges faced by Master's students in Civil Engineering and Mathematics. Although the primary focus was on these disciplines, the findings apply to other scientific study areas.

A significant challenge for French-speaking learners is mastering the language structures and cultural nuances that can hinder clear and accurate communication in English. These barriers affect academic performance and professional competence in scientific fields where English is the dominant language. Pronunciation difficulties and vocabulary and sentence structure issues highlight the need for flexible, targeted, and culturally responsive teaching strategies.

The discussion also highlights the importance of a reflective and adaptive approach to teaching ESP. Teachers must balance language teaching with their students' rigorous academic and professional demands. This requires innovative teaching methods that address learners' diverse needs while fostering the technical and linguistic precision essential for success in global scientific communication.

Finally, this paper emphasizes the need for further research into developing ESP teaching methods, particularly for Science and Engineering students. As these disciplines become increasingly interconnected globally, ensuring that learners can effectively communicate their expertise in English is vital to their personal success and the broader advancement of scientific knowledge. Future studies should focus on developing adaptable, context-specific strategies that bridge the gap between language learning and mastery of subject content.

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9. Appendix

Appendix 1. Course Outline

Source: Own elaboration

English course outline

Group	M1 Mathematics
Duration	15 weeks
Contact hours	2h/week
Level	B1-C1 (level of students in my class)

Course overview

The English programme will be action based, with the aim of developing the language skills necessary for participation in a wide range of social, academic and professional activities.

Course content

Lesson 1- pronunciation Fundamentals of phonetics Pronunciation in English Practice exercises (Listening/speaking)	**Lesson 8/9** Oral presentations of research posters (Evaluation test)
Lesson 2 Basic rules of grammar Commonly confused words Homonyms/ False cognates Practice exercises (reading/listening/writing)	**Lesson 10** Punctuation Professional writing(emails, enquiries, memos) Tone in Professional communication
Lesson 3 Numbers and figures Dates and time Telephone conversations (varieties of English accents) Practice exercises (reading/listening/writing)	**Lesson 11** Annotation in reading Summary writing Practice exercises (text annotating/summarising)
Lesson 4 The stock exchange (listening/group discussion) How to interpret a graph (reading/writing/group discussion)	**Lesson 12/13** Inter/cross cultural communication (role play/discussions) Multicultural work environment
Lessons 5/6 (Work in pairs) How to make a research poster (work in computer lab-canvas, Microsoft office or other)	**Lesson 14** Review of concepts learnt
Lesson 7 Sign posting How to make a good presentation	**Lesson 15** Final examination (written test on key concepts covered)

Appendix 1.2 Course Outline

English course outline

Group	Students in Civil Engineering
Duration	15 weeks
Contact hours	2h/week
Level	B1- C1

Course overview

The English programme will be action based, with the aim of developing the language skills necessary for participation in a wide range of social, academic and professional activities.
Emphasis will be placed on the four key skills outlined in the CECRL (reading, listening, speaking and writing).

Course content

Lesson 1- pronunciation Fundamentals of phonetics Pronunciation in English Practice exercises (Listening/speaking)	**Lesson 8/9 (Work in Pairs)** Designing a bridge (Materials: Spaghetti, cork, rubber bands, plastic tubes, toothpicks and a glue stick)
Lesson 2 The work of a civil engineer (listening comprehension) (b) Technology and its use (Describing technical functions and applications) Simplifying and illustrating technical explanations Grammar: Verbs (to allow, to enable, to permit, to ensure, to prevent)	**Lesson 10/ 11** Technical report writing Vocabulary (making reports/statements) Grammar: Technical verbs and adjectives) Oral presentation of the report (Evaluation test)
Lesson 3 Numbers and figures Dates and time Telephone conversations (varieties of English accents) Practice exercises (reading/listening/writing)	**Lesson 12** Annotation in reading (pdf tools) Summary writing (audio/written texts) Practice exercises
Lesson 4 (a) Commonly confused words (b) Homonyms (c) Practice-exercises (Reading/Listening/writing)	**Lesson 13** Inter/cross cultural communication (role plays/ discussions) Multicultural environments

Lessons 5 (a) Describing specific materials (b) Discussing quality issues (c) Grammar: consist of, comprise, made of, made from (group discussions)	**Lesson 14** A review of Key concepts learnt
Lesson 6 Working with drawings, discussing dimensions and precisions, Preposition of positions Grammar: phrases related to scales and Measurements Listening comprehension (about Building and construction/discussions)	**Lesson 15** Final evaluation test on key concepts covered in class
Lesson 7 Sign posting How to make a good presentation (Body language and voice control)	

Appendix 2. Examples of student work in class after a lesson on report writing
Source: Own from a class activity.

[redacted]

Nancy → Tomblaine bridge construction report

Realized by:

[redacted]

Real Bridge of Nancy-Tomblaine

[redacted]

[redacted] [redacted]

INTRODUCTION

For allowing to the people of Nancy to cross the river of Meurthe and Moselleand go to Tomblaine, the mayor have decided to build a bridge between this two towns. Students of Master 1 in civil engineering are loaded to make plans and calculations.

During construction, engineers have made many choices in order to be economical and ecological. In this report we will present all the procedures and difficulties that we have met during construction and the solution that wehave preconized.

I) Procedures

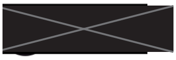
We have made a beam bridge out of the following materials:

1. Spegatti baguette:

it represents that beam taking overloads (vehicles, people, etc) and slabloads.

2. glue:

it used as a concrete to stick or join the materials and the different parts ofthe bridge



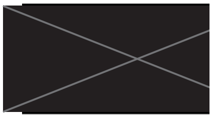
3. Papers:

These papers are used the bridge deck which are carrying the loads of thevehicles, people, etc. we used too as the bridge guardrail which protect human in case of accidents.

4. elastic rubber band

It helps to join the beams to the bridge pillars.

5. long toothpicks,



The toothpicks played the role of the pillars to transmit the loads to thefoundations and the main beam too sometimes.

6. champagne corks

These represent the bridge support device

II) Difficulties

During this project we had some difficulties, it was mainly problems of materials, time and stability.

During the first phase of the project we were confused, we had to think about the type of the bridge in order to economise time and materials, but also toassure the security of the construction, so we had to optimise each parameter to have the perfect quality price ratio.

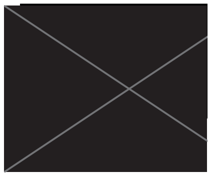
During the construction phase, we had some difficulties with the quality ofmaterials, it was complicated to assure the stability of the construction, so we had to use more materials in each part of the constructions especially in thefoundations; we also had some problems because of the time, we tried to beoptimist, to be fast and efficacy.

In the end of time we have completed our project but we had to be careful inorder to protect the construction.

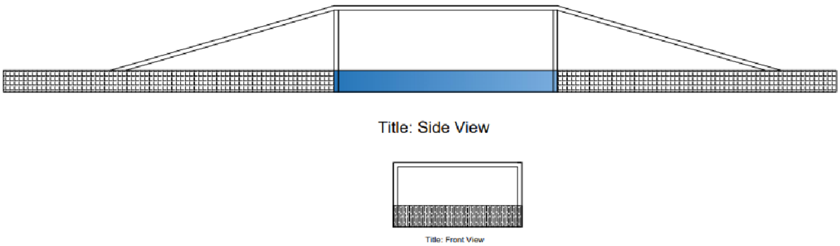
In real life, this project would be expensive, we could have problems with money, time, and weather.

To realise this project, we will have to optimise the quality price ratio by finding good materials and economising prices, we also will have to be careful because of the weather especially the rain, we may have to pump water everymorning to assure the stability of our foundations.

In the end of the construction, we will have to assure ensure continuity of maintenance of the bridge, and being able to control it every year.



View of the bridge



Conclusion

This project was an opportunity to manipulate different materials and to think about the main structures of the bridge. we encountered a lot of difficulties butwe found solutions.

Appendix 2.1 Example

[redacted]

Stanislas Bridge

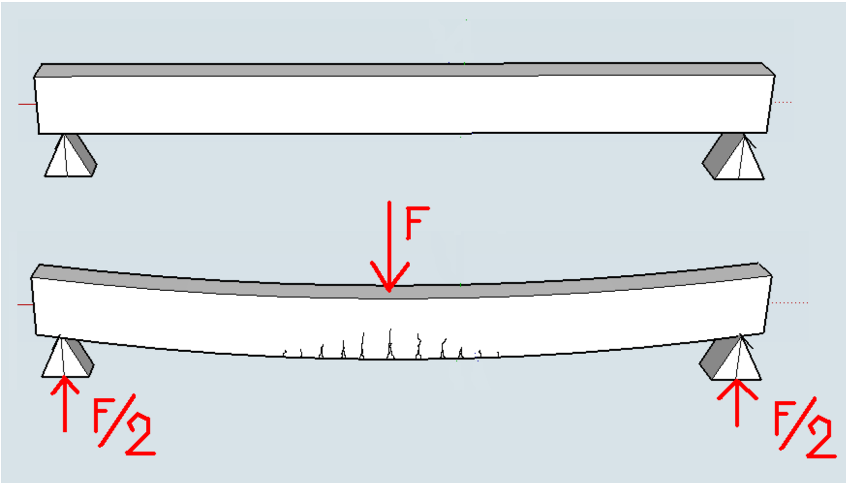
Table of content

Summary

The goal of the project was to build a bridge using daily objects like spaghetti, liege cork, rubber band, scotch, sheets of paper... We had to find the best material which will be the stronger.

Introduction

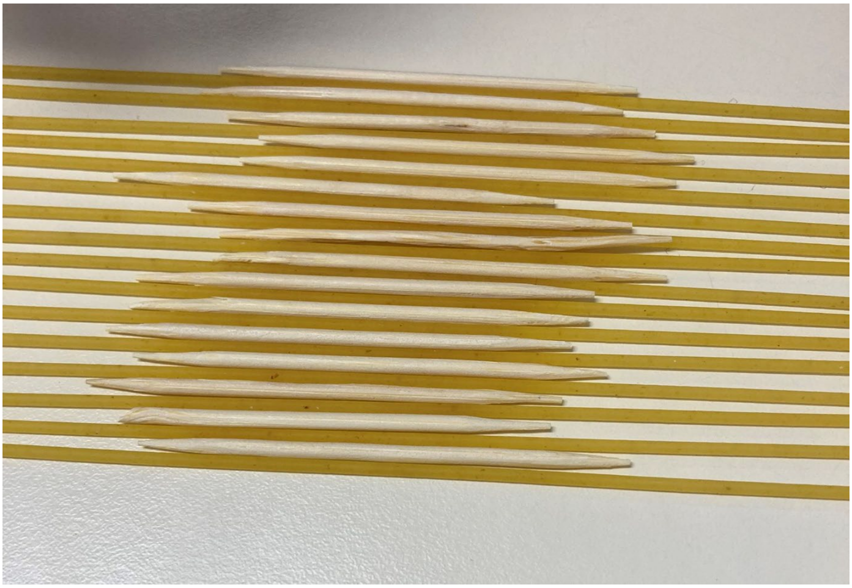
We chose to build a bride that will support as much weight as possible without bending too much or breaking, on a short distance. Indeed, the analysis of the structure reveals that the bridge's design can resist to the forces seismic up to 9 on the Richter scale.



Methods + procedure

At first, we wanted to build the bridge with spaghettis, tooth picks and patafix but we didn't know which type of bridge

We started by gluing spaghettis with tooth picks with the patafix to make the rug of the bridge. The rug would be placed on two liege corks at all the corners of the rug to lift the rug off the floor.



But we thought that it wouldn't be as strong as we wanted.

Then we tried to put tooth picks under the middle of the rug and we found another idea:

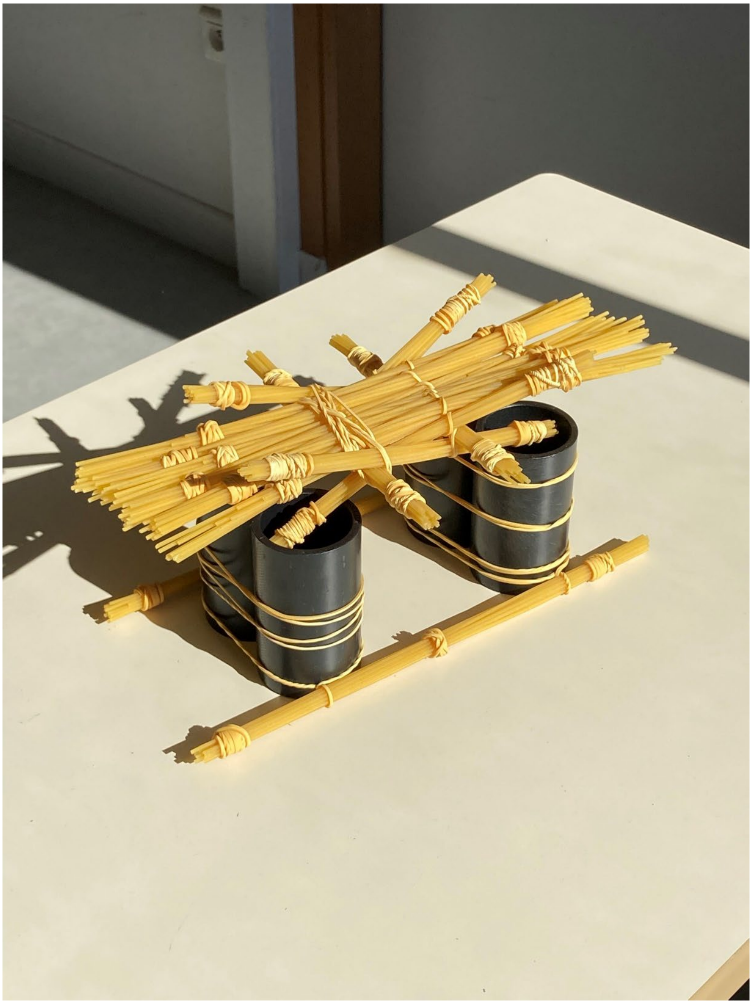
We attached spaghetti with rubber band by groups of 15 and twisted it in order to create a strong base for the rug.

After this idea came, we challenged ourselves: what if we do a bridge using only spaghetti and rubber bands?

By creating as many sticks of spaghetti a we needed we designed this structure

We used about 180 spaghetti and nearly 20 rubber band. The structure was able to hold 4 phones with ease, even though it bended a bit. That's why we put it on some cut pipes, attached also with rubber band, and that's how this work of art is born!

Results



Stanislas bridge in the sunshine

Discussion

We fixed the pillars diagonally compared to the rug on the two sides and on the both directions. It helps the bridge to support more weight. We finally put it in the pipes and we fixed them at a certain distance that allowed to be stronger.

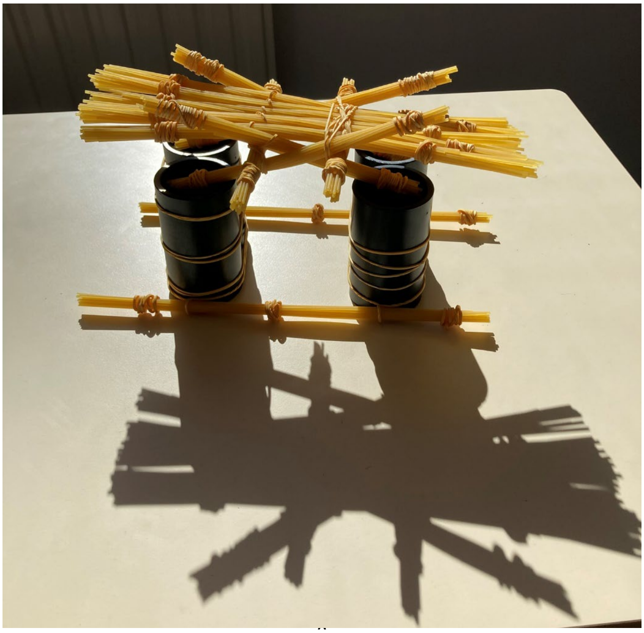
We had to take care of the spaghettis when we twisted it because it could break easily if we make too much. It is also a sensitive material.

We didn't have much challenges because we found early a great idee

Conclusion

We learned a lot about building a bridge, especially with what you have under the hand. It was challenging, but I think that at the end of the day we made a beautiful construction.

It is also a type of bridge dated from a lot a of time which were made of wood to pass over the rivers.



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The strongest bridge in the world

Table of content

Table of figures:

I. Introduction

In the last class we had to create a bridge within two hours with only spaghetti, paper, toothpick, cork and fix paste. The bridge needed to be solid, to permit the support of some weight while in a suspension state. To get in this project we will tell you about what our inspiration for the bridge was. Then we will show you the different steps of construction and creation of the bridges. Finally, we will present to you the results and the efficacity of our bridge.

II. Bridge inspiration

We decided to take inspiration on a truss bridge, more precisely a warren type truss bridge because a truss bridge is made of triangles who is a in deformable form so it & apos;s very solid.

Initially, the truss beams were invented by the American, but the first truss bridge was built by George Stephenson in 1823. After, they began to be really used in the beginning of the 20th century because they were cheap and fast to build with metal beams which are stronger than wood.

We wanted a strong bridge, and it seemed to be the best option for the materials we had. The truss bridge is a strong bridge because it’s made of triangle so due to its geometric design, I help spreading the compression and the forces. A truss bridge is made up of a top chord and a bottom chord that are connected by diagonals forming triangles. The bottom chords are connected to floor beams and the top chords are connected to struts. And to reinforce the floor beams, each of them is crossed by a Stringers as we can see on Figure 1.

There are still famous truss bridges all over the world, such as the 987 m long Quebec Bridge built in 1917 in Canada, or the 792 m long Tokyo Gate Bridge built in 2012 in Japan.

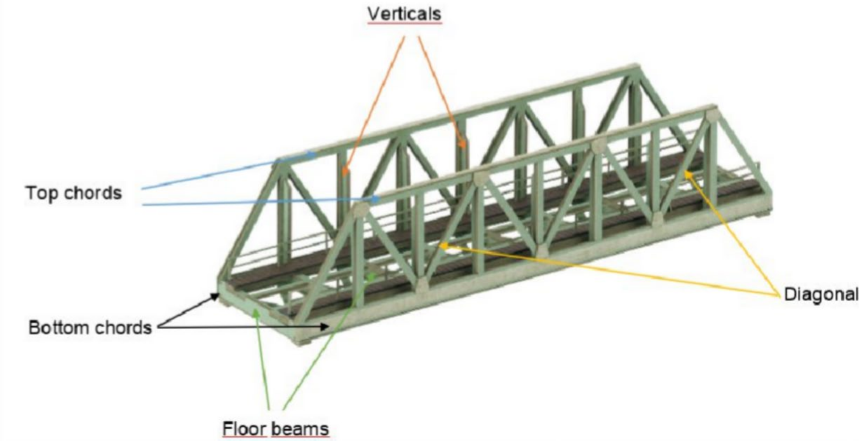

Figure T l Schematic bridge

Figure o l Quebec bridge

Figure k l Tokyo Aate wridge

III. Steps of construction

At the beginning, our first goal was to build the strongest bridge of all. We thought that was a cool challenge to create a super strong bridge with the weakest material ever: spaghetti.

A. Assembly of the triangular framework

First, we created the triangular framework. Like we previously explain, this pattern is interesting because the triangle is a rigid shape.

Initially, we wanted to stick the spaghetti in the cork but there were too breakable, and we could not stick them inside without break them. So, we decided to use toothpick instead of spaghetti. There are stronger and easier to pick inside cork because of their sharp tip. But we had not enough cork to use one of them for each connection. We chose to put the three corks that we had for the upper connection, to connect each triangle and maintain both sides of the triangular framework. This step wasn't easy, but we finally succeed, and we can see the result in the Figure 4.

Figure y l 7hords assembly

After that we had to assembly the bottom chords. To do that, we used some Blu-tack and made some bubbles around each down connection. It was not very resistant, but it was enough to hold it in place. And the pillar made this weak part stronger. We also added some glue around the Blu-tack connection to help Blu-tack to not deform too much. Finally, the triangular framework looks good like we can see in Figure 5.

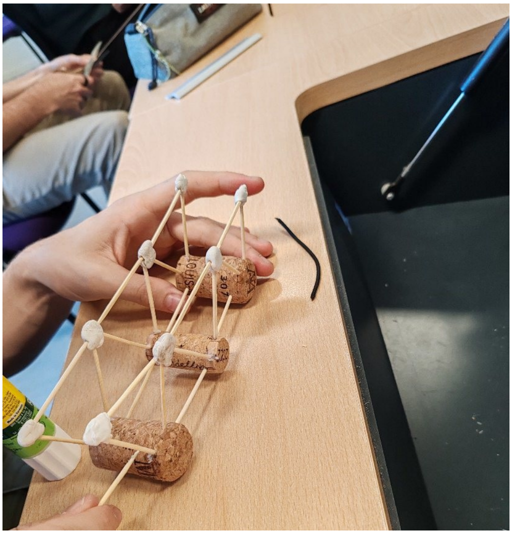

Figure G l Rnd of the upper part assembly

B. Building of the pillar

The second step was to build the 2 pillars uses as stringers to hold the bridge. To make them, we used again the triangular geometry to build them as strong as possible.

First, we drew lines on the 2 sheets at regular intervals, parallel to the top edge of the sheet. Then we folded the paper following the lines that we've just drew, as be seen on the Figure 6.

Figure B l 8rawing lines

Then, we unfolded the sheets, and we refolded them following a triangular pattern, like we can see in the Figure 7. We also added some glue on the paper before refolding.

Figure 7 : Folding paper

We waited some few minutes to make sur the glue has dried. At this moment, we had 2 strong pillars, but we noticed that the pillars could bend a little and crash into itself. To avoid the case where the pillar implodes into itself, we decided to reinforce the pillar with spaghetti. So, we added some spaghetti inside the stringer, and we added enough spaghetti to create a pressure force inside the pillar and prevent it from imploding. We illustrate this step with Figure 8.

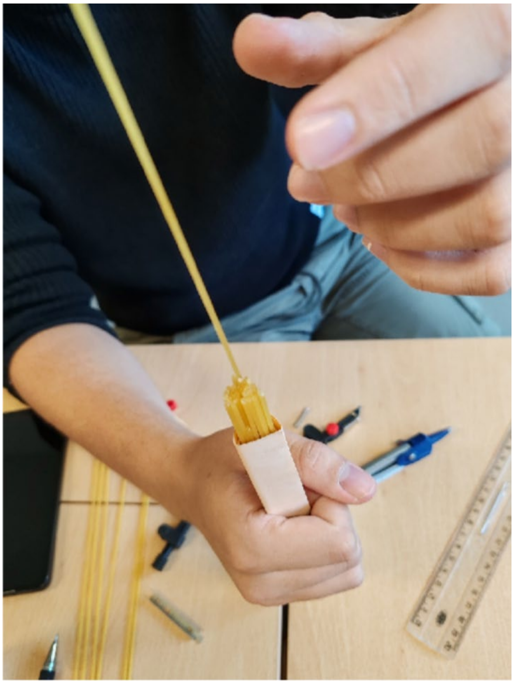

Figure C : Reinforcing stringers

C. Assembly of the stringers

During this third step, we assembled the stingers together. To do that, we used toothpick again because they measured the correct size. We pierced the stringers at regular intervals, and we put the toothpick inside of the pillars. We placed one for each 2 cm of each pillar. We finally obtained a super strong base for our bridge as show in Figure 9.

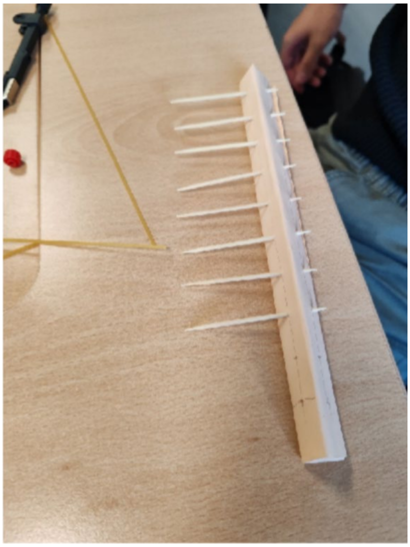

Figure s : Assembly of the stringers

D. Addition of the floor

Finally, we assembled all bridge together. We used some rubber bands to fix the upper and the lower part, like we can see in Figure 10.

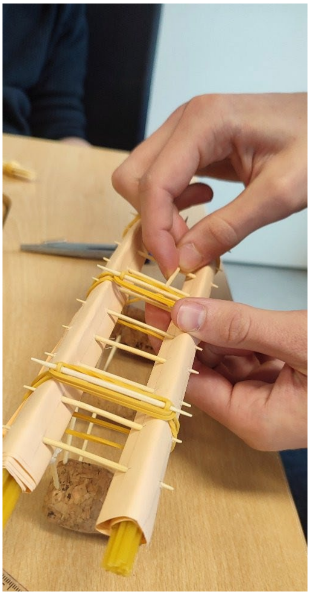

Figure 10 : Final assembly of the bridge

And we finally added the deck. To make the deck, we used some spaghetti that we put on the toothpick framework. We didn't fixe the deck because we had to make sur our bridge will not break with the thermic expanding. If the deck was fixed to the bridge, the sun and the heat, the different material of the bridge will not expand in the same way, and it could break. Moreover, the deck will be maintained between the two abutments, and it will not move too much. Finally, we obtained this result:

Figure 11 : Final result

IV. Results

To measure the strength of our bridge, we decided to put pencil cases on top of the bridge. The bridge didn't seem to bend even if the mass was equal to 1.2kg or a weight of 12N. To get the best precision we thought to weigh with a scale one of the ends of the bridge and put pressure with a finger on the middle of the bridge to find the strength of the bridge. With the resistance of the materials available it seems to be a pretty good result. It was still hard to bend it even with just a finger so we can certify that the bridge is solid.

V. Summary

To resume we build a bridge like a warren type truss bridge. It's a bridge created in 1823 by Georges Stephenson who use the specificity of the triangular shape which can't be deformed with gravity force which allow to build a bridge which is solid with materials that aren't solid as metal. To do so we build two reinforced pillars with paper and pasta and a triangular framework. Then we assembled those with rubber bands and toothpicks and create a floor with pasta. What we get with this process is a bridge capable of supporting 1.2kg without deforming which is pretty

VI. Conclusion

To conclude we were challenged to a group work which forced us to work in a team, divide the different tasks. The choice of the materials was here to challenge us even more. We needed to solidify the structure to get a bridge which can handle weight without deforming or breaking while keeping a great aesthetic aspect. We succeed to create a bridge with constraint like an everyday civil engineer.

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