



A Level Product Design Coursework

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Part 1 – Initial Investigations, First iterations, Brief and Specification



Situation and Context

Situation:

The UK's population is made up of many different backgrounds, with English as our main language. For those people who come from abroad, it can be a struggle to adjust well towards the language, especially when it comes to reading, writing, listening and speaking in English. In order to do so, they learn, obtain and retain it for their benefit for their lives. I know from my personal side, where I live with a lot of foreign people, that they become frustrated not understanding what is going on in their respective situations.

I want to produce a product that allows them to gain motivation and confidence, while being taught the English language effectively so that they can break down language barriers and be able to communicate to others in a healthy way.

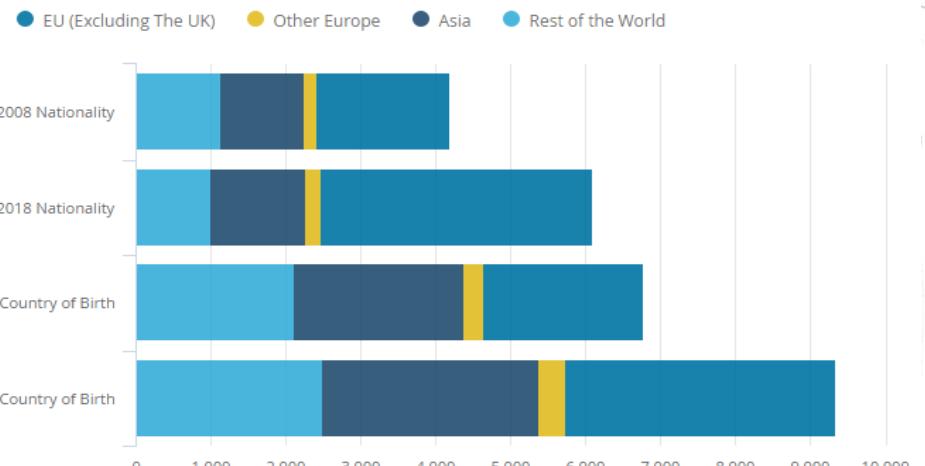
Where this problem applies to:

Learning English for foreign people tends to lean towards people of working age, so that they can speak well to their colleagues and friends around them. Not being able to understand a crucial situation, for example, a nurse taking care of a patient in critical care, makes them hesitant and dumbfounded.

However, for a family with children, the most common problem is at school. While there are English lessons taking place, a foreign student would find it much harder to understand and grasp the language, contrasting to born-and-bred English speaking people. To include, at home, they won't have as much access to learn, as the family will be speaking at their natural tongue.

Figure 6: The population of non-British nationals and those born outside the UK have both increased

Non-British and non-UK-born populations of the UK by country of birth and nationality, 2008 and 2018



Existing solutions and suitability:

For those children coming from abroad recently, a special education needs programme takes place in most schools, allowing them to settle comfortably, learning English with more guidance by professional guidance teachers. However, the process of being in the programme is very time consuming, and can get boring (and annoying) at times.

For the older generations, there are mobile apps, such as Duolingo and Rosetta Stone that provide language programmes in an interactive and entertaining way for the person to learn a new language, like English. The problem using this method is that its virtual, as in speaking to a bot that has been programmed especially for them, and it would be more useful if they instead spoke to a real person, native to English to help them understand, similar to the 'SEN' programmes. Furthermore, some of those apps would require a subscription, which may lead to dissatisfaction from the repeatability – which is not helpful.

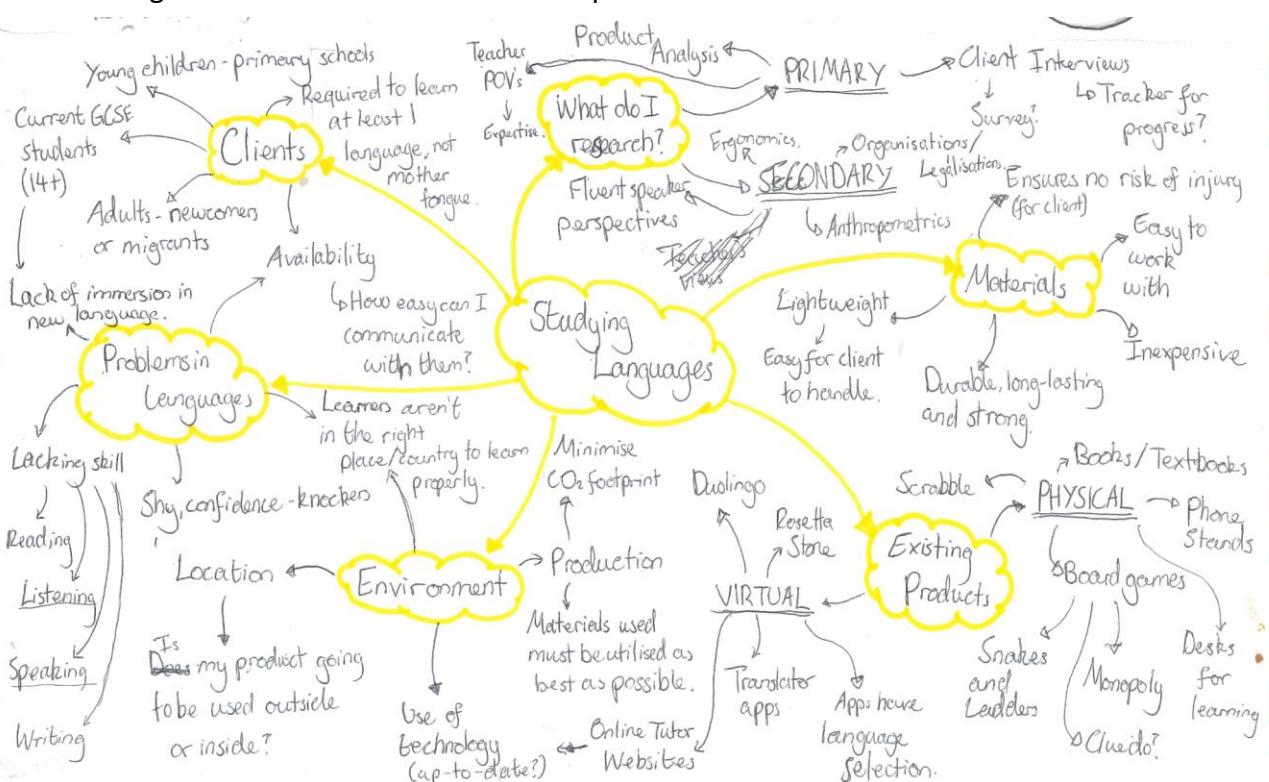
My clients:

For a successful outcome of a product, my clients need to be foreign, and from as many nationalities and languages as possible. This then can be cut down to a few, which will range from a few children and a few adults that associate best for my final product. I will have requirements in order to carry out my research, in which one of them is that they have arrived in the UK recently in the past few years – this ensures that their English isn't up to standards.

Constraints:

For my product to be deemed good for my client, I must implement their suggestions and requirements to be able to speak English well into the final design as much as possible – this includes the whole purpose and function of the product to benefit them in the long period.

Also, it is necessary that I use my clients when it comes to testing and feedback, as this will guide me on what is needed to improve.



Research Plan

To carry out a successful design, I need to be thorough in the research process to discover and understand the problems that surround the difficulties of learning English. This is carried out by researching into different parts, from my clients to individual and extensive research around the English language.



Research Type	Why do I need this?	What I need to find out	How it will be done
English Language Research and Statistics	Doing general research around my problem is essential to find key areas of improvement, so that I can go more in depth when it comes to my client – by means use this information to help perform specific and effective interviews and analysis of those people. This will set the foundation for my investigations, as I can always relate each other part to this research. Statistics will be used as a visualizer to what needs to be surpassed and improved by the end of this project.	There are a range of factors to look over but it should be related to these: <ul style="list-style-type: none">• Countries that foreigners come from (to UK)• The occupations these people are in• Opinions of the English language• How the English language is taught For students, it may be useful looking at results from exam boards, or styles of learning.	Most of the research in this branch will be off the internet, which might be concerning as some sources are unreliable or incorrect to date. I will have to use popular trusted websites like gov.uk for accurate analytics. These websites must be updated very recently, because some aspects may have changed from the previous time.
Client interview and survey	Because these are my target and test group, I need the research to give me an in depth investigation of what they would want and need in order to produce a product that effectively helps learn the English language. Because of how broad my age range is, there is a variety of opinions and in some cases they share the same problems in which I can counteract when designing my product. These opinions must somehow link up to the purpose and targets of my product.	To carry out a successful research in this branch I must: <ul style="list-style-type: none">• Discover that types of learning techniques they do• How long they spend learning the language per day• If they have any learning problems/disabilities, i.e. autism (may require parents for help)• How satisfied they are with their learning• What problems/concerns surround these fields	I will hold interviews personally with the clients, with relating questions – I can use this to survey out each individuals progress, even by their tone and pace of the language. I will conduct a survey for the greater clients to include as much of the target group as much as possible.
Teachers/Tutors perspectives	This can be used as a guide to which aspects of learning will be most effective when making the product, in which it will teach and interact with the client well. They have experience teaching students English, and most often help them be successful speakers in their future lives. A research like this gives me depth to where, direction-wise can be most promising at the production.	<ul style="list-style-type: none">• What teaching styles they do to engage their students• How they track their students progress• Their personal opinions on how hard English is to learn It may be a good stretch to them to question an experience with a particular foreign student.	I will hold a questionnaire relating to the questions. Most of these will be open, so their opinions are more expressed. I have a few tutors that I can get in touch with, who have taught me. I could do some internet research if necessary.
Fluent (English) speaking people	Foreign people who speaks English fluently helps towards the product because they are at the opposing end to my clients. These people can secure and set the ground if they correlate to my clients, in terms of the way they learned the English language. In general, these people provide extra information that can benefit me to make the ideal product for the client to serve its purpose.	<ul style="list-style-type: none">• How well the know the (English) language• How long it took to master it• The effects in the environment caused by learning the language• Techniques they used to learn• General well being and satisfaction overall	It will be conducted similarly to the tutors perspectives, using real-life people I know as well as internet research to back up the investigation if the questions aren't satisfactory to me.
Existing product research and analysis	I can identify the faults and problems that I can improvise from to make a better product for the market. That means my standards should not be equal to these existing ones, but to develop them in my way to make a product that stand out against them. It is important that the purpose and functionality stands out for my design product and these existing product are my inspirations to do so, including aesthetics, suitability, etc.	In each product I evaluate, I need to ask myself: <ul style="list-style-type: none">• Would this product be helpful in the overtime?• Does it satisfy the needs and wants of users well?• What improvements can I make to them?• Is the cost worth it? It is essential to compare products to each other, to see what's good and bad about each one.	An evaluation slide will consist of the product I have seen online and give my opinions on them. For product analysis I could possibly ask my clients for their own experiences with them as well. For the online products, I will read reviews and judge based off from them, as well as the components and aspects of the product itself.
Product standards/ legalisations	There are limitations in designing my product in which I need to consider beforehand. It could help me reduce the effect of certain factors, such as carbon footprint or work environment. I will follow these legalisation as well as I can to benefit myself and for the clients I am making the product for, while maintain its function and purpose.	I will need to: <ul style="list-style-type: none">• Explore different national and international standards in design• What each standard does and where its commonly used• Explain how important these standards could be part of my design process	I will initially use textbooks (will be referenced and mentioned) to find the main legislations and discover the broad view of their purpose. To go in depth, more research will be done online to specify which legislations are targeted to my target product.
Anthropometrics	I need this research for the ideal size and dimension of my product to match my client. Because my clients have a range of ages, I need to find the correct dimension in order to minimise any problem or risks the client may have – examples may be that it causes an injury or it could be too big to handle. An ergonomic product is a must in designing, to optimise the comfort when used in the environment, which is anywhere.	<ul style="list-style-type: none">• What do the clients want in a product that can access well with?• How will I include this in my design?• What are the most necessary parts that will be needed in the design process?• Am I meeting towards the information I being given?	Alongside the client interview and tracker, I can also inform them to ask their sizes, most likely their height and hand size, as I intend my product to be compact and easy to hold onto. I could back this up with the anthropometric books, which show average sizes of human bodies.

English Language Research

The English language is the 3rd most primary language in the world, behind mandarin (Chinese) and Spanish, but it is the most flexible and easy to learn of all languages known. It originated in England, UK and is now the official and primary language of more than 50 countries, from USA and Australia, to Philippines and India. The language is spoken by nearly a third of the whole world population – around 2 billion.

In the UK: (Source: gov.uk)

- Of all ethnic groups, most Asian groups, including Chinese and Bangladeshi, have the highest percentage of not speaking English very well – each group having more than 10%.
- People of other white backgrounds are the least likely to speak English at only 35.9%, and 1 in 8 of those people could speak English very well or at all.
- 1.6% of the UK's population (863,000) cannot speak English.
- Age groups between 3-9 and 45-64 were the highest percentages that cannot speak English. Of these, 17.4% of Bangladeshi females at 49-64 years of age couldn't speak it.
- Polish was the most common language other than English in the UK, with 546,000 people. Most languages from the Middle east follows from them.

This source clearly tells me that people from mainland Asia, middle east and EU countries (assuming its other white) are the biggest sufferers towards English, with a majority of their people not able to speak it fluently. Furthermore, young children and adults over 24 years old are the main age groups that English tends to be weakest. This may be due to the increasing levels of migration and immigration occurring in the UK – families of generations coming over with limited ability to communicate.



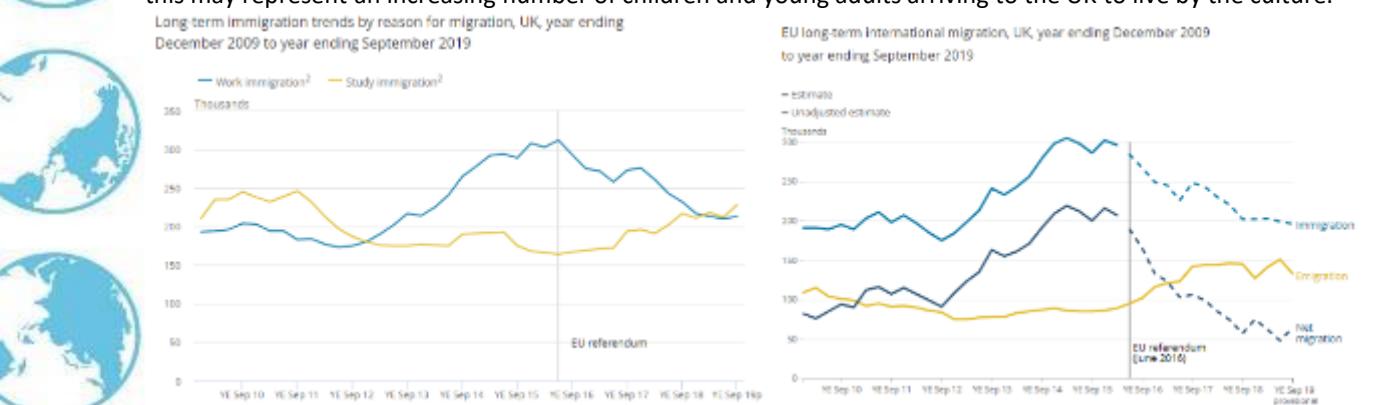
UK migration: (Source: Office for national statistics)

- There has been a decrease of EU migrations but an increase of Non-EU migrations since 2016.
- As of March 2019, study has been the main dominant reason to move to the UK.

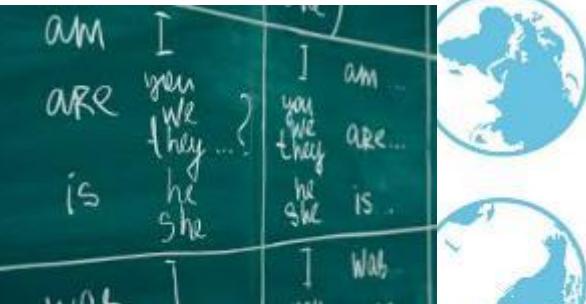
This is mainly due to fewer EU migrants staying in the country for work related reasons.

- The number of non-EU migrants for study reasons is 228,000, the highest since 2011, as of September 2019. 139,000 of these people are Asian.

In this part of the research, the facts are evident that work has become a less prioritised reason to come to the UK, as studying is growing gradually due to number of people staying in the country for an extended period of time than just 12 months, as work has done. If the main reason of coming to the UK is for study based reasons, this may represent an increasing number of children and young adults arriving to the UK to live by the culture.



Despite the number of countries listed, they all can have different alterations to the language, but the basis and foundations are similar or else the same.



English in the learning environment:

English language GCSE is a mandatory subject students must take as part of their qualification when they are 15 or 16 years old. The main part of the qualification helps them read and listen to a wide range of texts and write confidently with satisfactory understanding. Over time, they would develop their skill to use grammar, punctuation and spelling accurately and always seek to improve. Simultaneously, students are required to speak good English, as there is a spoken assessment that isn't counted toward the final grade, but will be accounted for as a pass, merit or distinction.

However, of 707,059 entries in 2019, just over 200,000 people have failed to meet a grade 4 (equivalent to an old low C), which accounts 28.5% of teenagers. While the majority of those who failed may be of a English speaking background, there may be a small number, approximately 30% of those teens who failed are foreign.

In lower schools, children are taught, according to an English blogger: (Source: TheSchoolRun)

- Learning letters and sounds – starting with phonics, how sounds are made with letters. This is then combined with other phonics, to produce a new sound.
- How to read – often, children are told to read aloud as a way to help speak confidently, in which teachers can help them improve every way possible.
- Comprehension – at times, teachers will stop to question individuals to see if they are understanding what they're reading. This includes what the text infers, and sometimes why its important.
- Spelling – most school do spelling tests every week or frequently to challenge children. Often, these complex words come with definitions which they will be required to also know.
- Grammar – this aspect helps join parts together for sentences, in which children will apply and attempt. There are many different techniques: past/present/future, imperatives and superlatives, apostrophes, and many more that children learn and master over their young time.

Except the phonetics, secondary schools teach a similar curriculum to their students, and are the main motivators towards young people to develop their English skills. Each teacher keeps a progress tracker for every student accountable, from tests to ability to learn, in which its presented to them and their parents.

Main problems of learning the English language

For children and students: (Source: TheClassroom)

- The tendency to speak a native language – its easier for foreign students to fall back to their roots, as it can be frustrating to think and change thoughts in a more English manner.
- Real life application – for students learning it as a second language, they assume in-class speech is applied as well the outside environment, but is clearly different and confusing to adjust. Also, some part of learning (like texts and resources) can be out of date and never used nowadays.
- Written and spoken language conflict – English and other languages have alterations on how grammar is written and spoken. For example, in Spanish, an adjective is put AFTER a noun, whereas in English, it is before the noun.
- Learning vocabulary – English has over 1 million words in total, and some are more sophisticated than others which foreigners would have to take in for longer times.
- Confidence – non English speakers can be afraid or oblivious to what something means or how its said. It can knock down their ability to speak out.

POTENTIAL ISSUE:

Due to the trends mentioned (on the left), it may be an issue that finding suitable clients for my English research will be challenging to come by, and it may require me to look towards another similar alternative, such as people attempting to speak Spanish instead.



This slide should aim to:

- Show the general (broad) problems of the English Language
- Show how diverse the UK is, how English is evolving with them.
- Present statistics to help visualise for reference.
- Present the general features of learning English as a whole.

Client interview

UPDATE:

My potential issue in the previous slide has been true, as over time, I cannot find any clients at all that have recently moved to the UK, as the trend in migration graphs are decreasing which has effected my research – the ‘potential’ clients I’ve asked have all come into the country at 2016, when Brexit was first announced. By now, they’ve all become fluent. Instead, my clients will be people currently learning a foreign language.

It is important for me to get in touch with my clients, to understand their issues from their own perspectives. As mentioned in previous slides, I will interview a wide range of students learning a new language in school to maximise my research and give critical analysis on each aspect. This way, I can look back into this to help me find potential solutions to suit their needs and wants when developing the product – they will also help be my test group later on.



Key:

Black – Simeon King, 17

Red – Christopher Carvajal, 9

Green – Juleanne Cinco, 14

Blue – Nowi Padilla, 12

Question	Justification (why am I doing this?)	Client's Answer	Analysis of Answer
How long have been learning your language for? How did you start?	By finding out how old they first acclimatized to it, I can find the optimal age group that my product can focus on. Most languages have a different approach to learning, just as will as foreigners bearing in the English language – which includes they way they start. In English, we are fond to the letters and phonics before advancing to words and to sentences. While this may be the same for most other languages across the world, I need to ensure the best approach to help my clients as best as possible.	<ul style="list-style-type: none"> Started 4 years in actual lessons, but 5 years since mother spoke it fluently (French) Family helps him with accent/ pronunciation first. For 2 years, started with greetings (Spanish) 3yrs French, 2rs Spanish, introductions (greeting) French 6 years/1 year in Spanish, both began with greetings, vocabulary and conversation talk. 	The ideal age where students learn a foreign language is 11 years old, but some schools provide language programmes at KS2 (7-11). The most common languages here are Spanish and French, in which most began with basic greetings and introductions, such as Hello, Goodbye, See you later, etc. Spanish and French may be languages I may specially have to design for.
(In schools) What activities do they perform to boost your ability? How do you find it? Is it easy, hard? Why is it?	Most learners in school will do various and unique activities that teachers give out to help them in their language ability. Some can be complex, entertaining and engaging, but at times, it can be copy-and-paste off the whiteboard situations – which are boring and lazy. I need to understand their satisfaction for the activities that they do because the ones that work the best will be used as inspirations, that I could implement or improvise in my design. Any criticising feedback will help me find an appropriate solution in the design process.	<ul style="list-style-type: none"> Games – guessing word and quiz (hangman, charades) It was alright, but lack of confidence knocks him. Written work, Songs, memorising games - likes it a lot, fun Language clubs (voluntary), group work – find it good, but intimidating, and can forget things. PowerPoint with words/translation put into games, quite easy because it keeps track how well you can bear in. 	In classrooms, most teachers provide interactive games like Kahoot and hangman as they are being fun and entertaining, though depending on the personality of my client, they can be shy to participate. Primary schools seem to take a relaxed route, using memorisation and songs, but for secondary schools, they use PowerPoints and clubs outside of school for extra help, which would make sense that qualifications have to be taken seriously.
Do you feel like its helpful for your future? Why?	Some career paths demand or intrigue people to work abroad, in which having a good sense of knowledge of the countries’ language beforehand can give them a boost when it comes to that moment. This is what I want to achieve by the end of my project, to support them in their understanding, and not to be frustrated or uncomfortable with the language barrier that may come.	<ul style="list-style-type: none"> Yes, helpful for volunteering with foreigners Yes, in ending up in Spanish countries. Not sure jobwise, but good to know and helps learn more about other cultures. Yes – having a job abroad will help communication will others around the world. 	All answer relates to the work environment outside the UK, which I wasn’t surprised because of how dominated most countries have with one language. My design has to be optimistic for them if this is the case.
In what ways do you try to tackle the language? What current products or apps do you use? Are they useful?	I want to know what learning techniques or strategies that exist, either to maintain or improve on when considering it to the product. I will explore this further in the market research and product analysis, where my client actually tries to use an existing product. I will take account for their experiences with each of these, to judge and evaluate between other techniques to see what works best for their learning. This will be in depth in psychologist research.	<ul style="list-style-type: none"> Talks to people who speak French well, textbooks & French books. Uses educational language websites – doesn’t find it too helpful. Doesn’t like using apps, doesn’t seem its helpful. Language angels, YouTube videos, is given books to write on – it is helpful, helps him be more adventurous in language Quizlet (most) and very useful, got a load of activities to do, kerboodle (not useful) Kahoot and Duolingo – yes, helps add vocabulary to talking and entertaining to play with friends. 	One person prefers to not use any technology to help him learn, which is interesting, because in my opinion, textbooks can eventually be outdated over time. The rest of the clients spend the majority to improve their ability using technology, which I could understand as it ‘always has the answers’. It was common between all of them that these ways to improve are fun and explores deeply into vocabulary.
In what areas of language do you find hardest to improve on? How do you improve on it?	I need to know what their main struggles are so far in their learning career in foreign language, as it may be the big obstacle of progression to master it. I want to make life easier and more stress-free for their learning. Some resources or skills aren’t as available than others, for example, listening is much harder to access than reading. Using their suggestions on improving their ability can be set as target to achieve when considering the design process for the client.	<ul style="list-style-type: none"> Improve fluency, takes a while to learn structure, gender words Pronunciation is hard, go on videos to help him speak wrong words right. Listening and speaking because of accents .Improve by movies, videos in other languages to understand accents/ pronunciations more. Grammar (writing), improves by re-reading what she has written. 	Pronunciation of words in another language is the main answer given from younger people, and will usually try to look up videos to hear how to say it right. Structure and grammar is also mentioned to be difficult due to word gender (masculine and feminine) and positioning of words, as not all language have the same pattern. Its clear that speaking and writing are the hardest to face.
Would you prefer something to help you on the go or in a fixed place? What situations would you feel like its most essential?	Accessibility is key for my clients, as communication between them and the potential product is important to improve their learning. There are both positives and negatives for each side, so I must come a conclusion using my clients to justify what direction of learning environment they want to be in.	<ul style="list-style-type: none"> Likes portability, wants to do a little practise. In a fixed place -classrooms for learning environment Wherever you are – never going to know when you need it most. On the go – when bored, you can practise learning 	My clients prefer a language aid to be portable, so that they can learn Spanish or French wherever and when necessary. This means my product should be lightweight and easy to carry.
Outside the learning environment, how frequently do you use the language? Is there anyone else that helps you often?	Since English is the most common language around the UK, and due to the statistic mentioned in the English research, there aren’t as many foreign people to help them learn, making them inexperienced. To see how often they use it outside the classroom, it will give an insight how confident they	<ul style="list-style-type: none"> Almost never except with interactions with French people due to family so has good frequency of using it. Not too frequently, uses his brother to help him as he also learns it for GCSE. Not frequently, but when she does, only for fun. Older sister 	Most of my clients say they don’t use it frequently outside their classrooms or other learning environments, which I expected due to the lack of accessibility to people, especially in this COVID-19

Client Survey

Before advancing any deeper into design, I must see as many of my clients views on their perspective of foreign languages – they are the pinpoint and target group of my project. This survey will be the introductory stone of many different stages, including the initial ideas, development and feedback of each stage.

I have sent this survey (document) to as many people I know who are currently learning a language:

Foreign Language Survey

What foreign language(s) are you currently learning?

Are you studying the language from school? Yes No

What do you use to help with your learning? List all of them.

Do you think you have enough support in your learning? If not, explain why:

How much time do you spend studying a language per week on average?

Under 1 hour 1 - 3 hours 3-6 hours Over 6 hours

Overall, do you enjoy learning this subject?

Not at all A little bit It is alright I like it I love it

Fill the bar on your ability of each aspect in foreign languages below (more = better):

Speaking Listening

Reading Writing

How would you want to improve your ability on this subject?

Please mention any other issues you have regarding foreign languages:

Thank you for filling out this survey.

I have included the age to ensure I am meeting my target group, children. The ethnicity has been put there because some foreign languages have a synoptic link to other backgrounds, for example, Filipinos has some Spanish as part of its language.

They are many existing apps and resources learners use. I will look into them further into my investigation.

Time and satisfaction have been included to see how devoted or interested they are with the language.

From personal view, listening, reading, writing and speaking are the main aspects encountering a language. Using an open bar shows a range in which I can come back to when focusing on specific element of my product.

I left an open answer to receive any suggestions and solutions that could help within the design process.

These are some of the responses:

Foreign Language Survey Name: **Muse** Age: 10 Ethnicity: **Philippines**

What foreign language(s) are you currently learning? **Spanish**

Are you studying the language from school? Yes No

What do you use to help with your learning? List all of them. **Music**

Do you think you have enough support in your learning? If not, explain why? **Yes**

How much time do you spend studying a language per week on average?

Under 1 hour 1 - 3 hours 3-6 hours Over 6 hours

Overall, do you enjoy learning this subject?

Not at all A little bit It is alright I like it I love it

Fill the bar on your ability of each aspect in foreign languages below (more = better):

Speaking Listening

How would you want to improve your ability on this subject? **I would like to speak Spanish more fluently**

Please mention any other issues you have regarding foreign languages: **No Issues**

Thank you for filling out this survey.

Foreign Language Survey Name: **Christopher** Age: 9 Ethnicity: **Filipino**

What foreign language(s) are you currently learning? **Spanish**

Are you studying the language from school? Yes No

What do you use to help with your learning? List all of them. **Videos Games Written work Songs**

Do you think you have enough support in your learning? If not, explain why? **Yes**

How much time do you spend studying a language per week on average?

Under 1 hour 1 - 3 hours 3-6 hours Over 6 hours

Overall, do you enjoy learning this subject?

Not at all A little bit It is alright I like it I love it

Fill the bar on your ability of each aspect in foreign languages below (more = better):

Speaking Listening

How would you want to improve your ability on this subject? **More learning time**

Please mention any other issues you have regarding foreign languages: **No Issues**

Thank you for filling out this survey.

Foreign Language Survey Name: **Patrice Padilla** Age: 12 Ethnicity: **Filipino**

What foreign language(s) are you currently learning? **French and Spanish**

Are you studying the language from school? Yes No

What do you use to help with your learning? List all of them. **Powerpoints, test results, Quizlet, Kahoot, Duolingo**

Do you think you have enough support in your learning? If not, explain why? **Yes**

How much time do you spend studying a language per week on average?

Under 1 hour 1 - 3 hours 3-6 hours Over 6 hours

Overall, do you enjoy learning this subject?

Not at all A little bit It is alright I like it I love it

Fill the bar on your ability of each aspect in foreign languages below (more = better):

Speaking Listening

How would you want to improve your ability on this subject? **I would like to learn myself frequently on new vocabularies**

Please mention any other issues you have regarding foreign languages: **Maybe if the variety of languages changes - maybe learning some Asian languages (or any besides Spanish, French and German) at school?**

Thank you for filling out this survey.

Overall Analysis from the client interview and survey:

- All but one are learning from school
- The most popular languages mentioned were Spanish and French
- Everyone feels they have enough support at their learning
- In abilities, speaking and listening were the worst on average
- Most of the clients spend 3 hours or less but the overall enjoyment is positive (alright to love it)

The most common responses of resources are textbooks and interactive apps, such as Duolingo and Quizlet. I would of expected this, as they are the most accessible to reach than all other resources. To investigate further, I will evaluate each of these in my product analysis (with the clients using it) to help me understand the benefits and negatives of using each, and compare.

Speaking and listening was also expected by me to have the lowest rating than the rest, because there are limited accessible teachers or fluent speakers to interact with. Through psychologist research, I could deepen this to understand why it tends to be weak.

Teacher's Perspectives

To successfully carry out the perspectives of teachers, I should:

- What teaching styles they do to engage their students
- How they track their students progress
- Their personal opinions on difficulties learning a language
- Why learning a language is important for their students.

Due to unavailability of foreign language teachers, I will ask teachers doing English as I believe they have similarities between each other to approach a language. This means my questions have to answerable for both sides.

RH = Ross Hammond, English teacher at Finley Community School, Gloucester

SR = Sarah Roche, English teacher at Sir Thomas Rich's School, Gloucester

Q1. Why do you think learning English or another foreign language is important for students?

RH: Yes because it allows to communicate to other people.

SR: It broadens their vocabulary and therefore helps them to better understand their own language. It helps them to understand other cultures and appreciate their differences. It teaches self discipline and resilience as well as helping learners become more confident.

Q2. What do you think are the hardest things to learn in a language?

RH: Spelling, Punctuation and Grammar (English) because of complex names that are harder than the term itself – e.g. fronted adverbial – 'After a while,'

SR: Subject verb agreement. Tenses. Colloquialisms. Idioms and metaphors. Generally the subtle nuances of language.

Q3. How do you teach your students? What activities engages your students and do you think they help?

RH: After break, students are taught literacy/ SPAG activities, covered before the main lesson, splitting them into groups while the main objective relates to SPAG. I give them a good example of good writing for them to find key details which can be put into their writing. I start writing the opening of their writing and they continue, so they don't copy fully.

SR: I teach my students by showing them what they are aiming for and helping them to then produce the end product independently. Students are engaged when they are challenged but they also need support and structure.

Q4. How do you monitor your students progress in learning?

RH: Children's progress is monitored on their ability to meet all SPAG objectives for their year group. Work is marked every lesson and a judgement is passed on each work.

SR: By listening to their verbal contributions and helping them to develop or refine them. By reading their written work and comparing it to their last piece of work to see if progress has been made. By introducing concepts and content and then assessing their knowledge and understanding of what has been learnt.

Q5. Do you have any experiences teaching anyone foreign (recently coming to UK) or anyone with learning disabilities? What significant differences in teaching are there between them and other people?

RH: Yes, most are Polish, their English skills are generally better than the rest. SEN children all the time, yes, but varies depending on their needs – dyslexia, etc.

SR: Yes - both. It's hard to introduce abstract concepts and learning tends to be more concrete and repetitive. Students in these circumstances would need greater support and scaffolding. Someone with a learning disability may not be able to retain information from one day/week to the next, whereas someone who has recently come to the UK is more likely to retain information and make links and connections. Having English as an additional Language does not mean you don't have the capacity to learn but it can be a barrier to learning.

It was necessary for me to question teachers from a primary and a secondary school respectively, as they provide different teaching programmes to their students. This information will certainly be useful when applying features to the product, so that the functionality is optimal for the client to help them learn their language.

The online research, using 4 websites is a back up to this and sets the roots for what I need to consider going forward into the design. I have used my questions on the left side (in bold) to help look into my research, and add any necessary details. They give the general idea of the problems and solutions, which I can always look back into.

I will continue my research by exploring the behaviour and perspectives of those of the other end of learning – this targets to teachers and fluent speaking people. For each type of person, I will produce necessary questions and an individual research about their approach to learning. The main aim after both slides is to compare and decipher the most important points that will be processed through in the main design process, from the initial ideas onwards.

Internet research

On Flash Academy, Isobel Owen highlights that's these are the main reasons for why foreign languages are important for people:

- Many institutions require students to have learnt a language – universities and colleges are progressively getting more competitive to apply for.
- It can improve communication and English skills, giving a wider understanding and knowledge of the English language and grammar patterns.
- Career sectors that has international relations will employ foreign language learners best.
- Students can be culturally accepted in communities around the world.



Teach, a language guide website, explores the possible ways that teachers should teach their students another language in the best approach possible. They generalise them to these:

- Expose the language as much as possible, and limit native language as much as possible.
- Encourage participation with games – e.g. Role-playing
- Encourage activities outside the classroom - work experience is best to expose language as well.
- Use multimedia to enhance learning experience – videos and films help understand language flow and how quickly native speakers converse.



Teacher Julian's BlogSpot mentions the main problems of learning a foreign language in the classroom environment are:

- Students have a lack of motivation
- There is not enough practice outside the classroom
- Classes don't tend to be ideal when distractions take place, like bad behaviour and constant loudness.
- The tendency for the native tongue affects what they think.
- The subject itself can be seen as isolated to other subjects.

He provides solutions for each problem mentioned, for example (the isolation point), he suggests to connect to other subjects like English to feel like students are learning the same thing twice.



There are a number of ways that teachers track students progress. This is important to see the trend whether or not a person is maintaining a satisfactory standard in learning or not. Examples:

- Pre-assessments (Starters) – to see what students know or don't know.
- Whiteboard practise – to put knowledge into action.
- Tests or quiz scores – keeps on track how to improve next time.

I can use these tracking ideas on my clients to see how well they are doing in their languages, to see how much progress is achieved throughout this project.

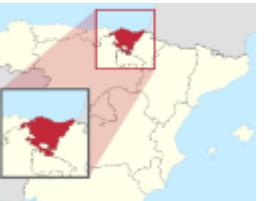
Fluent Speaker Perspectives

The main objectives to get across for fluent speaking people are:

- How long it took to master it
- The effects in the environment caused by learning foreign languages
- Techniques they used to learn
- General well being and satisfaction overall

S – Sulaiman Hasan, 17
W – Wisdom Elabor, 17
M – Megan Beloso, 16

Language learnt: English
Language learnt: Basque (in Spain)
Language learnt: Tagalog (Filipino)



Basque, Spain
- Has its own language.

Q1. How long did it take for you to learn your language? How much time did or would you take into learning it per week?

S: I learnt English for 2 years, it would take 5 hours if I did learn.

W: I learnt Basque for 3 months in school, a school period per day.

M: I wouldn't say a certain time, because it came to me naturally.

Q2. What ways did you try to learn? Which ones work the best for you and why?

S: TV and socialising with people and friends, since they are fluent and easy to access to.

W: 1 on 1 interaction with teachers in my free time in class periods, showed me ABC, etc.

M: Learning it from my parents and relatives in Philippines talking in Tagalog.

Q3. How happy are you, now being able to speak this foreign language?

S: 10 out of 10, since it's the most popular language in the UK I guess.

W: Very satisfied, I can understand them and vice versa.

M: Very satisfied.

Q4. What have you been able to do that you couldn't when you began learning it?

S: Making new friends obviously.

W: I can help people by translating their speech into English or Basque, depending where I am. Its also cool to recognize people fluent in Basque, even though they don't live there.

M: I can teach my friends how to speak certain words, so they can adapt and speak it often as well.

Q5. What do you think is most important for current language learners to experience to enhance their experience?

S: Movies, listening to music and radio will help a lot and it requires a lot of time and perseverance (dedication) to learn a language.

W: Having more confidence to speak to fluent speakers, because they cant just rely on videos and books. Will be able to get the accent and the way fluent speakers speak.

M: They should know their 'roots' (fundamentals in the language) to have at least an understanding in your own language.

I have displayed a similar style to the teachers perspective, using interviews and research to back up. However, some of the questions I delivered were poorly written and left answers being very short and with insufficient information to grab out. At least, the main questions, 4 and 5, show optimistic views for me to inspire my clients to help their development in foreign languages, such as being a translator, which slides in well on why languages could be helpful for the future. I was able to go in depth through internet research, to find a good accurate time scale to reach a basic fluency, which takes 1 or 2 years in a 1 hour per day situation, which applies to most of my clients. I have found that being fluent in another language can help boost memory and sharpening minds. I took extra research why it would be better to study abroad than at home.

The second perspective to help the clients are fluent speaking people. This slide will investigate using the same approach as the teachers views, by questioning people in real life and on research. This will extend my knowledge about what is seen from the other side of the language spectra.

Internet research

I have repeatedly asked how long my clients take to learn a language, most of which take multiple years to do so – but can it actually make them fluent in a language? It depends on the intensity of learning that my clients and other learners approach, and what surrounds them is another big contributor to why people can be so fluent.

Group 1:

French, German, Indonesian, Italian, Portuguese, Romanian, Spanish, Swahili

Group 2:

Bulgarian, Burmese, Greek, Hindi, Persian, Urdu

Group 3:

Azerbaijani, Cambodian, Czech, Finnish, Hebrew, Hungarian, Lao, Polish, Russian, Serbo-Croatian, Thai, Turkish, Vietnamese

Group 4:

Arabic, Chinese, Japanese, Korean

According to FSI, the US Foreign Service Institute, languages are broken down into 4 groups (mentioned left). To reach basic fluency, they indicate that, for group 1 languages, it takes 480 hours, and for groups 2-4, 720 hours. This is equal to 48 and 72 days of 10 hours each respectively, however, students would very unlikely take most of their time on learning a language, as they have other priorities to focus on. Since most of my clients mentioned they don't use other languages outside learning, and given from my survey that most people learn it for about an hour, it would approximately take them 1 or 2 years, depending on the language.

I also questioned their wellbeing and satisfaction from learning a foreign language, this is because having a positive outcome, will improve many factors mentally and physically, according to psychologist research. I have used the EtonInstitute to show these factors:

- Improves memory
- Boost brain power
- Enhances ability to multi task
- Sharpens the mind, and keeping it sharp for a longer time
- Enhances decision making
- Improves the students first language
- Improves performance in other areas or subjects
- Increases networking skills – communicating with other countries
- Provides better career choices



The fluent speakers I have interviewed have all been or lived in the country of the native language, whereas my clients haven't. This is a problem for those learners as they wont receive the full experience. From EF, here's why it is better to learn a language abroad than at home:

1. Students can be fully immersed in the language; Living in another country means that nearly every interaction In the culture will deepen vocabulary and understanding.
2. You will use new skills daily; Practise makes perfect and being able to do so abroad every day will eventually feel like nothing. My clients are mostly confined in classrooms to learn, which has no proper application outside.



Market research

The Dyslexia Shop:

The company aims to pick products carefully for those who are dyslexic, in Special Educational Needs or having learning difficulties. Before they put products out, their team tests them beforehand to ensure the product is reliable for the people. They provide outstanding services to its customers and is gold rated in customer feedback. Below is some of the product they have carefully selected:

Product	Photo	Description	My thoughts/rating
The C-Pen Readerpen Cost: £237.00		<p>The C-Pen Reader is a totally portable, pocket-sized device that reads text out aloud with an English human-like digital voice. Includes features such as:</p> <ul style="list-style-type: none"> • Hear words and line of text read aloud • A Collins 10th edition dictionary • 1GB of storage, and can be scanned by computers • Built in Voice recorder with playback 	<p>The products features make it versatile for English learners to grasp and enjoy learning the language with an electrical device which is easy to carry around. However, it could be better if the device can judge the pronunciations of words, because in my problem, my clients will be from a range of different heritages with certain accents.</p> <p>Rating: 9 out of 10</p>
Homophones flipbook Cost: £5.99		<p>Homophones are words that sound the same but have different meanings and spellings. Students match the words and complete three sentences that use the different words. Size: 226mm x 93mm Pages: 12 (each split into 3 sections)</p>	<p>This product is interactive and requires the students mental thought to successfully join up sentences with correct homophones. Downsides to this include the fact the topic is quite minor, as there are more important techniques that a student would want to know instead. Furthermore, it could get boring overtime after they have successfully done everything correct.</p> <p>Rating : 4 out of 10</p>
High frequency word fan Cost: £1.32-2.00		<p>This product aims for children as a 'first dictionary' to support them in spelling and reading. There are 25 words on each petal, and up to 6 petals with a detachable pivot. Size: 30mm x 165mm</p>	<p>For its product lifetime, its worth spending, as it would help young children to understand key words with ease. It can also serve other purposes, as a bookmark or a fan to cool the user down. It's also a positive that words are colour coded to signify connectives, adjectives, etc.</p> <p>Rating: 8 out of 10</p>
Listening for mistakes Cost: 14.38		<p>A pack of 15 double sided cards with a picture and sentences. The child will read the sentences and find the mistake between them and the picture. Suitable for ages 3+. Size (per card): 260mm x 170mm</p>	<p>This product engages children to critically think of the English used, and find the mistakes which can be done mindfully or by spoken language, which adds a boost into learning. In my opinion this product is worth the money, as it can get repetitive.</p> <p>Rating: 6 out of 10</p>
Chunks Cost: £23.98		<p>This exciting word building game contains 140 bright, durable plastic tiles of the most commonly found onsets and rimes. It provides a fun way to discover and remember the key components that make up words, as the tiles can be manipulated into thousands of combinations. It is suitable for children 5-11 years, and for older pupils with special needs.</p>	<p>What I like about it is that it helps English learners to be extensive in vocabulary, with the amount of combinations that can be made. The simple aesthetic makes it clear for learners to engage. However, the product is overpriced.</p> <p>Rating: 7 out of 10</p>

The existing product investigation will be made up of two parts: the market research and physical product analysis - this slide will only feature online products I found on websites that link well for my problem. Its essential I include as many products as possible to give a thorough insight into the current solutions of tackling the English language. For each product, I will mention the company, the cost and the main focus of it.

This slide should aim to:

- Include a variety of products, which should be evaluated.
- Mention the cost, the function and other important details of the product.
- Compare the effectiveness between each product.

Other products:

T11 Translator by Buoth

- 2.4 inch touch screen display
- Available in 106 languages
- AI tech with noise-cancelling
- Price: £192-£199 (Amazon)



Foreign card set by Travelflips

- 60 card set with English translations
- Available in 9 languages, including Spanish, French, Russian and Korean
- Price: £16.95



Learning portable foreign language notebook by JOOM

- Available in 4 colours
- Foldable flaps to cover words and meanings
- Can be used for any language
- Price: £4



WT2 Plus Translator Earbuds by TimeKettle

- Translates in real-time
- Available in 40 languages and 93 accents
- Requires Bluetooth
- Price: £199.99

'Each block is embossed to give it a classic look inspired by traditional blocks. They are handcrafted in Michigan of Basswood grown in the Great Lakes area and printed with non-toxic inks. The blocks feature bevelled edges for a more comfortable hold.'



Buoth aims to break down language barriers using this portable device in any situation or environment. This is the most recent model of the T translator series. Integrated noise cancelling blocks external sounds, giving the optimal translation for users.

'Each language kit includes 60 flash cards featuring essential words and example phrases On each card, you'll also find phonetic pronunciations (transliteration) and English translations for faster learning.' The product can easily be carried around, and is ideal for beginners wanting a solid ground on a new language.

The notebook has multiple pages each consisting of columns of words and its meaning, which can be covered using the flaps on the sides. This allows learners to test themselves on their vocabulary and understanding, while the product is easy to carry around.



Scrabble board game by Hasbro Gaming

- For 2-4 players
- A bag collection of letters
- Scrabble Dictionary is provided
- Price: £17.99



Scrabble is mainly available in English, but is a game that stretches vocabulary to create words to earn points. It's a tactical and intellectual game for people aged 8 and above. The winner of the game is the one who accumulates the most points when the board is filled.



Product Analysis

This slide should aim to:

- Show the products used by my clients
- Explore their cost and main functions
- Present the clients opinions on their products
- Evaluate the products in ergonomic and anthropometric views

Duolingo App:

Lots of my clients from my survey uses this free app on their devices. Its very versatile in the fact it can be downloaded from a phone, to a laptop. This app can be used anywhere on the go, as its linked to your device, as long as an account is connected.

The app is provided with over 20 languages to learn from, in which learner can choose multiple languages. It's approach can be deemed similar to how its taught in schools. Depending on their ability on each language, it is programmed to supply the best path to educate and teach learners as best as possible. Beginners can start from scratch and intermediate or advanced students can be pre-tested to determine what they will need to learn.

For each 'lesson', they are given tips which helps them with what is taught beforehand. At the actual lesson, they are given mini-activities to improve each ability, shown in the video below.



duolingo

The video on the left is one of my clients, Joseph, using this app to help him learn in Spanish. He generally likes the whole setup of the app, as its really good for writing, reading, listening and speaking, which is spread out in different quizzes and subjects to learn more about. The fact that the app is free to use is a bonus for him as well to help in his learning.

However it has its limitations. On the top right of the video is a heart counter, which he complains that he couldn't get further into the app as he has to wait a while for them to restore.

He exclaims about the Duolingo Plus, which is quite expensive to him, which is totally understandable for students his age and even younger. This feature costs £4.99 per month.

Overall, this product is very useful to educate students of the target age group, as it's cartoon style provides a fun, overwhelming experience. It is ergonomic, as it doesn't require multiple fingers to function, and uses typing and dragging mechanics to achieve mini-activities. Though the user could be slightly confused because of the many buttons that lead to many functions within the app. Anthropometrically, the buttons are big enough for the biggest hands to touch accurately, so there isn't an issue. This can not be judged properly as it's a mobile app, which can depend on the device.



Leagues are included in Duolingo that can motivate students to competition.

Onwards from market research, I will discover the current products that my clients use to help engage in learning a foreign language, which they had mentioned in their interview and survey. Just like the previous slide, it will be essential to evaluate and interpret the effectiveness of each product not just from their perspective, but also myself. My clients will actually test these products to give their opinions, to see what's right and wrong, in which I can look further.

Kloo's Race To Language Board Game:

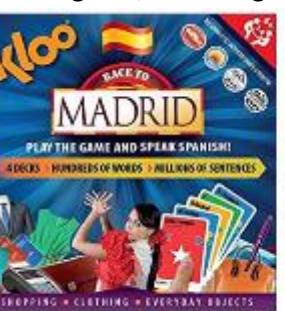
KLOO is a winner of 10 awards, including ToyTalk's Best Board Game of the Year, by using education to make a game. The board game comes in 3 different versions, Race to: Madrid, Paris or London – all of which are capital cities. One of my clients bought the Madrid version, and was generally satisfied with it.



The main point of the game is for players to make up sentences and learn words in their respective language (e.g. Madrid – Spanish) to score points, to which they can move across the board towards the capital, the end goal. Rules can be altered to endure the length of the game, or to toughen up the competition. An instructional video will demonstrate the function of the game, on the right:

On amazon, the product costs £33 – 35.

2+ players are required, can be played from children to adults.



From my client, this was his opinion:

- Really educational, as it engages his brain to think more concisely and accurately with his sentences and words to score more points.
- Its very suitable for everyone, regardless of ability – their family has little knowledge and has helped them know more Spanish words, as he teaches them how to structure.
- Argues that the price was a little too expensive, as he doesn't play often, as most of the family have other priorities.
- The game is repetitive, with the same goal, which he finds boring. However, the setup is simple, and colour codes help him organise within a few minutes to commence a game.

Like most other board games, it is ergonomic, as he further mentions that there is a plastic tray that sorts out all type of vehicles and cars that are used in the game, so there is no mess and everything is kept tidy as much as possible – including the board itself, which is 1 piece, and not multiple pieces to put together like a jigsaw. Anthropometric-wise, I would consider it reasonable, its not too big nor small for anyone to carry which would unlikely cause any injuries. The sizes and texts of the cards is fair enough for adults and children to feel properly.

From all the existing products, I have used an award winning company to present their selected products for dyslexic and SEN children, which has helped me see the complexity and simplicity between products and comparing them helps what direction of design I should consider.

Technology, as always, can make the price become more expensive, as seen with the other products in that slide, but offers a highly intellectual side to learning, but has a common problem that it wouldn't help a student understand the word, but just give the answer.

For my product analysis, I have asked two of my clients to give their open opinions on their respective products, Duolingo and KLOO'S race to Madrid, in which I have evaluated. Kloo's race to Madrid opens up well how education can be made into a fun, worthwhile game, and this will help me choose how I can design a product that meets the solution that I had said at the start.

Product Standards

This slide should aim to:

- Explore different national and international standards in design
- What each standard does and where its commonly used
- Explain how important these standards could be part of my design process

International Standards Organisation (ISO):

It is an independent organisation that creates membership to over 150 national standards which are internationally recognised and agreed to be put in place for products. For companies looking to expand their markets and trade to an international level, they must comply with both national and international levels.

Most common ISO's found in all types of product are:

- ISO 9001 – Quality management
- ISO 14000 – Environmental Management
- ISO 31000 – Risk management

These three will apply to my product and its production as I will have to consider minimising the carbon footprint from extraction of raw materials and manipulating them to make the desired shape. In terms of quality, I could try using my clients to test my prototypes and designs to find what is necessary for them to keep the quality very high. But for my case, with languages, ISO 21001:2018 will be most important as it handles education systems, in which my product will need to help students abilities and keep them satisfied.



British Standards Institute (BSI):

BSI is one of the companies aligned with ISO, working with industries, companies and government to produce standards to assure products are well produced, safe and ergonomic. It is very well recognised, as its seen in multiple products, such as cycling helmets and plug casings. This standard is very helpful to provide safety and protection of the consumer from getting harmed, and to protect the company or producer from being charged responsible of those serious cases.

Companies can pay to the standard to test if the product meets their requirements. If it's certified and confirmed a quality mark of a kite can be seen. It is mandatory for those affiliated with them to test their products to ensure standards are maintained.

This standard can be applied to my design because for languages, it will need to be safe in all ways, or example the type of finish that may be applied on my finished product, or the products weight to reduce any risk of injury for my clients.

Furthermore, these clients will also help me by judging my products to see how ergonomic and comfortable it is to use – that may come from the assembly of pieces to build the product.

Before designing my initial ideas, I need to know what direction my product will take upon solving my problem on languages, to find what is best for my clients to meet their needs and wants. These standards are put in place to keep the production of my potential product as optimal as it can be, from recognizing its quality and effectiveness, to the material sources that are used to make the product.



The Lion Mark:

The mark can be easily recognised by consumers to identify toys that are safe to use. As mentioned, this only applies to toy-based products and its essential that I show this for my design because a possible route since my clients are mostly children and within a sensible range for this mark to be applied. I have said in my context that my product should be enjoyable and educational, to keep the client engaged in their learning towards foreign languages.

We have seen products such as Chunks game from the Dyslexia Shop, and the foreign language blocks by Uncommon books, both of which had potential of using this trade mark. However, toy manufacturers must:

- Carry a safety assessment of the toy product
- Make sure the toy is provided with instructions for safe use and information.
- Investigate any complaint made towards the toy and record each one.
- Apply information identifying the toy and manufacturer on the toy or packaging.

The lion mark (by Toy Retailers Association) is partnered with BTHA to show it as classification. On international markets, it is recognised as 'EN 71'.



Forest Stewardship Council (FSC):

I have chosen this standard as one of my priorities as I will assume my potential product will predominately consist of wood, in which the council targets on preservation on wood materials and other wood-based sources. Also I have chosen this because it keeps a reminder for myself to minimise the wastage to reduce the effects on wood, such as replanting and reduction of deforestation.

FSC certified products include chairs, tables, sofas and beds. The main points from FSC are:

- Wood sources come from well managed forests/ recycled materials.
- Managed forests are environmentally appropriate, socially beneficial and economically viable
- Workers within FSC are local, well trained and work in a safe environment
- When trees are cut down, they replenish by replanting and regenerating to produce new trees., to reduce deforestation.

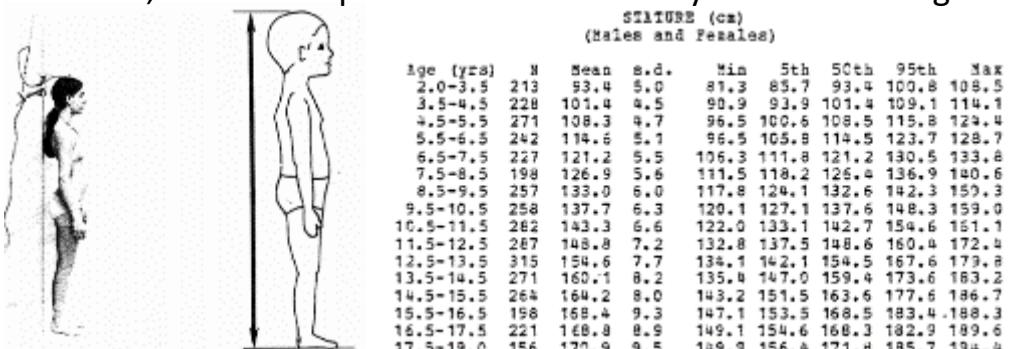


These standards give me a reasonable limitation on what my product should do and happen during its production. Coming out from this, its important to test my product and make it as safe as possible for myself and the clients themselves. This includes the materials that are used. I have explained how each standard may be related to my design process thoroughly.

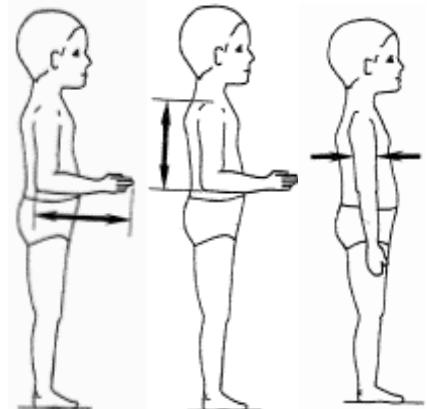
Anthropometric Research

Anthropometrics is defined as the scientific study of the measurements and proportions of the human body. My clients are children that are learning a language mainly from primary and secondary schools. Size and shape of my product is crucial for my clients to be satisfied and much of ease when design my product.

For the most part of this research, I should take values of lengths of humans aged between 7 – 18 years of age. This is because my target range is children, as I have explained earlier that they are the main ages of learning. I will record also the sizes of boys and girls, as my clients are mixed.



One main feature of anthropometrics I should look into is my clients height, from head to toe. My design could potentially be large, and would be more concerning towards my younger clients, who would be much smaller than someone at 17 years old. If it were to be large, I would need to consider the proportions between the client and product, and in what environment it would most likely be for.



I could consider the clients arm length and size, from the shoulder to elbow and elbow to hand lengths respectively. Like the two images on the most left, their arms should be at an 90 angle and against their torso as much as possible. I am doing this because the design may have a relation to contracting and extending the arm due to the weight of the product, and to see if the clients can bear it if it was made.



The wrist circumference and thickness may be a factor into my design, measuring around the wrist as accurately as possible. There may be implications on my design where spacing is narrow for spacious reasons.

It is essential that my design incorporates the measurements of human bodies when the product is directly targeted for my clients, as they are all children, in which sizes change between each year by a margin, compared to other ages that are above adult age. Anthropometrics is also important so that I can include as many of those clients to suit their needs and wants, without the risk of getting injured due to the designed size being too large or small. I have considered what applications these features may be needed for the first iterations, and so on – for example, the wrist circumference being necessary for the width and depth of the product that could be made. The most important general part of the human body are the hands, as I would predict myself using them to carry things across in environments, as my previous parts of investigation has guided me towards that idea. For this research, I have used a resource that may be outdated as it was made nearly half a century ago, and has missed out some key anthropometrics that I may need – e.g. the lengths of extended fingers or wingspan.

The main outcomes from this slide are:

- To find the necessary parts of the human bodies, relative to my clients
- Explain why these details of the human body are important to the design process
- Use a reliable source of human data for anthropometrics.
- Explain the importance of anthropometrics in design

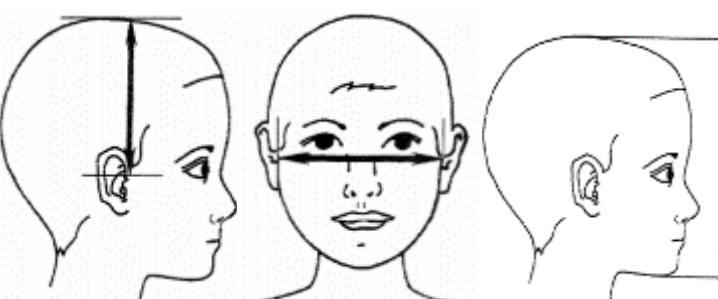
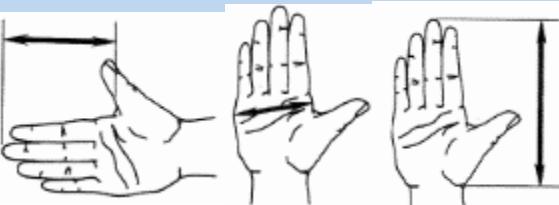
Resource:

http://mreed.umtri.umich.edu/mreed/downloads/anthro/child/Snyder_1977_Child.pdf

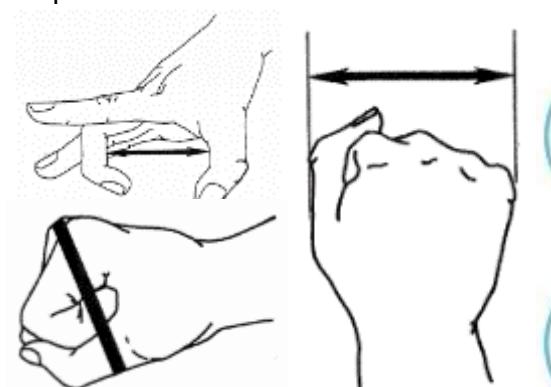
The hand in my opinion may be the most important anthropometric feature in my design as I intend to create a product that will utilise the hand, for example, carrying the product around from one place to another which was hinted from my client interview.

HAND LENGTH (cm) (Males and Females)								
Age (years)	N	Mean	S.d.	Min	5th	50th	95th	Max
2.0-3.5	212	10.3	0.7	8.6	9.3	10.3	11.7	12.5
3.5-4.5	247	11.4	0.7	9.4	10.3	11.3	12.5	13.9
4.5-5.5	282	12.2	0.8	9.5	10.3	11.4	13.1	13.8
5.5-6.5	219	12.0	0.8	10.8	11.5	12.6	14.1	15.5
6.5-7.5	225	13.3	0.8	11.1	11.9	13.2	14.6	15.5
7.5-8.5	192	14.6	0.8	11.5	12.6	13.5	15.1	16.1
8.5-9.5	251	14.4	0.9	11.8	13.0	14.3	15.9	17.1
9.5-10.5	281	15.0	0.9	12.6	13.6	14.9	16.1	17.5
10.5-11.5	281	15.9	0.7	13.2	14.0	15.9	17.3	18.9
11.5-12.5	287	16.3	1.0	13.7	14.5	16.1	17.4	20.0
12.5-13.5	312	16.9	1.0	14.5	15.3	16.3	18.6	20.1
13.5-14.5	269	17.5	1.1	14.6	15.7	17.2	19.3	21.7
14.5-15.5	262	17.8	1.1	15.2	16.0	17.7	19.5	20.4
15.5-16.5	197	18.6	1.3	15.1	16.0	17.9	20.0	21.5
16.5-17.5	221	17.9	1.3	14.4	15.1	17.3	19.9	21.7
17.5-19.0	156	18.4	1.3	15.5	16.2	18.1	20.2	21.6

Table showing hand length of male and female (average) up to 18 years.



It may be necessary to record the ear to top of the head because the size of my design could require a headphone-like shape to improve my clients listening. I have also pointed out the width and length of the head just in case my design requires.



Other hand gestures and actions such as knuckle clinching and hand grip have been mentioned here due to the design possibly requiring a force of compression or pulling to for the product to function to satisfy the clients needs. These measure the maximum fist length, from thumb to little finger, fist circumference and middle finger-thumb grip length.

First Iterations

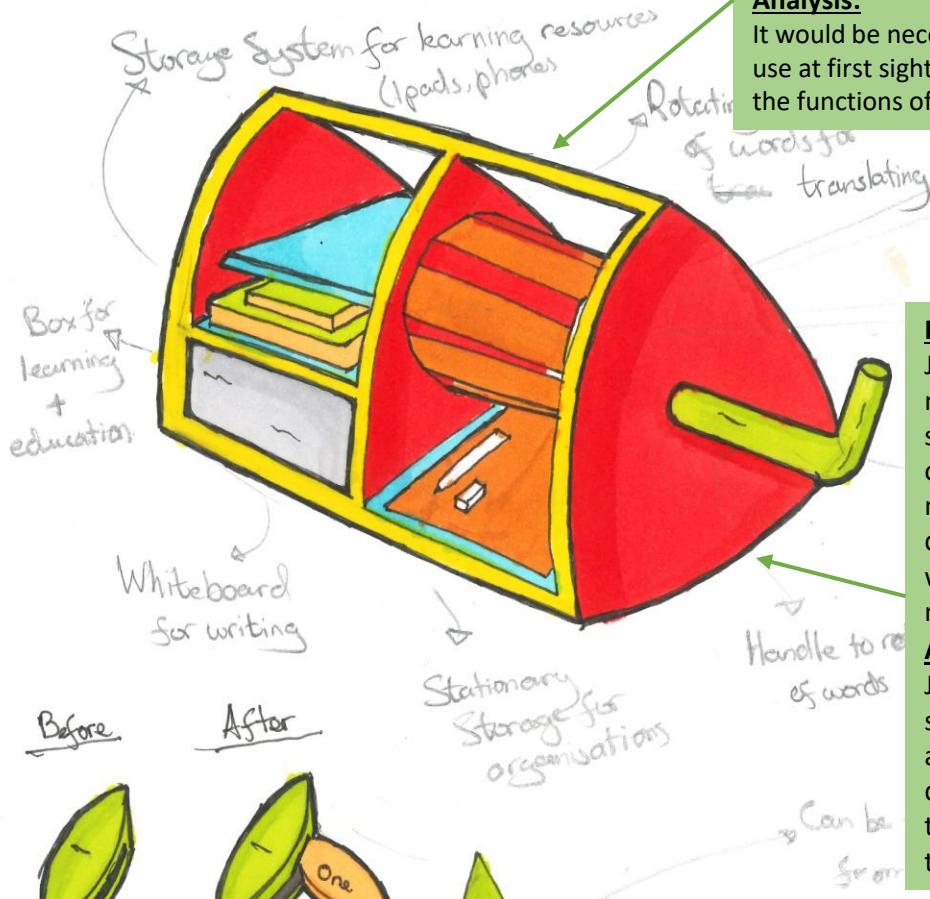
The first iterations are the basic design concepts that I will make before heading into a specific direction. I will be using the information I found out in my investigation so far and produce a range of designs that suit them. To guide me in these designs, I will have gain inspiration from different environments, and show these to my clients to receive feedback.

Feedback:

Nowi, 11, like the many functions of these designs, but she thinks for older children, it may be confusing, like her.

Analysis:

It would be necessary for a design to be simple, and easy to use at first sight, so that they can remember how to use the functions off by heart without technical issues.



Feedback:

Joseph finds it useful and practical to store multiple items based on languages into one system. The whiteboard feature saves a lot of paper being wasted, and sees it necessary if you want to write something down temporarily, and use it again. The wheel trains students well, by holding memorisation of key words or phrases.

Analysis:

Joseph finds this as his favourite, but he stresses out that every feature should have a purpose and benefit to gain. My final design should efficiently create features that will continuously help my clients in their learning.

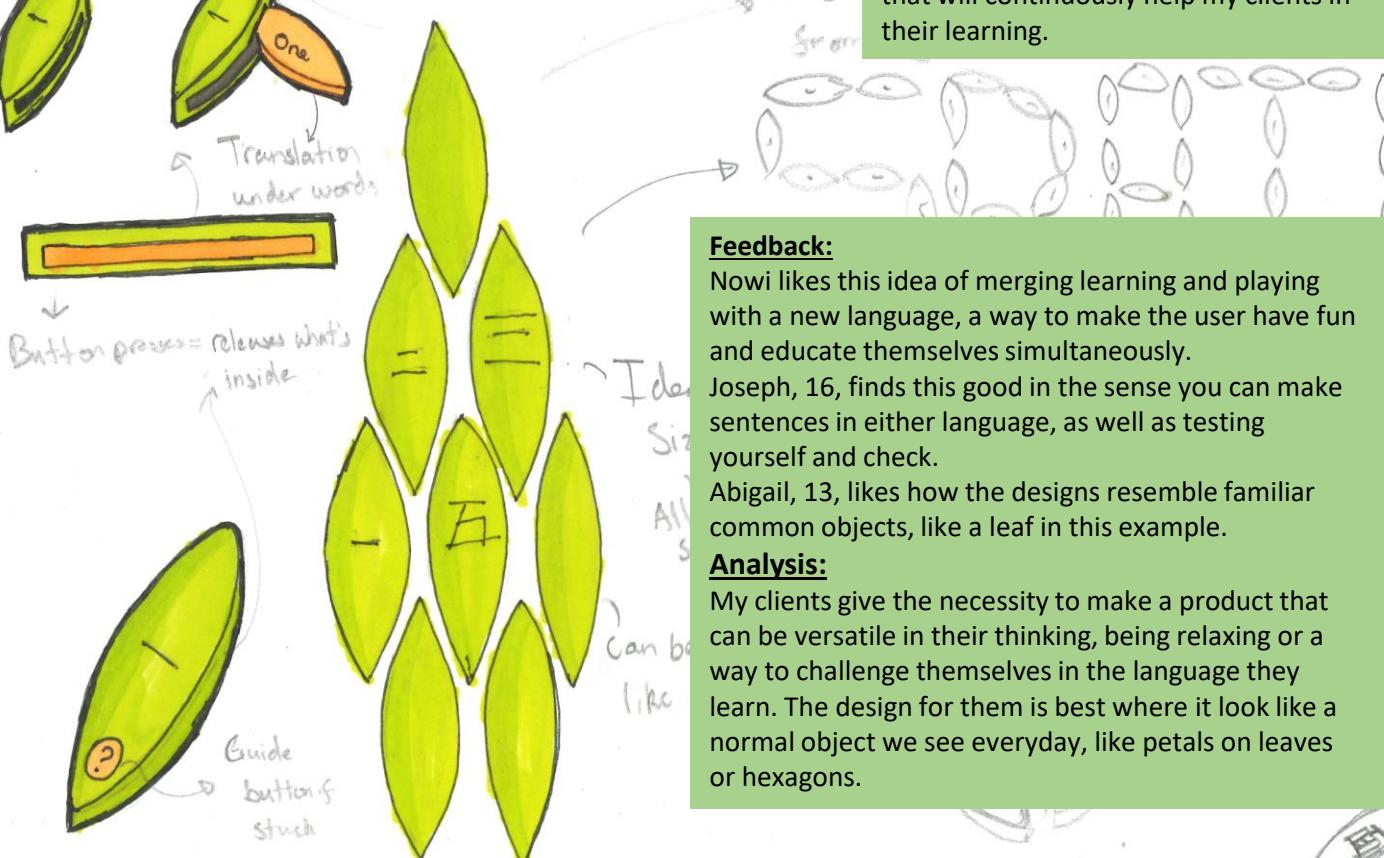


Feedback:

Joseph says this is good as it feels more realistic to have conversation to listen and speak with at one place. He likes the idea how educational material can be stored, but has its limitations – flash card would fit, but a book wouldn't. However, Simeon, 17 feels the design is terrifying and weird to look at.

Analysis:

My clients are conflicted by the aesthetic of the product, so I will consider using a different person or living being to disguise as a more real experience, to reduce the awkwardness. Just like the left design, the function will need to be there in place, but how it's placed here should be changed, so it becomes more versatile for storage or the placements of parts.



Feedback:

Nowi likes this idea of merging learning and playing with a new language, a way to make the user have fun and educate themselves simultaneously.

Joseph, 16, finds this good in the sense you can make sentences in either language, as well as testing yourself and check.

Abigail, 13, likes how the designs resemble familiar common objects, like a leaf in this example.

Analysis:

My clients give the necessity to make a product that can be versatile in their thinking, being relaxing or a way to challenge themselves in the language they learn. The design for them is best where it looks like a normal object we see everyday, like petals on leaves or hexagons.



Inspiration
for leaf
design

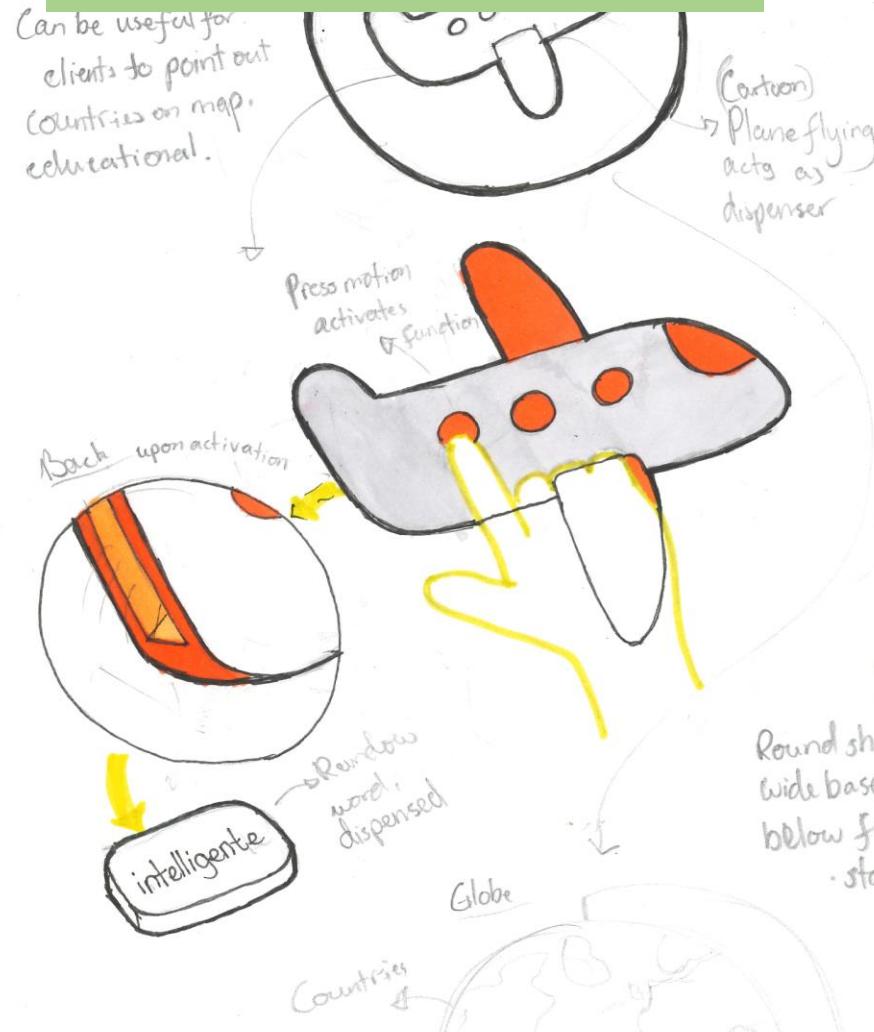
First Iterations

Feedback:

Nowi likes how unique this design is – its aesthetic and creative. She likes the idea of dispensing words out of something unorthodox and unusual, which bizarrely could help language students learn.

Analysis:

She is content with the unique and oddness of the design, which was inspired by planes dispensing off in the air. However I took in mind from her if something like this could be portable for learning – I could remake this again in the second iterations in a different orientation.



Feedback:

Juleanne, 14, finds it handy and convenient, almost as if its essential as a watch, which most people would wear in any occasion when they are out. She emphasises how easy and simple the design is overall. Abigail likes how the colours indicate what language the product is for learning.

Analysis:

This design is my personal favourite, because of the simplicity and ergonomic that a cylinder design can have for a client that would like to learn as they go. I should consider a product that only requires a simple action, such as a finger tap, to activate the product. Abigail's comment shows me that I can make multiple versions of this prototype, but the flag can represent other countries to indicate a different language – which would be essential for someone learning multiple languages at once, such as Juleanne.



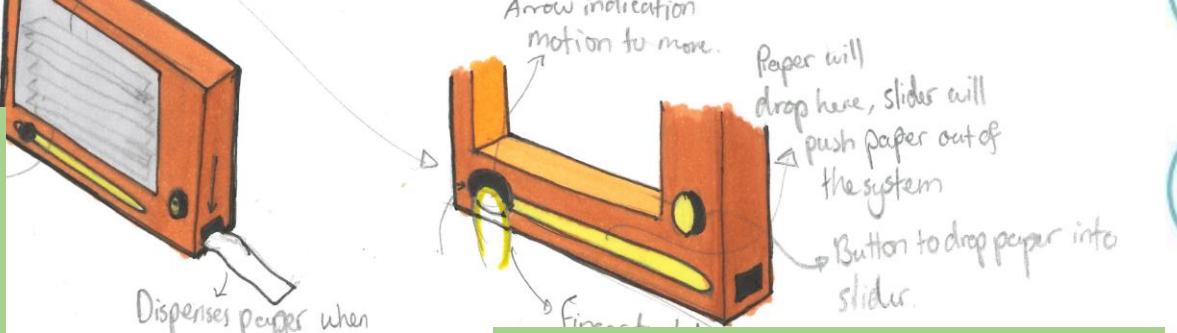
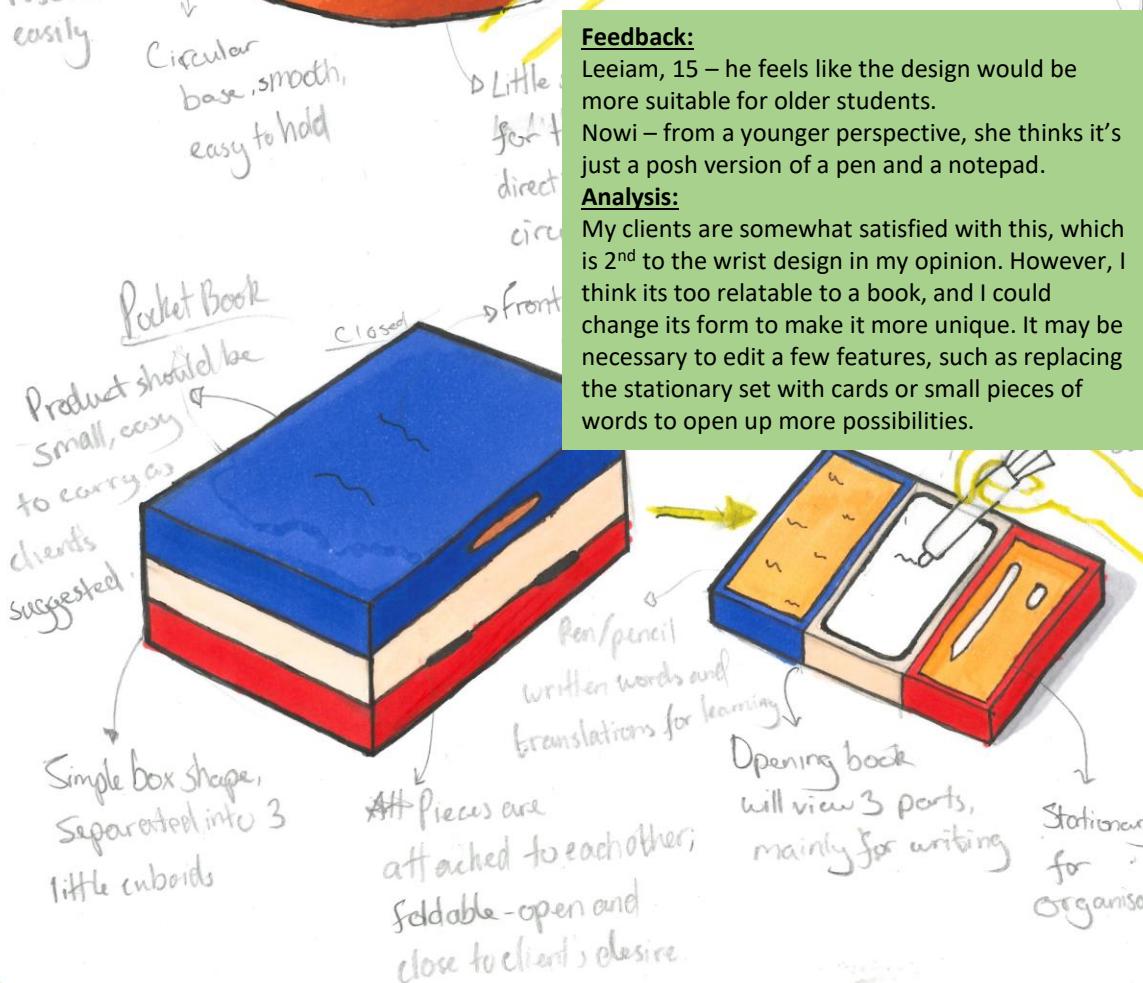
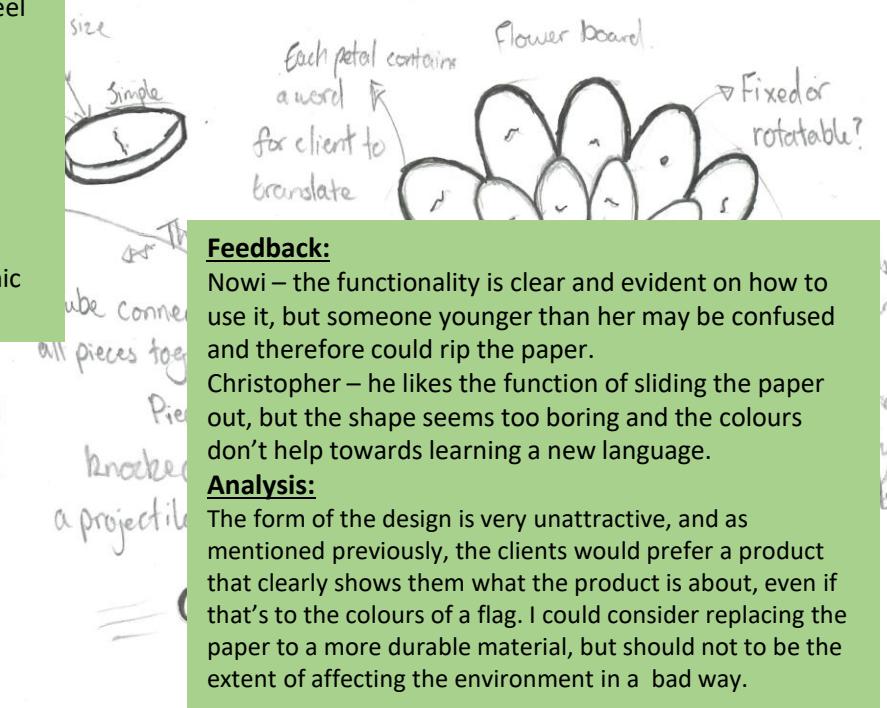
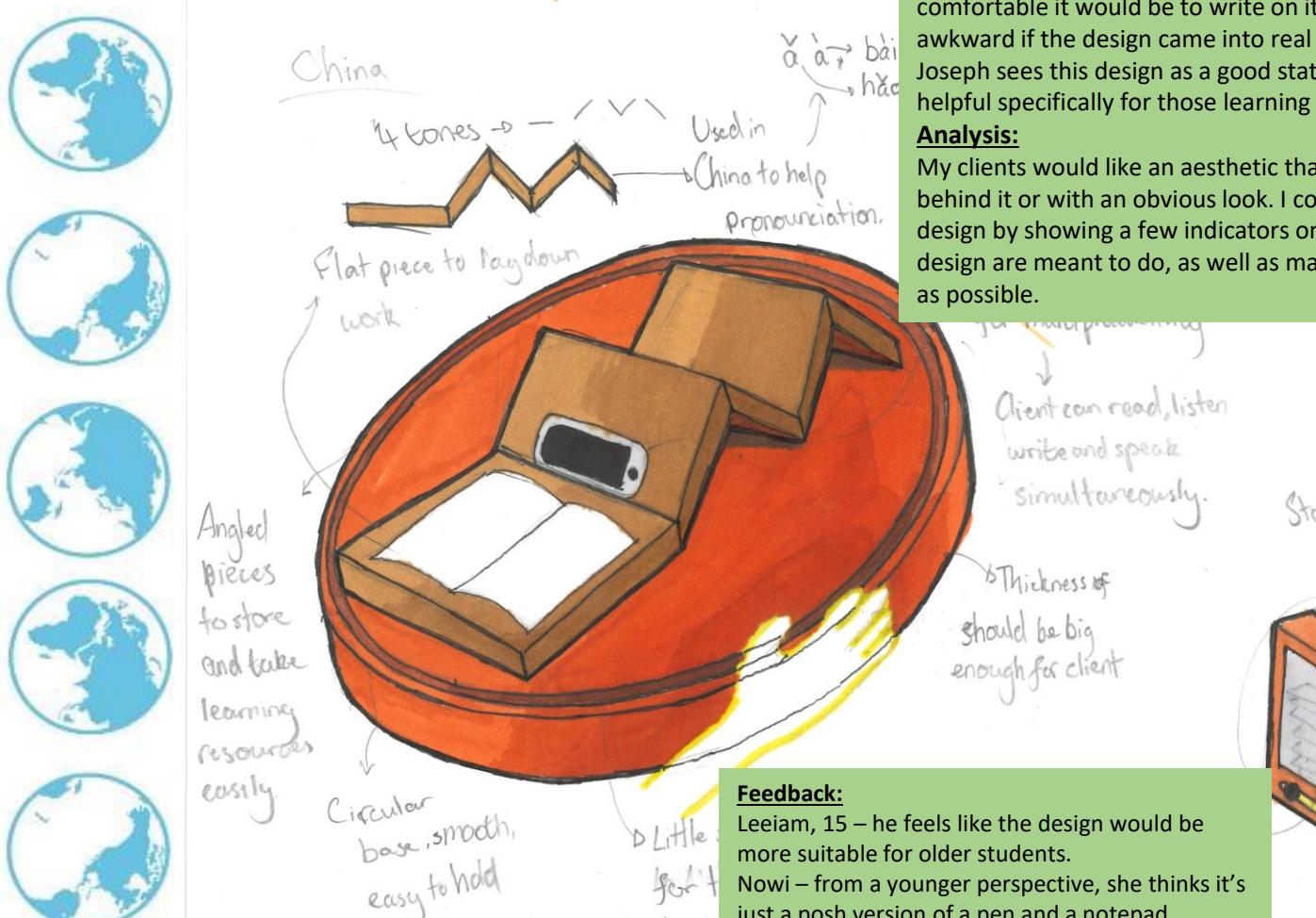
Feedback:

Christopher, 10, loves this design because it reminds him of Kung Fu Panda, and the essence it gives – which is, bamboo, and the feeling of China. He is a bit disturbed by the mini door for the tokens because it is quite visible and feels it doesn't match against the panda itself. Maisie likes the opening mouth concept as it gives more entertainment, however, she is not sure about the shape of the tokens – she is confused on how it relates to the rest of the product.

Analysis:

My clients are the youngest, but they are satisfied with the panda shape, as it reflects to childhood memories. I could improve this particular product by making the door less obvious, in which it would blend in. Furthermore, the tokens will need altering, for example, I could change it to a bamboo shape to match what a panda eats on a normal basis. I could change the design and show different countries with their national or representative animals for my clients to understand what country and language they're from.

First Iterations



First Iterations

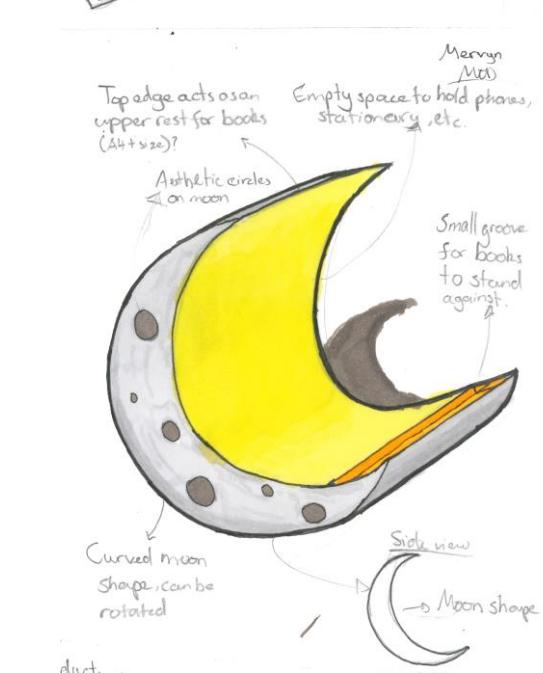
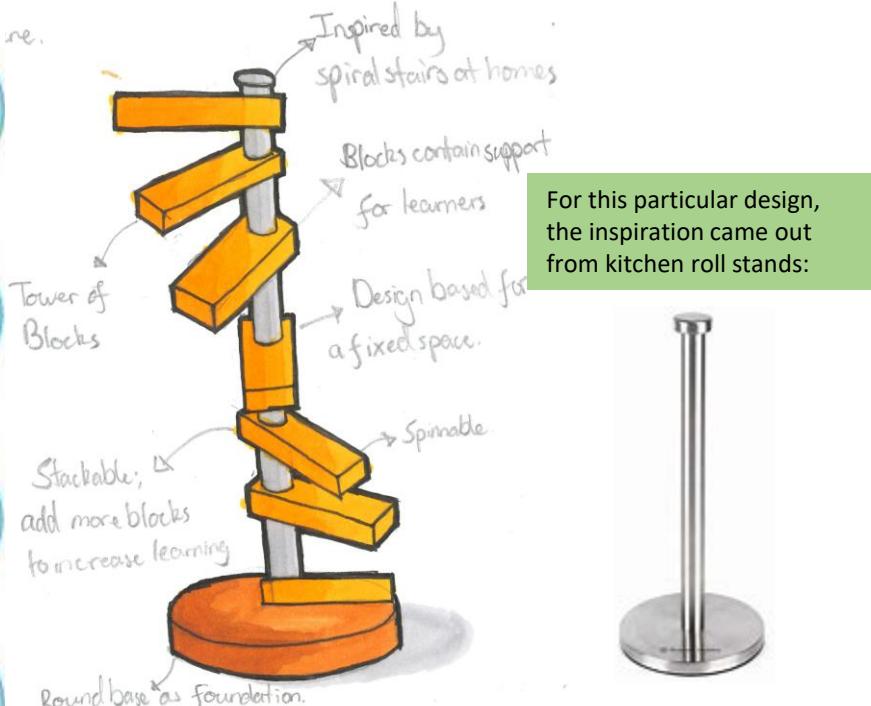
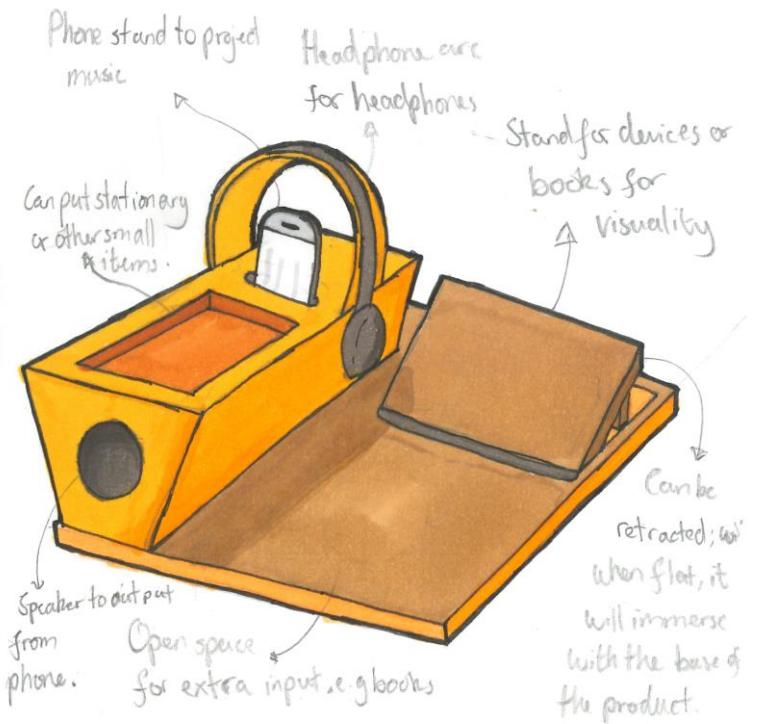
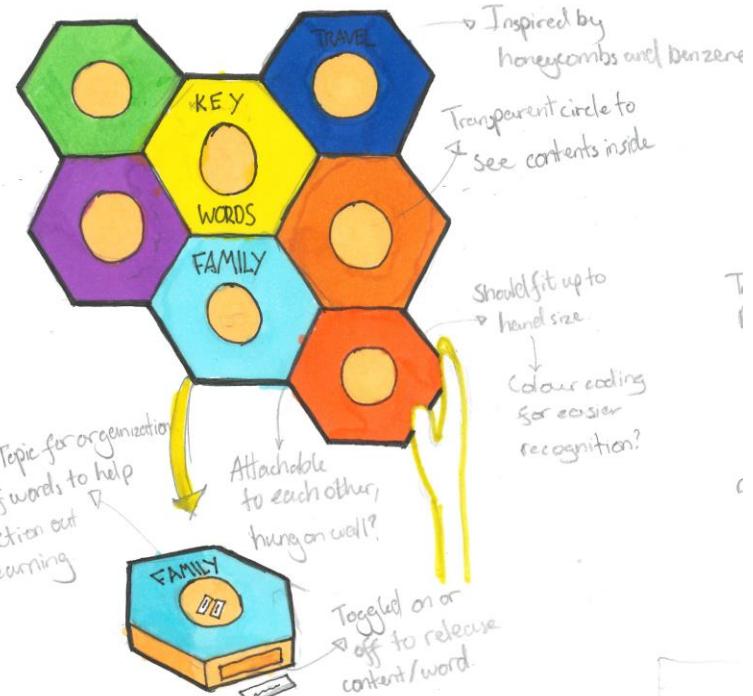
Feedback:

Leeiam – He finds the colour coding eye catching and useful for any ages because it can help memorise it easily. He does include that he's not sure about trying to take out the surrounded hexagons as it could break the whole system.

Nowi – she is concerned about the risk of ripping the paper upon dispensing.

Analysis:

Leeiam gives a good point about the 'trapped' hexagons, which could be a failure or time-consuming if taking out adjacent hexagons. I could consider have a distance between pieces so its more ergonomic and easy to take out. I will definitely consider colour coding as a way for indication, as it reflects a vibe for children.



Feedback:

Juleanne – The design is cool and unique, but it seems like a waste of space and has very limited use.

Christopher – He likes the tower of blocks, but doesn't seem like he would have it for long time, as the blocks can be lost or broken if not handled properly.

Analysis:

This design is something to avoid when progressing on to development and reiteration, because it could give the clients boredom and useless as it would get repetitive over time. To counter this issue, I should try designing in a way they can manipulate it and edit it to work in their favour.

Feedback:

Jairus – he finds it cool and intriguing, however he finds it unsuitable to use and has no relation whatsoever towards languages.

Maisie – she likes the design, but is concerned about the product being easily tipped over, ruining the product and its purpose if it were real.

Analysis:

This is another design I experimented with the ideas of streamlining and smooth surfaces, while having a purpose. However, my clients do not like a design that would easily fall over, and prefers a design that's more stable.

Feedback:

Abigail – this is one her favourite designs because of how each part of space has a purpose (multifunctional), in which you can do anything from reading, writing and listening to another language.

Jairus, 10 – He finds it useful that the headphone rest is in place so that its easy to take it off and put it on himself if this were a real product. Contrastingly, he suggests that a better shape of the speaker and rest would be needed – he sees the existing one here unnecessary.

Analysis:

This design was experimenting on different forms of shapes and sizes into one product. Though, I can infer from this that the main parts of a product could be more integrated inside the shape, for example, the stand. I also revisited this, and was concerned about people who are left and right handed – they might have different experiences at use.

These first iterations are quickly planned and designed – most of these are including colour. I have shown these to my clients, in which their responses have been analysed.

Overall, the analysis tells me that they prefer:

- A product that related to real life objects (e.g. panda, leaves)
- The form of the product being simple and colour-intriguing.
- A small product, easy to use and carry around in their environments
- Have at least one interaction with the design.

I will bear in these preferences, as they will be essential in choosing the direction my product for my client. This may mean that my age bracket may be narrowed down.

Brief and Specification



Brief:

Design and manufacture an educational and entertaining product that will satisfy the learning of young children aged 12-16, in order for them to help improve their independent ability on Spanish. It must be easy to carry and comfortable to use, while keeping them motivated to gain experience in the long run.

Spec No.	Specification Point	Explanation	How will this be measured?	Research used to this point
F1	The product function must be interactive and easy to recognise for all clients and users between 12-16 – there should be at least one physical action.	This can be as simple as pressing a button to release the inside of the product. It would be more beneficial for the client to be more immersed in the language, as it will improve their general writing, reading, speaking and listening skills, which has been emphasised from the beginning of the language research.	During the development stages, I will be asking my clients to test the product. If they are able to 'activate' the product physically and in within a decent amount of time with no assistance, then it can be considered as a pass.	<ul style="list-style-type: none"> Market research Client interview Client survey
F2	The product must use successful (and familiar) teaching techniques used similarly to those in classrooms, to allow the Spanish learner in focus of studying well.	It is important for those clients to continue learning and maintaining a foreign language as best as possible, so using techniques used in school, such as whiteboards (for temporary showing), and flashcards give that school environment feeling. This should be complimented by applying that knowledge in the outside world; to communicate with others, close to the client.	I will be testing with my clients to see how efficiently they use the product and its contents, in which I can make them leave a review on what they learnt coming out of the product. It may be also helpful to spectate what they done during the use of the prototype to see how well it corresponds to their learning.	<ul style="list-style-type: none"> Language Research Teacher's Perspectives Fluent Speaker Perspectives
F3	The product may be 'refillable' or require a continuous replacement of material to extend the useful lifetime of it, for my client.	A certain part of the product could need restocking to help the client learn more vocabulary or language techniques as part of a continuous cycle of revision. Materials such as paper, that is cheap and easy to access, can be added to the product by my clients. I may research other affordable materials that they could add.	I will check in my design if there are any parts that can act as a refillable storage, and test it out with my clients. I will observe if the client has the refillable material available, and see how easy or difficult they can put it in the product.	<ul style="list-style-type: none"> Market research Product analysis
U1	The products outcome must leave the user satisfied and motivated to pursue learning the language (for as long as possible).	This means I must consider the function of product to appeal to the user as much as possible. The best way forward to meet this is a game, as research shows that it is the best form of entertainment. I should also be considering the aesthetic of the product, that not only attract the client to using it, but the form may represent the origins of language, for example, the bracelet design (slide 14).	Like the client survey, I can give a small review sheet that will include how content they are with using the product. I could judge by eye when giving the developments to the clients to see how well they feel during their use.	<ul style="list-style-type: none"> Client interview Client survey Product analysis
U2	It should guarantee safety for the clients, to prevent any serious risk of injury. It may show safety signs to help the user identify the certain risks that are potentially in place.	It is necessary to ensure the protection for my clients from the product otherwise it could lead to serious health issues that will be accounted for badly – most commonly these include inhalation of toxic chemicals or injury to a hand. Safety signs will give clear warnings for the client to know what to do and not do for their benefit.	I will take into account the use of materials and applied finishes in the whole manufacturing process and identify the certain risks. These can be carried over after the product is finished to provide information to my clients as a safety measure.	<ul style="list-style-type: none"> Product Standards
E1	My product must be small, and easy to carry by my clients and all children between 12-16 years old. The product should not exceed 350mm on all sides as it should not be longer than the clients elbow to hand length.	Alongside the materials weight, it should not overwhelm them and cause any risk of strain or injury, allowing the client to control the product as comfortably as possible. I mention the maximum elbow to hand length relative to the eldest of the users so that them and younger clients can hold it with arms bent allowing more balance and stability.	I will test it with my clients, from the youngest to oldest, to see how easy it is to hold the product. Anthropometrically, I will see how far the product is from their hand to their elbow – if the products length exceeds this, I must reconsider its size until suitable for them.	<ul style="list-style-type: none"> Anthropometric Research
E2	The product must be able to differentiate between the full age range of 12-16 to allow them all to learn at their own rate based on their personal ability.	The product should not pressure them to learn forcefully to help educate the user for a staggering amount of time. Instead, the leniency lies upon them. It would most likely be that the older clients and users will spend more time on Spanish than younger years, as they haven't dug deep, and still finding a potential language to learn.	I will test among my clients to judge their satisfaction towards the prototype. I will thoroughly check the efficiency of the product and how much it reflects for the clients, which is important for them to gain knowledge at their desired pace.	<ul style="list-style-type: none"> Anthropometric Research Language research
Q1	The product must be finished with a high quality standard to engage the users attention, but also to protect the materials associated with the product.	It is more important to ensure the materials used to produce the product are finished with applied finishes, such as oil varnishes for woods, or electroplating for metals, to prolong their lifetime in order to continue aiding the user in their language education as long as possible. It is not desirable for users to use a product that will rot or decay in aesthetic after a few months, as that may affect the products performance (negatively) for them to use.	I should be trialling the finishes on its respective materials beforehand, and use different quality and control tests, especially compression, toughness and compression checks to see if the finish is reliable and repeatable when it comes to using them for the actual finished product.	<ul style="list-style-type: none"> Market research
Q2	The product should not damage the users personal items that are not associated with the product itself.	I must ensure the materials used have no splinters or open sharp edges that are exposed to scratching personal property, such as mobile phones, or other expensive technologies. This will include when the product is accidentally dropped or in harsh impact.	I will check the product thoroughly with each material used, to see if they are finished to the best standard, with no open sharp edges. Using mock items (not expensive), I will test it in different locations and vary them, such as a rough road or on a desk.	<ul style="list-style-type: none"> Market research

Spec No.	Specification Point	Explanation	How will this be measured?	Research used to this point
Q3	A high quality product should be minimising the risk of danger or threat to my client, in any given environment.	As I specify that my product will be interactive, it is essential that most or all materials and substances are used very well. This includes lack of smoothing down the sides of wood, or leaving exposed sharp edges that can cause the user to bleed. I stress the environment, in the fact that a rough surface, such as a road, should not cause damage to not just the product, but also the user if the materials fails to stop the impact.	I will account the stages of my manufacture of the product, to ensure finishes are applied thoroughly to guarantee the protection of the product and user. During testing, I will test them in more realistic environments to see if it is satisfactory.	<ul style="list-style-type: none"> • Product Analysis • Market research • Product Standards
A1	The design must appeal and attract the user into using the product as much as possible. It should be unique and personalised to the clients and other users' desire, compared with common existing products.	This means the form and finishes are crucial for the product, therefore acrylic paint, varnishes and streamlining are examples of what is necessary to pull the user into using it. The presentation from the outside from first glances should be put a statement to the products function – this should be giving off a better impression than existing products I have investigated.	I will use my clients to give their first thoughts from their views on the product. This will be supported by myself, to check that the colours give off a certain impression or feeling of languages. For example, a curved, crispy brown colours could represent a croissant, which is associated with France and French.	<ul style="list-style-type: none"> • Market research • Product analysis
A2	I must keep the form and shape of the product relatively simple and easy to recognise (and use) by all clients. The aesthetic may be related to the outside world, such as leaves or flags.	I should balance the form and function to where its not one sided. This means while the looks of the product may be appealing, I should compliment that with a long lasting, effective function. To help recognition for all my clients (of teenage years), colours should be included. By having a product that looks similar to a common object seen outside, the user can associate and possibly have a better immersion of the culture and language.	I will show more iterative design to my clients to receive feedback on which object, relative to the outside world, is liked the most. I will use inspirations from the internet or from outside that can be relatable to a country's language, and test the clients if they know what language the product is based on.	<ul style="list-style-type: none"> • Anthropometric research • Teachers perspectives • Language research
M1	Materials used in the production should be durable, lightweight and worthwhile, and able to withstand against different environments.	For a product to be effective and versatile for any given environment, the product should be tough enough to reduce the quality of the product from degrading, for example, rain not affecting a weatherproof material – this will reduce the changes of malfunction. As previously mentioned, the product should be easy to carry, so a lightweight material should be optimal so the client doesn't require a full force into carry the product around.	I may conduct a small practical researching on the types of materials – and I should use a wide range. I will must choose the most appropriate materials and sizes for the application, and use my clients to see if they are satisfied handling the material. This may be done by making them hold the specific material for a duration of time. I will do a materials research.	<ul style="list-style-type: none"> • Market research • Language research
M2	The materials to make the product should be easy to work with, and that most of these are available in the workshop.	Having a material that can easily be worked with saves an amount of time which can be efficiently used for other stages in the manufacturing process. It also allows me to reduce any difficulties along the production, as I can easily understand their property behaviour when fabricating or redistributing them. The easiest way of going round this is to use materials I have a good experience with, which is woods, as it will save time well.	I will try using a range of materials and understand their properties at work using different machinery, like pillar drills or belt sanders, to test if I can use it well to my advantage – which will be processed through to the development of my product.	<ul style="list-style-type: none"> • Market research
Env1	The product may include materials that are easy to recycle when the product is no longer useful – in order to protect the environment.	I could use these to prevent increasing the carbon footprint, or to save up on finite resources such as crude oil for plastics. It is important to reduce the landfill caused by one-use materials, as they can take several years to decompose. Recyclable materials are able to be reused again for a different purpose.	I will consider each material (and source) and their associated processes and evaluate if it's the most ethical choice to create the product. If that's not the case, I will have to look for a different material as an alternative.	<ul style="list-style-type: none"> • Product standards • Product analysis
Env2	The product should be versatile in use, where the client is able to study the language wherever they go.	My product should adapt to different environments, whether that may be in a busy train station or at home, so that the clients have a constant learning routine that is helpful and fun at the same time – this provides that immersion.	I must make my clients use it around with them for a time period (e.g. a day) and receive feedback on how well it works for them in every place they went to. I could ask them to try the product in the most extreme circumstances, like a dark or noisy room.	<ul style="list-style-type: none"> • Fluent speaker perspectives • Teachers Perspectives
C1	The product must be affordable for the users and clients, and it should have a profit. The price must not exceed what was bought to produce it.	This product should be inclusive, in terms of wealth, for all children who learn a language. Because most of them are jobless, the price should have to be listed low, but not too low to where I lose money. This will need to cover the materials that were used into making the product, but also items bought off the internet or external market, if it is necessary a functional reason.	I will have a separate document to accumulate the total cost off all materials and other external items that may have been bought outside the workshop to find a reasonable listing price that will achieve an appropriate profit. I can compare this evaluation to those existing products to see if the price is reasonable.	<ul style="list-style-type: none"> • Market research
T1	I must keep in track of time for all development stages leading towards the final product before the deadline date, using a Gantt chart.	The Gantt Chart will help me keep organised and aware of what needs to be done, from my next iterations all the way to the final evaluation and testing. I should not overlap stages and remain in a chronological order, so the outcome becomes more fluent and well thought out.	I must mention when each development stage is intended to be completed and compare it to when it is actually done using different signs. I could explain reasons why some tasks weren't completed in time to justify.	<ul style="list-style-type: none"> • Client interview • Client survey
P1	I should show a production timeline of my final product that may be used to scale at mass or batch manufacture – to fit the product for other languages like French.	The production of the product can be important if the product is deemed useful and efficient to serve the clients needs. This prototype can then be amended and improved to serve users that are learning other languages, in which investigation into each respective language will need to be done.	I will provide as much evidence in my production, which includes pictures and text to illustrate what I've done in each part. This may be used to compare to other existing products on the market to see if my process is valid for a higher scale of manufacture.	<ul style="list-style-type: none"> • Market research

Spanish Research

After looking over my clients and the languages they study, I found out that the majority of them study Spanish as a second (foreign language). I will conduct research about the language, to compare and link this to my English research. As mentioned in my specification, my product will focus solely on helping the clients learn Spanish, but can be interchangeable at production, to support other clients studying other languages, such as French or German.

This slide should aim to:

- Give general background information of the language
- Discuss the technical aspects of Spanish - sentence structure, verbs, etc.
- Understand the pronunciation at listening and speaking
- Evaluate what could be done to improve students in this language.



The Spanish language is spoken by 414 million people, most predominately in South (Latin) America, and including Spain itself. All of these countries on the left are those which Spanish is the official language.

It is also the 2nd most spoken language, behind Chinese Mandarin with over 1 billion speakers.

Other Spanish facts:

- Experts say the language can be mastered within 24 weeks.
- It is the most romantic language in the world.
- Spanish is the 2nd most studied language in the world, within 3 generations, nearly 10% of the whole population will be able to communicate in Spanish.
- The Spanish language has grown by 1312.4% over the last 15 years.

Spanish Pronunciation

Like English the pronunciations are phonetic, so as long as students can memorize the sounds of each letter, this can be applied to most, if not all, Spanish words.

Spanish Alphabet					
Aa a	Bb be	Cc ce	Dd de	Ee e	Ff efe
Gg ge	Hh hache	Ii i	Jj jota	Kk ka	Ll ele
Mm eme	Nn ene	Ñ eñe	Oo o	Pp pe	Qq eu
Rr ere	Ss ese	Tt te	Uu u	Vv ve	Ww uve doble
Xx equis	Yy i griega	Zz zeta			

It is recommended for beginners to hear the Spanish alphabet first before proceeding with words, which contains multiple phonetics.

The Spanish Alphabet, with literal pronunciations below each letter – notice there is a ñ.

There are some exceptions – they have a different and unique sounds when said:

- ll – pronounced similar to y, as in yo-yo.
- ñ – pronounced as n, followed by yuh.
- rr – sounds like a purring cat.

Example: Llenar (to fill)

Example: Año (year)

Example: Guerra (war)

The letters 'b' and 'v' are almost indistinguishable when said by Spanish speakers, but it will get used to by the learner – it may require them to spell it out first. Examples:

- Botar – To throw or bounce
- Vestíbulo – lobby, hall

The letters 'g' and 'j' can change pronunciation depending on the next letter that comes after it.

- Girar – to spin, but 'Gi' sounds like 'gee'
- Jirafa – giraffe, but 'Ji' sounds like 'Hee'

Letters beginning with 'h' are silent.
e.g. hora – hour, but said as 'ora'

Spanish Grammar (SPaG):

To advance through to more complicated forms of Spanish, it is essential they get the fundamental technical aspects of the Spanish language so it can be applied for those situations.

Declarative sentences:

In Spanish, the subject (in Subject-Verb-Object) isn't necessary, as the verb already directs the action to an object – words such as yo (I) will only emphasise. However, pronouns are needed if the object is not mentioned, just as in English.

- These subjective words are mostly put before the verb.

Spanish Subject Pronouns

SINGULAR		PLURAL	
1st person	yo	I	we
		nosotros	we masculine
		nosotras	we feminine
2nd person	tú	you casual / familiar	vosotros
		you casual - masculine	vosotras
2nd person	usted	you formal / polite	ustedes
		you formal / polite	ustedes
3rd person	él	he	ellos
		they masculine	ellos
3rd person	ella	she	ellas
		they feminine	ellas

Examples:

1. Compro manzanas → I buy apples.
 2. Yo compro manzanas* → I buy apples. (emphasised)
 3. Las compro → I buy them.
 4. Nos compramos* → We buy. (emphasised)
 5. Lo ellos compran* → They buy it. (emphasised)
- (*The subject pronouns agree with the verb)

Table 1. Affirmative and Negative Words	
Affirmative	Negative
sí (yes)	no (no, not)
algo (something)	nada (nothing)
alguien (someone, somebody)	nadie (no one, nobody)
alguno/-a/-os/-as (any, some)	ninguno/-a (no, no one, not any, none)*
o ... o (either ...or)	ni ... ni (neither ...nor, not ...nor)
siempre (always)	nunca, jamás (never, not ever)
también (also)	tampoco (not either, neither)

Gender nouns, adjectives and adverbs:

Nouns are assigned a specific gender, known as masculine and feminine, depending on the end of the noun.

These will affect the ending of most adjectives, (describing words), which can be placed before or after a noun.

- Feminine: -a (singular)/ -as (plural)
- Masculine: -o (singular)/ -os (plural)

Some adjectives end in -e or -es, which can be used on both masculine and feminine words.

Accents on words:

The 'on á, é, í, ó and ú is called a 'tilde'. For any word that includes them, they should be pronounced in a higher tone – some may even change the meaning of the word.

Punctuation:

Nearly all punctuation used in English is the same in Spanish, but exclamation and question marks have an inverted counterpart that goes before each statement or question respectively.

1. ¿Qué comes? – What did you eat?
2. ¡Cuidado! – Watch out!

Since my prototype will focus on Spanish, I conducted a basic research outlining the fundamentals of the language, mainly because my clients are on different levels of ability, so having this allows them to support their accuracy in the language from reading, speaking, listening and writing. There are many more aspects that I have not mentioned in this slide, which will be closely considered moving forward into the product development. All this information should be implemented to the design to allow a constant reminder for my clients and other potential user that may want to use the product for other languages.

Spanish Perspectives

Teacher's Perspective

I have asked a Spanish teacher from my school's modern languages department, about the most effective teaching methods, activities and possibilities to improve on the language for their students. These are the questions I have sent that's they have answered.

1. What teaching methods are the most effective for your classes to learn Spanish?

Speaking, role-plays, pair work – anything that encourages the pupils to use the language spontaneously.

Analysis: During my design process, I must consider the accessibility of the product - can the product work with two or more pupils at the same time? Or it could be that the product itself can actively communicate with the client, as if it were a real person talking or acting.

2. Do you hold any extracurricular activities for your students? If so, what sort of stuff do they do there and do you think it helps?

Trips to Spain as immersion in the language helps students to remember it. Also teaching it helps so our Languages Ambassadors go to primary schools and teach Spanish to younger pupils.

Analysis: I should consider if the product will be influential and worthwhile for clients and users to share their gained knowledge to external environments, such as talking to other people – in this case, the client that uses the prototype must be able to take something memorable from it.

3. What do students commonly forget or get wrong in Spanish? (in terms of speaking/listening/writing/reading)

Grammar is where they will slip up as they need to be accurate. Adjective agreements, accents verb conjugations, there are also commonly misspelt words in Spanish where they use a double consonant for example.

Analysis: I have already mentioned briefly about the grammar and spelling in the previous slide, however comparing this to my research, I should look deeper into nouns and other grammatical places where it is more vulnerable to students to mess up on.

4. What do you think are the main problems for students trying to learn Spanish?

They find listening quite hard as Spanish is spoken quickly.

Analysis: I could consider when designing, the electronic technology that may be incorporated that allows the user to listen to speech at a slower pace to adjust to their skill – similar to how Duolingo works with their language learning (refer to product analysis). It is important I need to allow the product to let the user speak and listen without difficulty – however it is very likely going to use technology that I have no experience with.

5. For each skill, what do you recommend students to do to maintain and gain more knowledge for learning Spanish?

Listen to and read as much Spanish as possible – we always direct pupils to the revision links on SharePoint as it's not enough to just read or listen to Spanish, you have to test your understanding by doing interactive comprehension exercises so you can assimilate new language more quickly.

Analysis: The product needs to be as realistic and immersive as possible, for example, having a schedule plan in the design to maximise the students potential towards learning. For example, one day can focus on videos to help on pronunciation, and the next day helps them focus on correcting their incorrect grammar and applying it to sentences.

6. How much time should students spend on a language? (For those dedicated and relaxed towards learning)

Little and often is better – a couple of short bursts of 20-30 minutes a day but it has to be every day and you have to review what you have done before otherwise you'll forget it.

Analysis: The product needs to be attractive, in the sense that the user comes to the designed product to educate themselves, and also sets a reminder for them every day to use the product – I may use phone notifications as an inspiration to engage the user to efficiently use it.

I will extend my investigation into Spanish by asking questions with experienced speakers, who have lived in Spain. I will use these stakeholders as part of the design process to focus on what content is required for my upcoming product to be as optimal as possible. I will ask a teacher for their 'teaching' views and a Spanish friend of mine for the grammar and accuracy of the Spanish language.

Fluent Speaker Perspective

As I am purely focusing on Spanish, I have asked Wisdom from my fluent speakers perspective slide, to give more specification towards how the grammar and accuracy can be improved to be almost perfect to normal speakers who live in Spain, as he did himself.

1. As a native Spanish speaker, what do you commonly say incorrectly in Spanish? (e.g. nouns)

Nouns are tough to get around as you try to say the name of objects, but it gets worse when describing it to people, so normally you have to use alternative words and ways to explain them. For example, it took a long time to say 'las cataratas del Niagara' (Niagara falls) because its was so hard to pronounce the first few times.

Analysis: It opens to me how relatable this language is to English in terms of approach. Nouns are not very tangible in English, as is with Spanish. It does infer that a step-by-step instruction is required to allow the person to speak the word as professionally as possible or else, synonyms will do.

2. How did you get used to listening in Spanish? What do you advise learners to do to improve this?

For me, the best way is to speak with other people. If you follow along a book, you only learn specific conversation, but when you speak with people you hear the accent, the way they say it including slang and you will just pick up on it – and so they can speak words in the same way native speakers do.

Analysis: I shouldn't rely using textbooks to help with the research and process for the final product, as it can go so far. But because of society changing the way the language works, I can use real people such as Wisdom to allow students to understand the modern style of the Spanish language, so they are more relaxed when speaking to people in real life with that sort of knowledge.

3. For writing, what do you look out for to ensure sentences are accurate?

I normally focus on tildes, it's hard as the 'comma' changes the pronunciation and meaning. I still don't know how to use it though.

Analysis: I can relate this issue as I used to learn Spanish, and has been mentioned briefly in the previous slide. I should look up the most frequent words where this issue applies, such as 'esta' as tildes on the vowels differentiate each spelling to each other.

4. How do you approach unfamiliar/new Spanish words to use for other applications?

I search these words to get the meaning. Online resources show those new words in sentences to help. I repeat this to myself in my own time. Then if I will try to make a conversation that will lead towards the word.

Analysis: I could create a few exercise ideas for students to look up unfamiliar words and follow the same process Wisdom gives as it clearly works for him, and so should for my clients.

5. From your experiences at Spain in classes, how do they keep up the accuracy of the Spanish language in general?

Every day and everywhere, they use Spanish. You go home, school, ask questions... they always speak Spanish. They understand what you try to say, even if its horribly wrong, so its nothing to worry. Attempting to speak in English in England is pretty much the same vibe as speaking Spanish in Spain.

Analysis: I should not restrict myself to make the client get everything they produce on paper or speech absolutely 100%. My design should allow some leniency to allow minor errors by the clients when using the Spanish language.

6. Any other ways to help perfect accuracy in the Spanish language? Do you suggest any websites or resources for learners to improve?

I suggest people using 'Babó', but you need to pay, but is actually good – it helped me learn new phrases quite frequently. You can use Google translate, however it's not that accurate, it a more formal type. Watching series or shows in Spanish will increase your language range and potential but I recommend for those learners to turn on subtitles in Spanish and English for guidance.

Analysis: I may do further product analysis on each of the tech-based apps. But he also shares the same importance as teachers about recommending movies or shows (with subtitles to start) to expand the clients Spanish ability.

This slide should aim to:

- Thoroughly explore and evaluate answers I receive by two different views.
- Question specific areas revolving the Spanish language.
- Provide guidance for second iterations and further processes.

esta / está
Esta: pronome demonstrativo feminino.Ex:
Será que **esta**. Elas ficou bonita em suas?
A forma feminina do pronome demonstrativo este é **esta**.
Será que **esta** palavrão recebe acerto na última sílaba?
Não recebe acerto porque **esta** palavra é paroxítona, ou seja,
sua sílaba tônica é a penúltima, "es".
Está: flexão do verbo estar. Ex:
Ele **está** segundo a página do professor Pedro Agora, por isso
esta recebendo dicas interessantes diariamente.
(terceira pessoa do singular - presente do indicativo)
Está muito calor. (verbo imparcial)
Está tu. (imperativo afirmativo)
Dicas de português

To conclude, one point that has been made very clear by both perspectives is that a client should not be alone when learning Spanish, and instead relies on other people, fluent or not, to help them improve. Time and dedication to learn Spanish using resources will also assist learners to expand their knowledge.

But it is very useful and more specific for my second iterations, to give me ideas. Using the 'teaching', I will explore different functions for the design as useful as possible, and Wisdom's perspective to fill in specific details on what should be included in every function.

Investigation Sources

Slide 4 – English Language Research

- <https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/english-language-skills/latest>
- <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/bulletins/migrationstatisticsquarterlyreport/february2020#other-migration-outputs-in-this-release>
- <https://www.theclassroom.com/problems-teaching-learning-english-language-7966496.html>

Slide 7 – Teacher's Perspectives

- <https://flashacademy.com/foreign-language-teaching-strategies/>
- <https://www.telc.net/en/about-telc/news/detail/tips-for-teaching-a-foreign-language.html>
- <https://elteacherjulian.blogspot.com/2011/08/5-biggest-problems-in-teaching-foreign.html>
- <https://blog.reallygoodstuff.com/simple-ways-to-track-student-progress-and-a-few-things-to-do-when-they-arent-progressing/>

Slide 8 – Fluent Speaker's Perspectives

- <https://blog.thelinguist.com/2019/12/10/how-long-should-it-take-to-learn-a-language/>
- <https://etoninstitute.com/blog/top-10-benefits-of-learning-a-foreign-language>
- <https://www.ef.com/wwen/blog/language/10-reasons-studying-language-abroad-better-home/>

Slide 9 – Market Research

- <https://www.thedyslexiashop.co.uk/teaching-aids-for-teaching-dyslexics.html>
- <https://www.joom.com/en/products/5c395b9428fc71010145a54d>
- <https://travelflips.com/>
- <http://www.translatorlife.com/product/products-1-65.html>
- <https://scrabble.hasbro.com/en-us/product/scrabble-game:FA04DD51-5056-9047-F5CD-53F87A967AC6>
- https://www.uncommongoods.com/product/foreign-language-blocks?clickid=1yI3FmRm1xyOTWDwUx0Mo3ERUkiwwzyViSWnRM0&irgwc=1&utm_source=Skimbit%20Ltd.&utm_medium=affiliates&utm_campaign=8444&utm_term=Online%20Tracking%20Link&trafficSource=Impact&sharedid=plioz.com
- <https://www.timekettle.co/products/wt2-plus>

Slide 12 – Anthropometric Research (may be moved to next section)

- http://mreed.umtri.umich.edu/mreed/downloads/anthro/child/Snyder_1977_Child.pdf

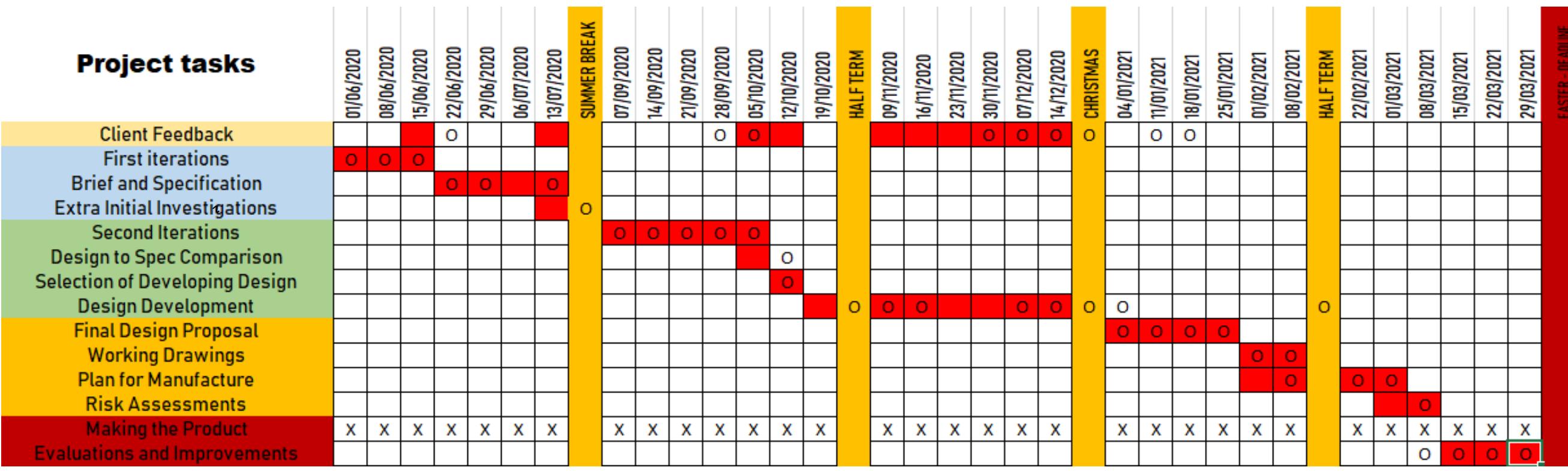
Slide 19 – Spanish Research

- <https://spanishlandschool.com/fun-facts-about-spanish/>
- <https://www.trustedtranslations.com/spanish-language/characteristics.asp>
- <https://www.fluentu.com/blog/spanish/spanish-sentence-structure/>
- <https://www.rocketlanguages.com/spanish/pronunciation/>

Gantt Chart

The Gantt Chart shows my progress of this project over time, for organisational purposes.

Project tasks



Deadline: 1st April 2021

Expected Completion

Actual Completion





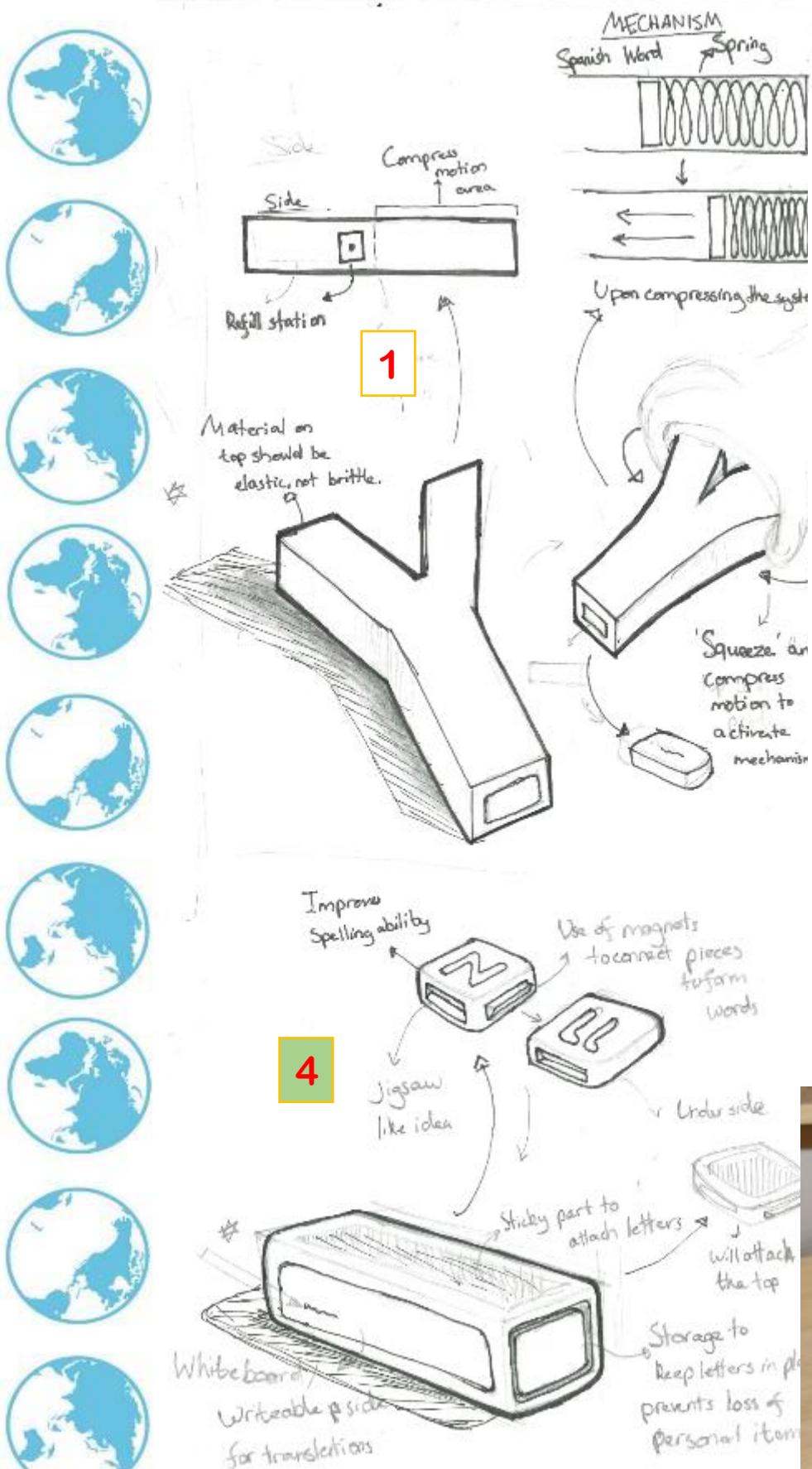
A Level Product Design Coursework

Mervyn Ochoa – Dugoy

Part 2 – Second Iterations and Developments



Second Iterations (Pocket items)



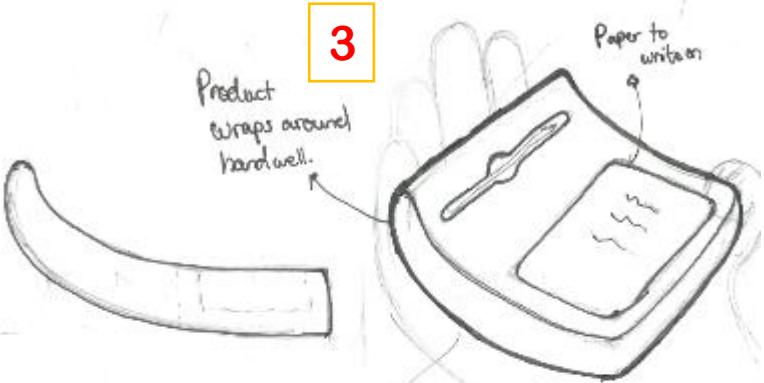
Of all the clients that gave me feedback, **design 2 and 4** were regarded as the best out of all the pocket item ideas.

Using the feedback from the first iterations and the specification, it has allowed my to narrow my direction of my physical product into 3 specific categories: pocket item, hand and wrist products. As mentioned in the brief, my clients would like to have a product that is comfortable and easy to use. By splitting these ideas into groups, I can model some of the ideas, and present them for my client to choose a final decision for further development.

Modelling Design 3



3



Modelling Design 4

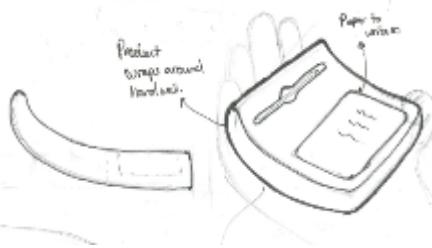


*Green means they are chosen going forward in this design process.

Modelling of Second Iterations (Pocket Items)

Design 3

This is a portable WordPad design. The concept behind the design is to allow my clients to write new Spanish words as they move in the outside environment. This would allow them to extend their vocabulary by picking up new words, while allowing them to be free and experience the culture in a Spanish speaking country.



In this model, I have demonstrated the placement of the Word Pad on a flat surface allowing the user to write comfortably with a strong stable support underneath. If considered as the final design, I will have to consider a tough and hard surfaced material to be written on.



Functionality:

Following the mechanism I planned out, I focused on the drawback system for the client to retrieve full written paper. In the end, it was successful to pull paper out, but it would be more desirable to push paper it back in without using an extra hand. A tray system would be best at this.



Client feedback:

Positives

Negatives

Comments:

✓ The curved end gives an advantage to hold the product in one hand.

X The pressure applied downwards when writing on the pad could possibly break as people can press write very hard.

✓ Small and compact, its very easy to bring alongside you, especially if you are in a foreign country.

X It is not easily recognizable, as my clients saw it was more of a waiter's notepad or shopping list.

✓ Equipment is set up ready, no need for extra material, unless it is paper, which is easy to access.

X The product is unlikely to help with the development of language skills (Listening, speaking)

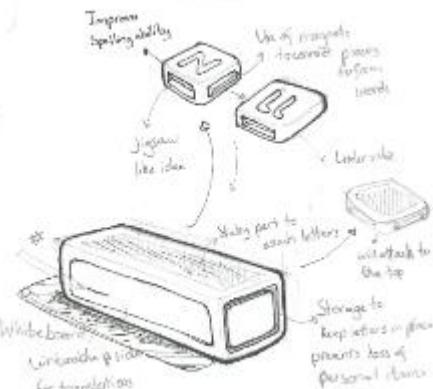
Following my specification, these points I have covered or not done well in this design:

- ✓ F1, F3, E1 and A2
- X F2, U1 E2 and A1

I may have focused too much on the ease of use and aesthetic of the product with the curved shaped idea, without taking into account the main functionality of teaching the client properly. From my clients, they didn't get the picture clearly of what the product is for, as mentioned in the negatives. I realised with the feedback that this product would fit more for a student living abroad, as my clients are between 12-16 years of age, and they do not desire to go abroad at this time, this product will not work for learning purposes.

Design 4

The design here is a multi-functional, portable learning aid, in which size is relatively similar to wireless speakers, specifically from Beats by Dr Dre. The design features a whiteboard and paper section, tiles of custom words or letters and a speaker with all primary functions (pause, play record, etc.) allowing the client to improve on all aspects of Spanish – reading, listening, speaking and writing.



Functionality:

There are 3 faces of this design, each with a function:

1. Whiteboard/paper display – the client can write on its surface for temporary or permanent writing. The paper can be refilled so clients can bring it with them elsewhere for learning.
2. Sticky tiles – a Velcro layer allows clients to stick mini tiles on top, to spell or connect pieces to make a sentence. These tiles are editable to the clients desire.
3. A Bluetooth speaker – clients can record their voices and play them via mobile device. They can also rewind, fast forward, play or pause.



Ergonomics/User:

The model is to scale, and can be held comfortably around the palm of the clients hand. The hole is a space for the tiles to be stacked up, but also for pencils and stationary as a possibility, as the depth is long enough to fit those sort of equipment, having it tested with my clients. For this reason, the client won't need to worry, as the stationary will be ready for them to use.



Client feedback:

Positives

Negatives

Comments:

Following my specification, these points I have covered or not done well in this design:

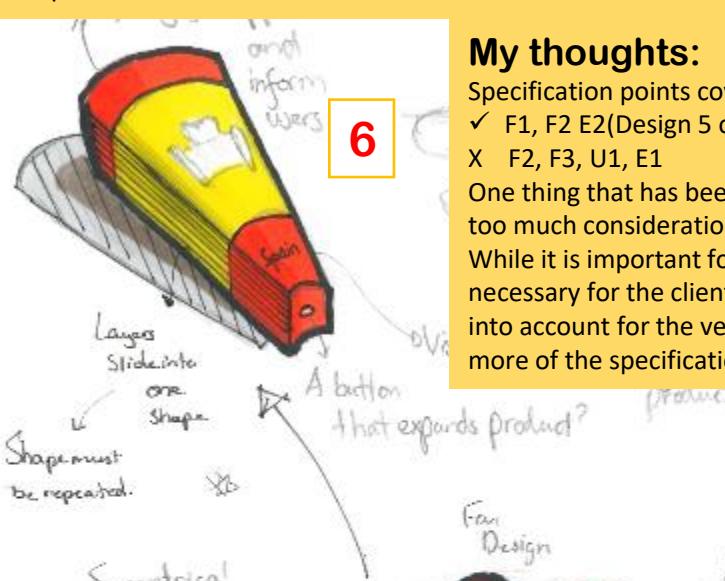
- ✓ F1, F2, F3, E1, E2, U1, Q2 A1 and A2
- X C1 and P1

The design overall meets all of the major points in my specification, but does leave problems in regard to production costs and manufacture itself, as I have no experience with electronics. On the good side though, the clients were heavily satisfied, that they could use it to their pace and said it is unlikely they will be bored if it were real. This design will be considered.

Second Iterations (Hand)

Pros:

- All designs are simple and easy to understand.
 - For design 6, its very recognisable and likes the idea of a retractable design, which they could see that helpful for storage in claustrophobic areas.
 - The clients all agreed that the concept behind Design 5 is able to help them improve in all aspects to improve their Spanish ability – listening, speaking writing and reading.
 - My clients liked that Design 5 is pair work which can support each other's personal development by peer marking – allows client to receive feedback on what is good and what needs to improve.
 - Designs 6 and 7 show easy access to translations of Spanish words.



My thoughts:

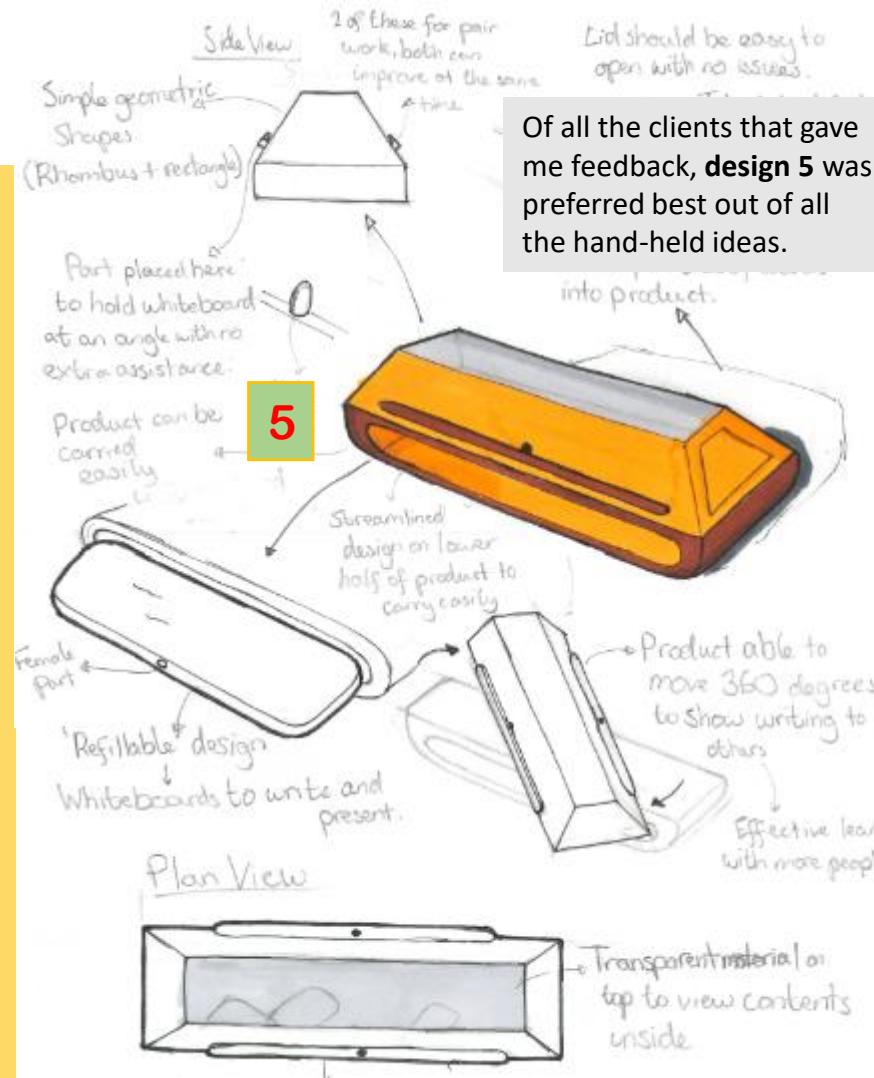
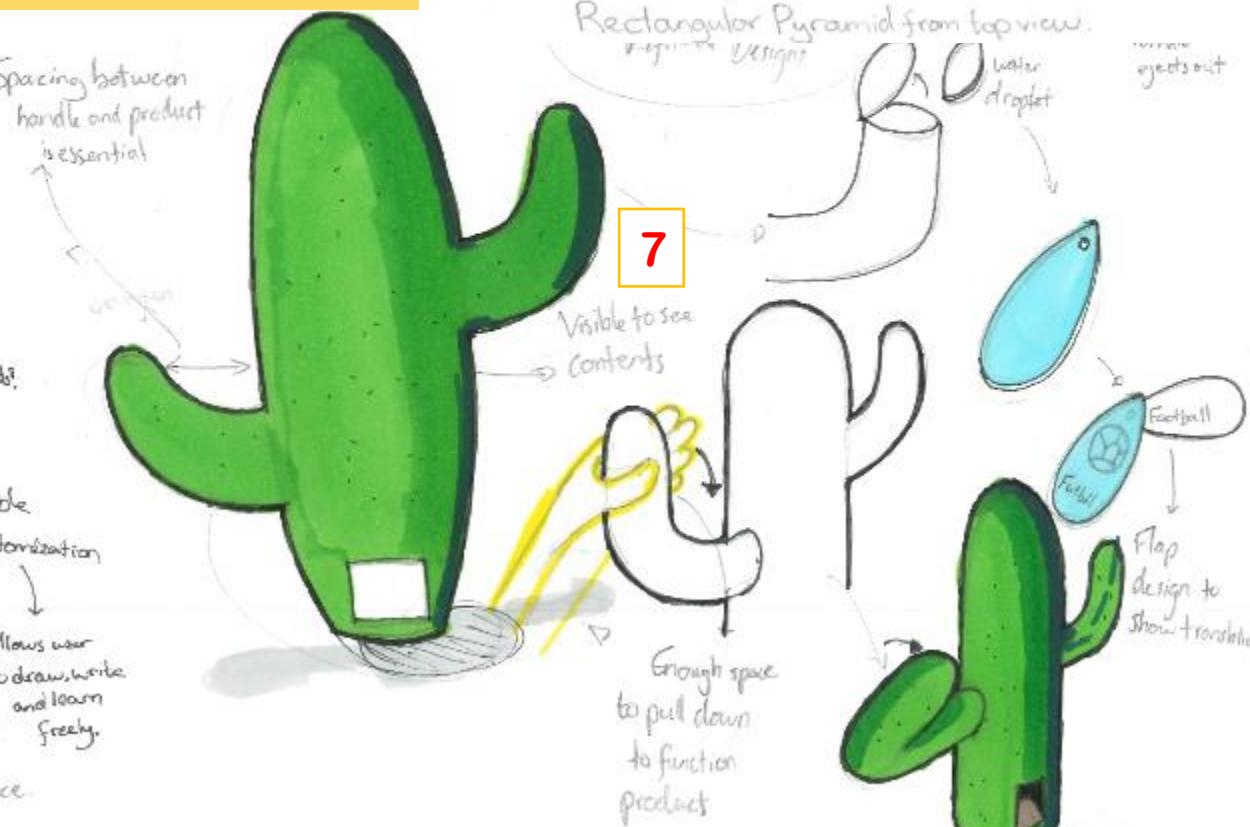
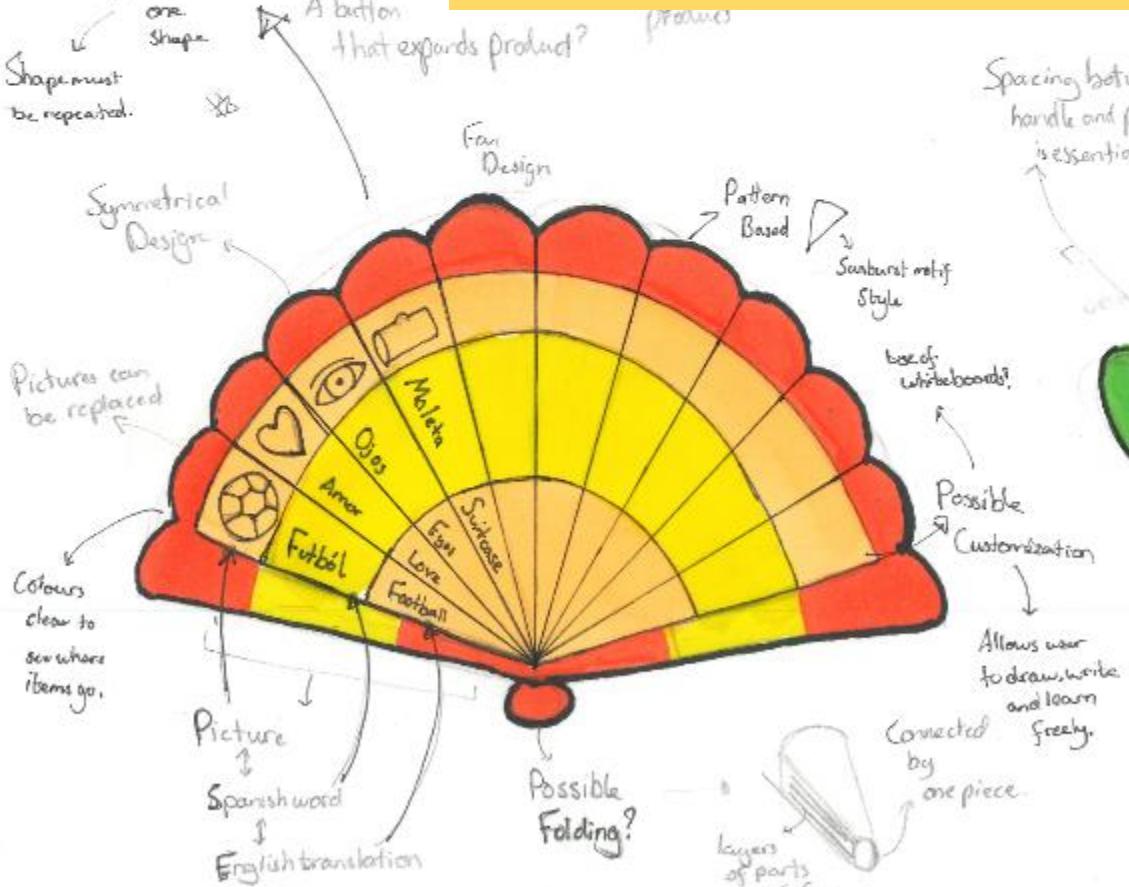
Specification points covered/not covered well:

- ✓ F1, F2 E2(Design 5 only), A1 and A2
 - ✗ F2, F3, U1, E1

One thing that has been set quite clear is form over function, which means I took too much consideration on the designs looks than its purpose and function. While it is important for me to consider the aesthetic, the function is absolutely necessary for the clients to work effectively with them. Design 5 will be taken into account for the versatility of teaching and personal improvement, as it hits more of the specification points than the rest in this slide.

Cons:

- Designs 6 and 7 can be repetitive after several uses, and that it doesn't improve any Spanish literacy (SPaG) other than nouns – so they're not teachable.
 - All designs face the cost of the tokens being lost, as they are not directly attached to the designs.
 - Design 6 and 7 also do not prioritise improving Spanish through speaking or listening, the clients would only read, and if ever write a sentence about the words given.
 - Design 5 is aesthetic enough to show the purpose of the product, the clients would desire some outside text to help understand the product's functionality.
 - They mention that design 7 would be awkward to carry if it were a real product, and its stationary.

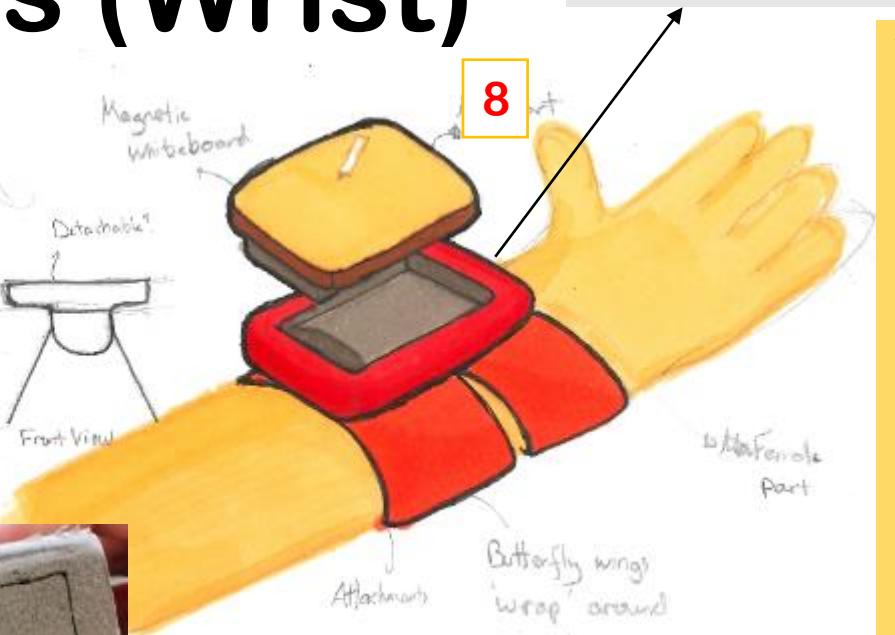


Of all the clients that gave me feedback, **design 5** was preferred best out of all the hand-held ideas.

Second Iterations (Wrist)



Of all the clients that gave me feedback, this design (8) was regarded as the best out of all the wrist ideas.



These designs were prioritised with the ergonomic factor of 'easy to carry', with easy portability. I have discussed these with my client and this is the summary of the client feedback:

Pros:

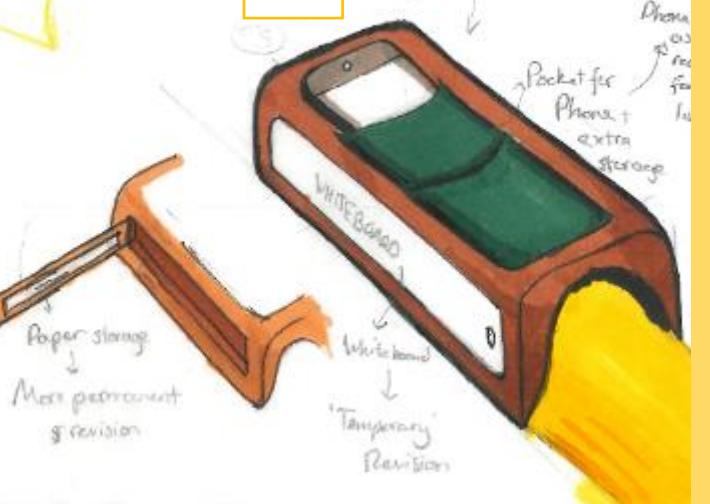
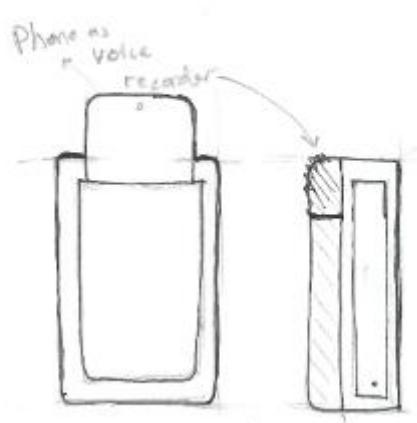
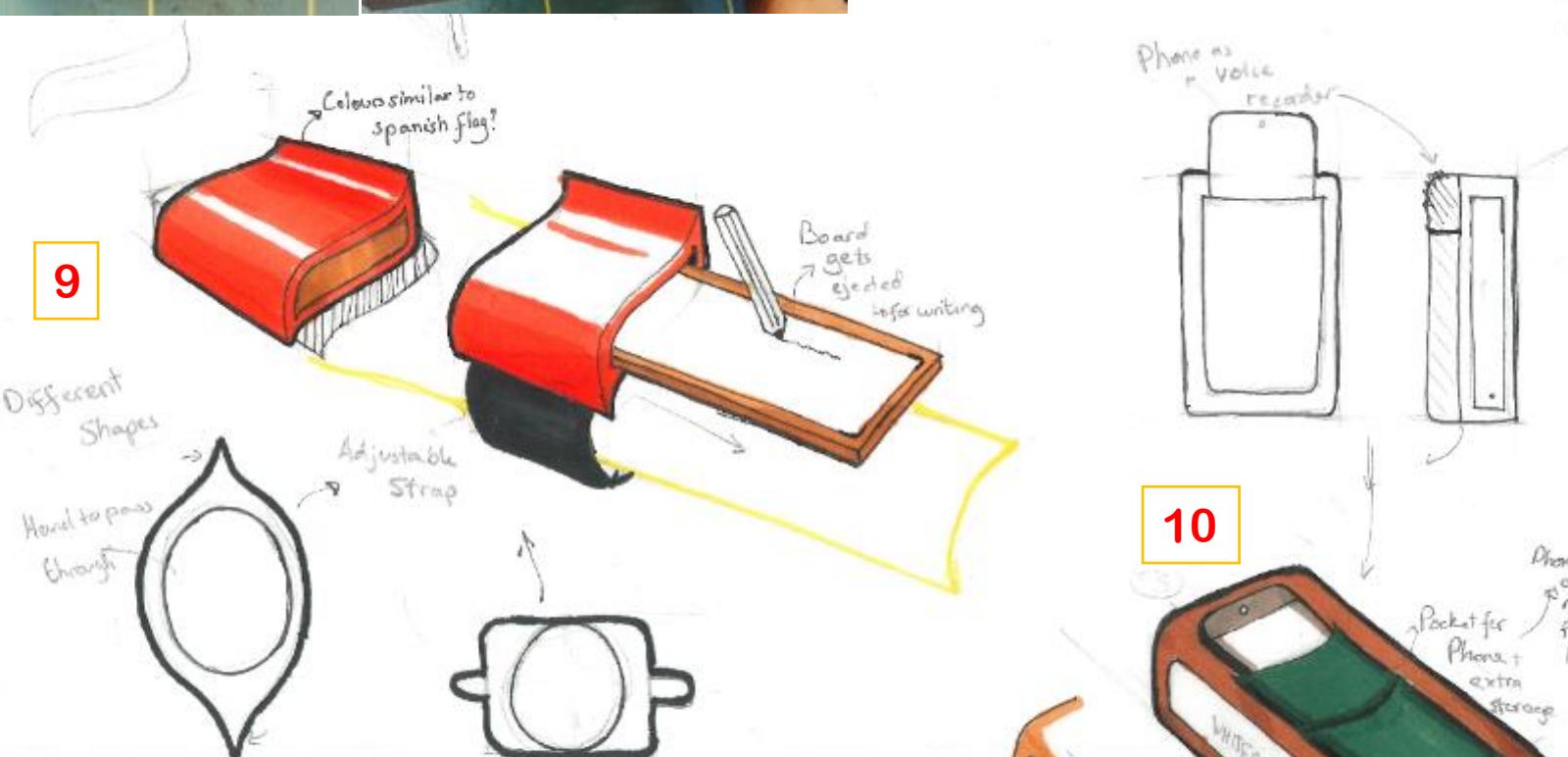
- Design 1 has a magnetic feature, so the attachments help secure it from being lost.
- The general idea of the wrist allows the client to have the product with them on-the-go, and is unlikely to be lost.
- They design may be allowed in a school environment, but only to an extent, which can help with access to material.

My thoughts:

Referring to my specification, these points I have met with the following designs:

- ✓ Function – F1 and F3
- ✓ Ergonomics – E1
- ✓ Aesthetics – A2 (A1 partially met)

While the concepts behind each design remains similar, they are all quite simple and recognizable as they can be related to a watch, but more interactive, especially in the writing aspect, which I aim for the client to do with the product in the end.



Cons:

- Designs 2 and 3 have written aspects that are uncomfortable when they are withdrawn or retracted. They have poor structural stability if pressure is applied to the product when writing on its surface.
- My clients would prefer the stationary embedded into the design, in case they might not have the equipment externally.
- For design 3, the phone can cause the product to be top-heavy and gives a high risk of personal property being damaged, if the product is facing downwards.

My thoughts:

Specification points that were not covered well:

- X Function – F2
- X User – U1
- X Quality – Q2

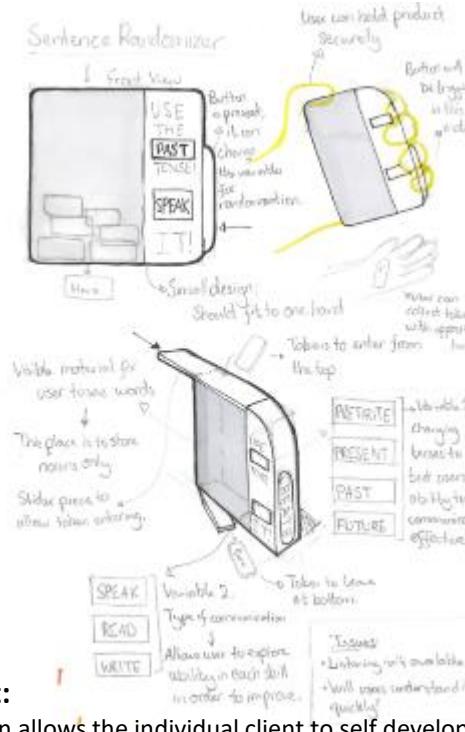
I feel it an absolute must that the product must be able to 'teach', in respect of broadening the use of language, rather than just fetching new words from the outside world without knowing how to use them in a sentence. This could potentially make them bored, as the only function is to write, and not listen or speak, which are also main aspects of learning Spanish.

In comparison to all other possible design routes, the wrist designs will not be taken into account going forward because it is impractical in teaching my clients the way to learn Spanish, such as speaking new words in different tenses to friends. Furthermore, it sounded reasonable by my clients that the concept was generally unrealistic, for example, having a writing pad that would more likely be uncomfortable to write on because of poor balance.

Chosen Second Iterations

These designs were chosen with a green box.

Design 2 – Sentence Randomiser



Concept:

This design allows the individual client to self develop on the spot. It will test and help them with each aspect of learning Spanish, from speaking, writing and reading. The whole shape of the design is inspired by Tic Tac - a small, easy to bring product that everyone wants to take the mints out.

Main functions:

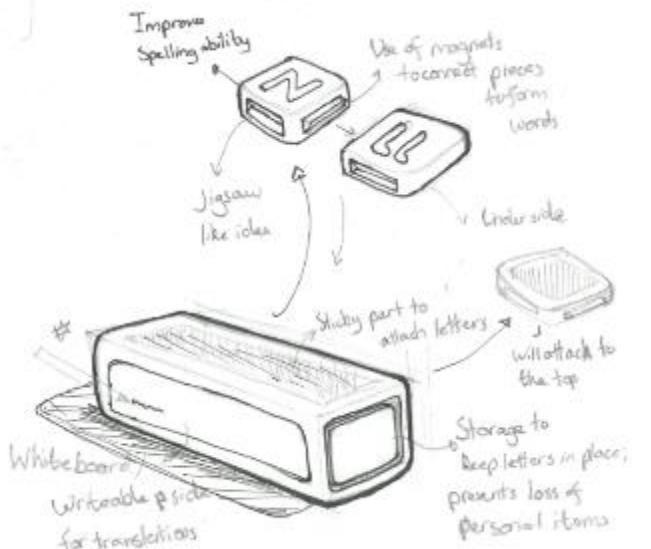
- A button on the side can be pressed, activating a mechanism to randomise the two variables and release a noun.
- The two variables are categorised: Tenses (past, future, present, etc.) to improve their overall literacy, quality and accuracy of language, and Skill (Listening, reading or writing), to help communication skills.
- Clients can insert paper of Spanish nouns, e.g. hamburguesa, tren, biblioteca, that they learnt from their lessons and gives them a subject to talk about.

Positives

Negatives

Positives	Negatives
✓ It is RNG, so not one skill is disadvantaged against the others to allow better communication between the client and other people.	X It does not improve the skill of listening, as it is unlikely for a second client to help assist and improve your communication skills.
✓ It is small and compact, and aesthetically appealing. My clients would be intrigued to use it over and over again.	X The product is small, so that could lead the possibility of the product being lost, so the aesthetic should also be memorable for the client.
✓ It adapts well to the pace of learning, clients can input new words that can be tested on to improve the adaptation of language.	

Design 4



Concept:

Inspired the ideas of portable, wireless speakers, the design is intended to use a mix of physical and technological learning to develop the clients ability to learn Spanish. The design has three sides that provide support for the client, from spelling tiles to an interactive speaker with voice recording.

Main functions:

- A writing side consists of a whiteboard that can be written on for temporary use, mainly for flash learning and revision. For more permanent writing, a paper layer is behind the whiteboard to store words that can be taken out after its filled.
- A sticky spelling – clients can spread tiles out to form a sentence or spell out a word. These tiles fit inside the hollow shape and can be edited to the clients desire.
- Bluetooth speaker – the client can link their device to the speaker with playback for clients to adjust to the speed of spoken language.

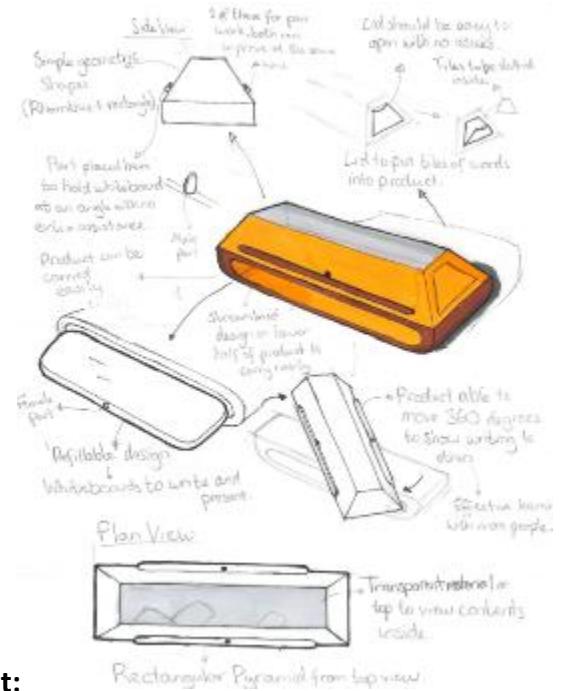
Positives

Negatives

Positives	Negatives
✓ The product can link to mobile phones, and the potential use of technology makes clients want to use the product more.	X The production of the product will be expensive if taken forward to bigger production.
✓ It definitely will improve all aspects towards learning Spanish, especially listening, which is hard to access without distraction.	X Using Bluetooth will require charging or constant replacement of batteries, and could be dangerous.
✓ Equipment can be stored there so the clients will not have to worry.	X The editable tokens could be lost as its not directly attached to the product.

This slide will show the designs that I have chosen, with support of client feedback, in which I can decide ultimately what route to take for development and then the final product. Having compared each design to each other and the specification, these designs are shown here to show the concept to help me choose what will be optimal for my Spanish-learning client moving onwards.

Design 5



Concept:

The tank shaped design is similar to Design 2, but it more suitable for pair work, which allows dual improvement and help improve each other simultaneously to improve the quality of the Spanish language, provided with each others knowledge and ability. The design can be used to select certain topics and skills, unlike Design 2.

Main functions:

- The pyramid shape is rotatable to spin and present your learning to the client opposite. It is also a storage for Spanish nouns, verbs and other literature.
- The lower half is made to store the whiteboards that are used to present with the little male/female parts. It can be a point where it can be held for ergonomics.
- Different shaped tiles will indicate the type of language – one shape can be specifically for tenses, another shape can be for nouns, and the rest can be made of paper.

Positives

Negatives

Positives	Negatives
✓ The clients loved the idea of co-productivity between each other to help them improve to see what is right and wrong.	X It is not aesthetically appealing, and it is not easy to recognise the product quickly. It could use ideas from Design 2.
✓ The different shaped tokens makes the idea clear for the client to choose and select depending if a particular quality of language is lacking.	X What if the whiteboard completely takes the space for the hand? Will the product be easy to handle from another part of the product?
✓ It is adaptable to learning, so teachers and students can use the product, so the age range isn't limited.	

Design vs Specification

Comparing my design to the specification will be essential to pull out what aspects have been met or not, but it can also provide missing gaps in the specification that need to be added or removed due to the change of direction in design choices. I will justify most of the designs with what I believe, should be considered for development.

Spec No.	Specification Point	Design No.			Justification
		2	4	5	
F1	The product function must be interactive and easy to recognise for all clients and users between 12-16 – there should be at least one physical action.	Yes 8/10	Partly 6/10	Partly 7/10	All of the chosen designs will require the client to use their hands to activate a certain mechanism or electronic function in response to help them learn Spanish. However, the clients struggled to understand at first glance, which means I should consider adding text or signs within the design to guide the user where and what to do at specific areas. Design 6 was the easiest to understand because of its text.
F2	The product must use successful (and familiar) teaching techniques used similarly to those in classrooms, to allow the Spanish learner in focus of studying well.	Partly 7/10	Partly 5/10	Yes 9/10	From the 3 designs, design 5 for me was the most teachable due to the setup of the whiteboards and presentation already in place for the clients peers and friends. From a beginner learner in Spanish, design 4 with the ideas of the spelling and word tiles is a fun interesting way to assess the clients ability in quality of language, however, there is no second person who can comment on the individual, if they got it correct or not. A teacher-like experience should be in place of the product.
F3	The product may be 'refillable' or require a continuous replacement of material to extend the useful lifetime of it for my client.	Yes	Yes	Yes	The main materials that will suit this point are whiteboards and paper. Using whiteboards (and pens) I find really useful as a way to temporarily present your learning to be judged. Paper is more permanent way, which can be put in and out of the design to the clients desire.
U1	The products outcome must leave the user satisfied and motivated to pursue learning the language (for as long as possible).	Yes	Yes	Yes	The design should not be repetitive as it can make the client bored, completely annihilating the fun aspects of learning Spanish. The idea of randomising makes the experience more enticing, as the client may be thrown into a surprise, which can motivate them to push themselves as a way of self-improvement.
U2	It should guarantee safety for the clients, to prevent any serious risk of injury. It may show safety signs to help the user identify the certain risks that are potentially in place.	Yes	Yes	Yes	I will have to factor in later in the design process the types of material that will be associated with final product. As mentioned, it must be portable, so a material testing should be carried out if certain ones will give the client more stress than others. Though it is unlikely, safety signs such as warnings against exposed wires should be presented to the client for guaranteed protection – take into account, design 4.
E1	My product must be small, and easy to carry by my clients and all children between 12-16 years old. The product should not exceed 350mm on all sides as it should not be longer than the clients elbow to hand length.	Yes	Yes	Partly	While I have no certainty of the exact dimensions of the product, I must aim to reduce the size to make it easy to hold while maintaining the primary product functions. It could be that there is a point around the product where it can be gripped properly around the hand without going loose or damaging the user or the product itself in the process. With the age bracket, there is a tolerance with having heavier materials, but only to extent, or else, it won't be ergonomic in terms of comfortability.
E2	The product must be able to differentiate between the full age range of 12-16 to allow them all to learn at their own rate based on their personal ability.	Yes	Yes	Yes	The final product has to be versatile; allowing all types of clients to study at their own pace, whether they have just began learning the fundamental of Spanish, e.g. the -ir/-er/-ar verbs, to clients with several years of exposure to the language, where they are reliant on studying from whole paragraphs. In terms of my chosen designs, a common aspect between them is the allowance to add or remove phrases or words based on current learning, useful if the client is working between modules of a course.
Q2	The product should not damage the users personal items that are not associated with the product itself.	N/A	N/A	N/A	This point is irrelevant for the chosen designs as none of them have a storage for expensive items, such as mobile phones or tablets. This point is primarily toward the wrist ideas, but they are not brought forward. The only personal items associated to the product across these ideas are pens and rubbers – they are cheap.
A1	The design must appeal and attract the user into using the product as much as possible. It should be unique and personalised to the clients and other users' desire, compared with common existing products.	Yes	Partly	Partly	From the form and shape to the graphical text of the product, it must be designed in such a way it doesn't present 'form over function' which often will confuse the client. By means, it is more aesthetic with less purpose. While the aesthetic must be engaging and persuasive to be used, the functional part of the product should be considered first. For example, design 5's tank shape didn't appeal, but the functionality remains popular for the client to be interested in, whereas design 2 was styled to Tic Tacs, the client could see it as if taking parts of the product out.
A2	I must keep the form and shape of the product relatively simple and easy to recognise (and use) by all clients. The aesthetic may be related to the outside world, such as leaves or flags.	Yes	Yes	Yes	The idea of simplicity should be used. Using simple geometric shapes, like circles or squares being used, and the way they are particularly portrayed should be eye-catching to the client. However from my second iterations, making an exact replica of an item commonly known in Spanish speaking countries makes it hard to include all the main functions to make it a visually and teachable product. Examples include the cactus and fan design in the Hand iteration slide.

In this comparison to my specification, I solely focused on 5 aspects of the design: function, user, ergonomics, quality and aesthetics. From all my specification points and my justifications, there some points that will need amending because of how broad and unspecific it is towards development. These specifications include: F3, U2, E1 and A2. Also, I have seen that Q2 has become irrelevant moving onwards, as it has little or no significance towards the direction of the final product, as I intend to not risk damaging expensive items, such as mobile phones. The justifications have left gaps where certain aspects of the final product will need more specification points, including the function and the user. All other points not mentioned in this slide will be justified later in the developments, to see if it fits with the direction of my design.

Development Plan

Functionality:

Currently, the function is located mainly at the upper part of the product. I will need to consider and develop current individual functions and test it with the client. I will mainly develop these by hand, and if necessary, move towards a CAD model to test each function, as this aspect of the product must meet my clients needs. In order of development, this will be the first in line to finish, so I know how to fit all functions into the shape and form of the final design. Some of the functions to consider, with the given concept:

- Allowance of seeing peers work
- Lock and key system with whiteboards
- Accessibility to adding and removing content inside the product safely.

Aesthetics:

This falls 3rd in line of development, as the aesthetic will depend on materials and functions of the final product. Some materials may not be appealing than others, and the function needs to fit into the product without collapsing, or else the product is useless.

I should follow the updated specification so that the design meets those points.

Client feedback:

I will have to continuously communicate with my group of clients throughout this development and update them on the changes and amendments, so that they can see and possibly test the product for essential user experience. I am restricted due to current conditions (COVID-19) so I should transfix the developments for one or two people.

Development – Teaching methods:

My main mechanism relies on the top half of the product where the teaching content is made. I will refer back to my investigation with my stakeholders to provide sufficient teaching methods and see what fits best towards the final product. The randomiser is set as the base concept at the moment, which can be changed and thought through.

I have chosen this design and its concept for further development. This is not the final concept and form, so I will use this slide to outline what needs to be developed or manipulated to optimise with the client and compromise with the specification as best as possible.

Materials:

This will be 2nd in line for development behind the function. I will aim to find suitable materials for the necessary functions, as well as the materials that form the full shape of the product. As mentioned in the specification, it must be easy to carry and portable for all ages between 12-16 so that the risk of injury from stress holding is minimal. A series of material testing will be carried out, ideally hardness and toughness testing, carried mainly in the workshop. Some materials in consideration are:

- Whiteboards (melamine sheet with chipboard, etc.)
- MDF
- Resins (epoxy)

Feasibility:

- I should self test models for aesthetic of functionality, before it can be processed to the clients.
- These clients must always provide client feedback if things need re-iterating and developing.
- Refer to the specification to see if each aspect has been met in my design and evaluate thoroughly.

With these, I should allow a time plan, when and what to do at certain times leading towards the deadline for the whole development.

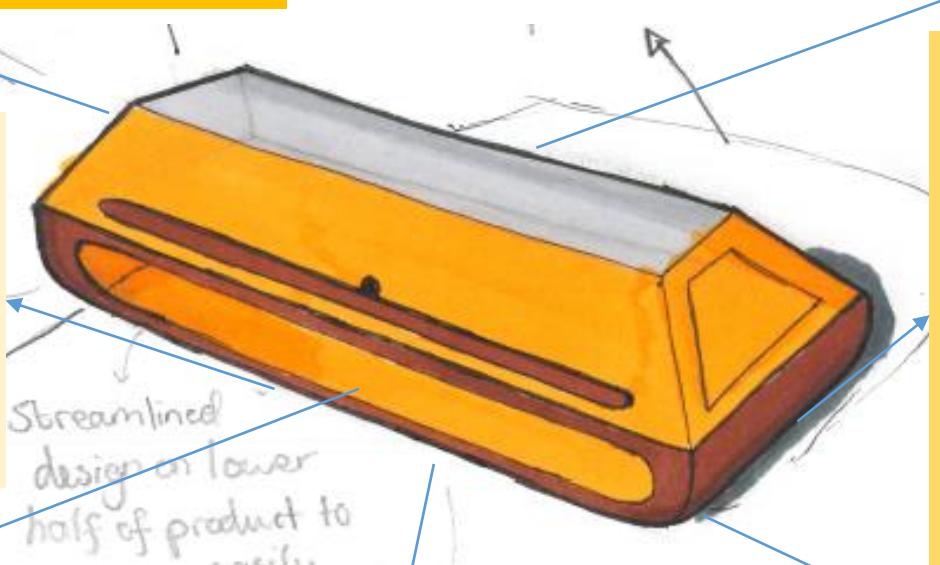
Scale and sizing:

Alongside the aesthetics and function, I should include a slide with necessary anthropometrics to restrict the sizing so that it corresponds well to the user in terms of ease of carrying. Full scale models must be made to present a more realistic and proportionate view of the product for clients to feedback if it suits them well.

Order of development:

1. Functionality and Teaching methods
2. Materials
3. Aesthetics, scale and sizing

Over this period, I will keep track of time, feasibility and constant communication with the client.



Specification Update

These next few slides will update the previous specification, so that it is more specific towards the final design choice from the second iterations. Noticeably, there will be more functional and user based points to meet their desires and requirements, as some points before are now 'outdated' to the final product.



Spec No.	Specification Point	Explanation	How will this be measured?
F1	The product function must be interactive and easy to recognise for all clients and users between 12-16 – there should be at least one physical action.	This can be as simple as pressing a button to release the inside of the product. It would be more beneficial for the client to be more immersed in the language, as it will improve their general writing, reading, speaking and listening skills, which has been emphasised from the beginning of the language research.	During the development stages, I will be asking my clients to test the product. If they are able to 'activate' the product physically and in within a decent amount of time with no assistance, then it can be considered as a pass.
F2	The product must use successful (and familiar) teaching techniques used similarly to those in classrooms, to allow the Spanish learner in focus of studying well.	It is important for those clients to continue learning and maintaining a foreign language as best as possible, so using techniques used in school, such as whiteboards (for temporary showing), and flashcards give that school environment feeling. This should be complimented by applying that knowledge in the outside world; to communicate with others, close to the client.	I will be testing with my clients to see how efficiently they use the product and its contents, in which I can make them leave a review on what they learnt coming out of the product. It may be also helpful to spectate what they done during the use of the prototype to see how well it corresponds to their learning.
F3	The product should freely rotate 360 degrees to allow ideas and learning to be presented using whiteboards or a temporary writing surface.	The 360 motion should be produced using a mechanism that begins with an input produced by the user or client. This will affect the upper part of the product, which I intend as the presentation, but the rotation will be most effective depending of the materials weight and tolerance that the rotation can hold without breaking the product itself.	I will use CAD (mainly Autodesk Inventor) and possibly 3D print the possible prototypes to process through and evaluate the effectiveness by testing. I may add different materials to attach to the rotational pivot to see how well it can rotate, which will be finalised at the final design.
F4	A successful storage system could take place in my product, to allow the user to keep organised with equipment in place for them, ready for learning.	In general, it helps the user keep tidy and stress free worrying about losing the items, as located in one place. I intend to put this system at the lower half of my developing product, but I also want to use the space at the bottom as an area to hold or grip the product.	I will first design the storage system and comply this to the overall aesthetic to the product, where the function agrees with its looks. Then afterward, I could consider area of contact where the human hand can support the carriage of the product, and test these with the clients.
F5	The users could be given flexibility to manipulate the product by editing, adding and removing items associated with the product such as tokens to help widen learning ability.	I would like the user to choose what they want to revise or recap from the notes they received or taught from the lesson they had in school. This can be done by styling out token shapes to indicate what skill needs to be achieved, including tokens that can be taken out and put into the product for selection if the user decides to add a certain noun or verb into the mix to enhance their learning experience.	I will carefully design the token shapes using CAD software, most preferably 2D Design to laser cut and add a writable surface so the product can be written on without damaging the token permanently. Due to this, I will need to consider briefly the correct material for this application, and decide with the help of the client if the shape and overall token is acceptable leading towards the final product.
U1	The products outcome must leave the user thoroughly engaged, satisfied and possibly motivating them to pursue learning the language (for as long as possible).	This means I must consider the function of product to appeal to the user as much as possible. The best way forward to meet this is a game, as research shows that it is the best form of entertainment. I should also be considering the aesthetic of the product, that not only attract the client to using it, but the form may represent the origins of language, for example, the bracelet design.	Like the client survey, I can give a small review sheet that will include how content they are with using the product. I could judge by eye when giving the developments to the clients to see how well they feel during their use.
U2	For the majority of the product, the user should be able to recognise and use each separate function so it feels like muscle memory for them.	This will link to the aesthetics because the product may have indications on what input should be done towards the part of the product to make it work in their favour for learning. For example, having arrows show what direction of movement the product should rotate. By keeping functions simple, it will be easier for the user to understand without extra support.	For each development, I will try to test each one with the client. If each one is viable, and towards the final design, I will test again if they can remember the exact function. It maybe be helpful to regularly test the product to the user to see if they did not forget what functions caused parts of the product to work – every 1 or 2 weeks, etc.
U3	There should be a companion simultaneously learning or assisting with the user to guide them in peer-assessment to critique or appraise their learning.	From my 'Spanish perspectives', the teacher I interviewed recommended the user to be with a second person, whether it is a classmate or the teacher to assist them to improve their Spanish skills. They stated as well that pair work was the most ideal way to learn, as it helps with immersion with the Spanish language.	During the final product, I will ask the client to bring a partner with them, ideally someone who's in the field of Spanish, and evaluate the product working alongside the two. The evaluation process will include the volume of communication and independency of the learners.
U4	The user should be safe using it with no state of emergency or danger, ensuring that the product does not harm them or their properties due to material, functional or ergonomic choices.	Factors I should consider during the development of this final design are the weight of the materials I choose, so that it doesn't overwhelm them to injury, as well as the possible use of electronics, such that the exposure to live wires should not occur to keep the user and client safe. The ideal end product should ensure the user is safe and comfortable around it.	For myself, I will carry out the material testing to choose appropriate materials that will support the whole product, from gripping to holding with base of the hand, and many more anthropometric parts towards the material. This will co-productively see if the ergonomic factor is suitable, so that the client and users will experience what I had during the test.

Spec No.	Specification Point	Explanation	How will this be measured?
E1	The product should be easy to carry around any environment by users and clients aged between 12-16 by having a good grip or holding motion to carry the product. It should not exceed 250mm on any sides (length/width/height)	My product should be relatively easy to bring around, from the clients' desk at home, to a classroom at school, hence the material choice will be crucial to optimise the ergonomic performance and experience for the user without risking any threat of injury or strain on their muscles – specifically muscles related to the arm and hand as they are the main point of contact of bring the product around.	I will test it with my clients, from the youngest to oldest, to see how easy it is to hold the product. Anthropometrically, I will see how far the product is from their hand to their elbow – if the products length exceeds this, I must reconsider its size until suitable for them. Material testing should be considered, by weighing density and overall weight and compare to the ease of holding it with the client.
E2	The product must be able to differentiate between the full age range of 12-16 to allow them all to learn at their own rate based on their personal ability.	The product should not pressure them to learn forcefully to help educate the user for a staggering amount of time. Instead, the leniency lies upon them. It would most likely be that the older clients and users will spend more time on Spanish than younger years, as they haven't dug deep, and still finding a potential language to learn.	I will test among my clients to judge their satisfaction towards the prototype. I will thoroughly check the efficiency of the product and how much it reflects for the clients, which is important for them to gain knowledge at their desired pace.
Q1	The product must be finished with a high quality standard to engage the users attention, but also to protect the materials associated with the product.	It is more important to ensure the materials used to produce the product are finished with applied finishes, such as oil varnishes for woods, or electroplating for metals, to prolong their lifetime in order to continue aiding the user in their language education as long as possible. It is not desirable for users to use a product that will rot or decay in aesthetic after a few months, as that may affect the product's performance (negatively) for them to use.	I should be trialling the finishes on its respective materials beforehand, and use different quality and control tests, especially compression, toughness and compression checks to see if the finish is reliable and repeatable when it comes to using them for the actual finished product.
Q2	A high quality product should be minimising the risk of danger or threat to my client, in any given environment from illness or injury.	Relative parts of the product to consider here to reduce possible risks: <ul style="list-style-type: none"> The overall shape of the product, giving the ergonomic for the user to hold the product in a sensible, safe position when gripping. Material choices – the heavier it is, the less the user can cope with it. Smooth finishes – no exposed splinters or edges. 	I will test it first before handing the developments to others for first-hand experience in their shoes. Any possible risks such as toxic chemicals at finishing will need recording of and inform this information to the clients and other users to safeguard their health.
A1	The design must appeal and gain attention by the client and users to use the product. Using colours, it should let them identify the product and its usefulness for their learning.	Colour choice is quite an important factor in aesthetics to bring users to try the product. However, the colours should not be too abstract or excessive and over-the-top to the point the outer product is more of a display than an interactive learning source. The inner product may be exempt at this, but there should be a limit of 5 colours in total.	I may do some research to the most attractive colours and balance this with 'realistic' colours used in the common market of design. By recording these colours into the product, I will check with the client if the colours are appropriate and helpful for them – e.g. to understand a part's function.
A2	I must keep the form and shape of the product relatively simple and easy to recognise (and use) by all clients.	I should balance the form and function to where it's not one-sided. This means while the looks of the product may be appealing, I should compliment that with a long-lasting, effective function – to educate the user in the most interactive and fun way possible.	After all functions are thought out and agreed with the client group, I will iterate the final design in the sense with consideration that all functions will still work inside of it. This will require constant communication with the client for agreement – then double check with them using Inventor.
M1	Materials used in the production should be durable, lightweight and worthwhile, and able to withstand against different environments.	For a product to be effective and versatile for any given environment, the product should be tough enough to reduce the quality of the product from degrading, for example, rain not affecting a weatherproof material – this will reduce the chance of malfunction. As previously mentioned, the product should be easy to carry, so a lightweight material should be optimal so the client doesn't require a full force into carrying the product around.	I may conduct a small practical research on the types of materials – and I should use a wide range. I will choose the most appropriate materials and sizes for the application, and use my clients to see if they are satisfied handling the material. This may be done by making them hold the specific material for a duration of time. I will do a materials research.
M2	The materials to make the product should be easy to work with, and that most of these are available in the workshop.	Having a material that can easily be worked with saves an amount of time which can be efficiently used for other stages in the manufacturing process. It also allows me to reduce any difficulties along the production, as I can easily understand their property behaviour when fabricating or redistributing them. The easiest way of going round this is to use materials I have a good experience with, which is wood, as it will save time well.	I will select materials that fit under M1 and get samples with and use various tests such as hardness and toughness testing that is practical in the workshop. This will deduct the selection and the materials left will carry on into the actual production of the final product. If any materials are bought online, I should minimise waste by taking minimal samples to reduce cost.
Env1	The product may include materials that are easy to recycle when the product is no longer useful – in order to protect the environment.	I could use these to prevent increasing the carbon footprint, or to save up on finite resources such as crude oil for plastics. It is important to reduce the landfill caused by one-use materials, as they can take several years to decompose. Recyclable materials are able to be reused again for a different purpose.	I will consider each material (and source) and their associated processes and evaluate if it's the most ethical choice to create the product. If that's not the case, I will have to look for a different material as an alternative.
Env2	The product should be versatile in use, where the client is able to study the language wherever they go.	My product should adapt to different environments, whether that may be in a busy train station or at home, so that the clients have a constant learning routine that is helpful and fun at the same time – this provides immersion.	I must make my clients use it around with them for a time period (e.g. a day) and receive feedback on how well it works for them in every place they went to. I could ask them to try the product in the most extreme circumstances, like a dark or noisy room.

360° Motion (Function)

Rotating mechanism:

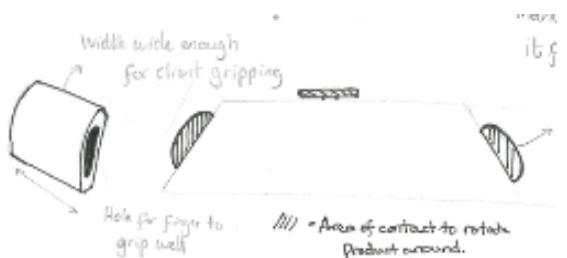
It was important to recognise that, to perform a 360 degree action to spin the product efficiently:

- My pivot to be central and loose enough to allow the rotational input.
- There needed to be a strong joint between the spinning pivot to the upper product to maximise rotational efficiency.
- The material used for the pivot is resistance to abrasion or else the rotational efficiency decreases, making the function less useful.

Ideation Proposals:

1. Aesthetically (more visual)

To meet the standards of the specification, the aesthetic of the product shape-wise had to be relatively simple and understandable: simple enough for the client to know how to use without extra help. As I intend to centralise the pivot at the base, this led me to choose areas of contact where the user would apply a physical push or pull force to allow the product to spin to their desire, ideally for presentation.



I added 'pads' on the long sides, and another on top to allow a more ergonomic experience, giving the client a more secure grip to hold on if they were to spin it.

However, my clients did not approve of this design as they implied:

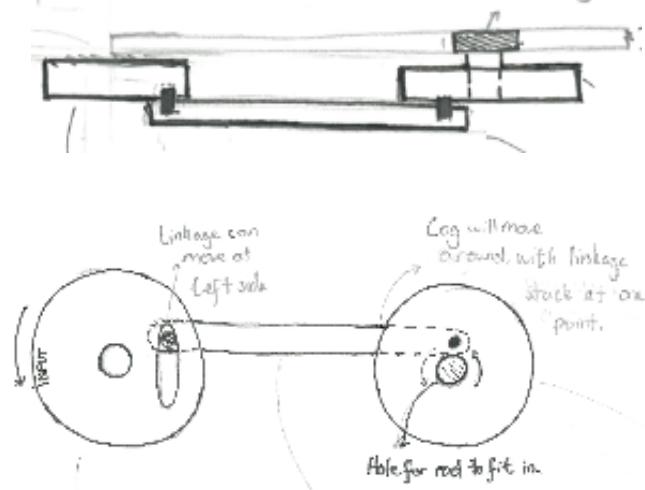
- The parts seem 'extra' – it doesn't fit with the rest of the design visually, especially the top, it looks more of an outlier towards the rest of the design.
- The exposure of these parts in real life may be irritating visually and physically – one client pictured he could accidentally hit the side without intentionally using it.

Because of this, I decided not to take forward this proposal as in general, the clients find it awkward and bizarre to understand. I could always improve this design by having another function alongside its main focus to be a place to apply force to spin the product. For example, it can be detachable, or it can unlock the inside of the product, for the client to add tokens or paper inside.

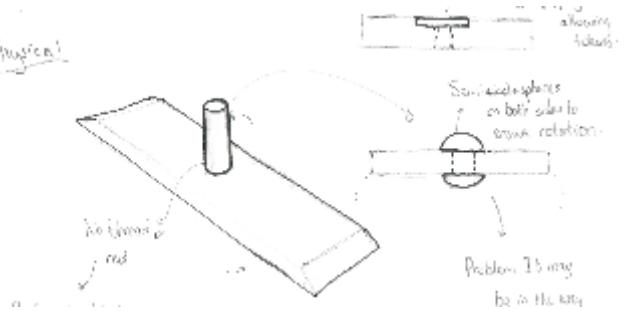
2. Mechanical (Functional)

My clients followed on from before that they want minimum effort to make the product work, hence a mechanism could be a solution. Initially, I designed a simple linkage with wheels attached.

Inspired by the video on the right side (Animation of Double Crank by Learn Mechanical), this uses 2 wheels, connected to a linkage. One of these wheels are exposed to the user, as the rest of the mechanism is hidden inside the product. As the user spins the exposed wheel, the linkage will also spin the other wheel at a similar rate to the clients input. The output, from the right wheel, will cause the base (and upper product) to rotate.



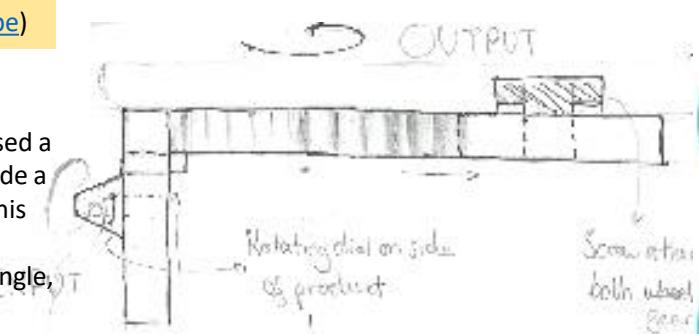
This slide will focus on an ideal functional aspect I would want for the final design. I will find possibilities to allow the upper part of my product be rotate 360 degrees at a singular plane, allowing the client to present their work easily with their partner to help extend their Spanish learning ability.



This video visually explains the mechanism I initially want to take through.
[Animation Of Double Crank | Locomotive Mechanism – YouTube](https://www.youtube.com/watch?v=JyfjwvXzgk)

Developing and Re-iteration:

Going back to the drawing, I proposed a gear train, that will be able to provide a more effective rotational output. This featured 3 gears, with two of them against each other at a 90 degree angle, like a bevel gear.



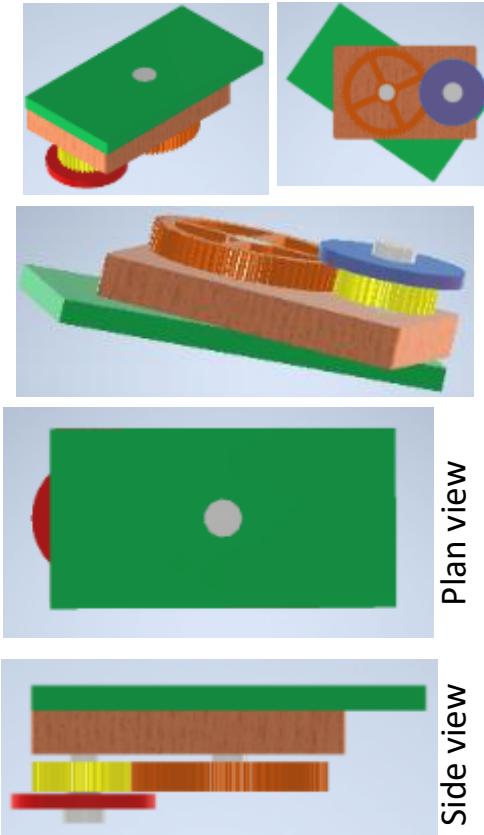
However, I felt that this may cause more stress and input on my client, as their input by rotating the dial on the side of the overall product will need to be twisted several times to get the rotational output to be effective – in other words, the transfer of energy from kinetic to mechanical isn't effective enough. This may wear off the overall system, and the effort I thought that the client may have to face would not be worth it, hence this development was discontinued.

Mechanism Development

CAD (Inventor) Development:

From the clients and previous testing prior to this stage, I understood that:

- My mechanism shouldn't be too complex.
- Having a very long gear train or else it would be harder to assemble/disassemble at production – it would be also time consuming aligning the parts together to maximise rotational efficiency at work.
- They prefer 'maximum output, minimal input'.
- The mechanism must compromise between simplicity and efficiency, meaning that the best outcome should require no extensive input by the user, and allow the product to rotate easily.
- The size of all parts related to the mechanism shouldn't exceed 30mm in depth.
- Ideally, the function should be hidden so the client won't be unhappy against the overall aesthetic. This will mainly apply to the real life model, to see if its size affects its performance to spin the product.



The green piece is the base of the upper product, which will spin according to the orange gear, joint by a thread (rod). For that spin, its connected to a compound gear, in which the red wheel is slightly exposed to allow the user to spin to produce the rotation. The side view is what I intend the final product to include – the whole mechanism 'hanging'.

Client Feedback:

Clients (Nathanael) rating: 7/10

Comments:

- ✓ The function looks clear and easy to understand, by turning the wheel to rotate the base.
- X The gear ratio could be more balanced, like a 1:1 ratio, so that the input is much more proportionate to the output – the video seems like I had to put a lot of effort physically to rotate 360 degrees once.
- X As a whole, the sizing of the MDF makes the part look chunky, and can't see it beneficial as it adds more height to the overall product.

Using this information, I can definitely improve this mechanism by adjusting the gear ratios on CAD, using identical gears of similar numbers of teeth, as I believe a 1:1 ratio is the most efficient route for maximum rotational efficacy in this case. Furthermore, reducing the thickness of the MDF pieces, above and below the mechanism, will help environmentally, but also ergonomically, as this reduction will allow the client and user to hold the product more firmly – it may be held using one hand. One way this reduction can be performed is by immersing the bottom MDF piece to the wheel of the compound gear, provided I cut the wood piece to fit its circumference.

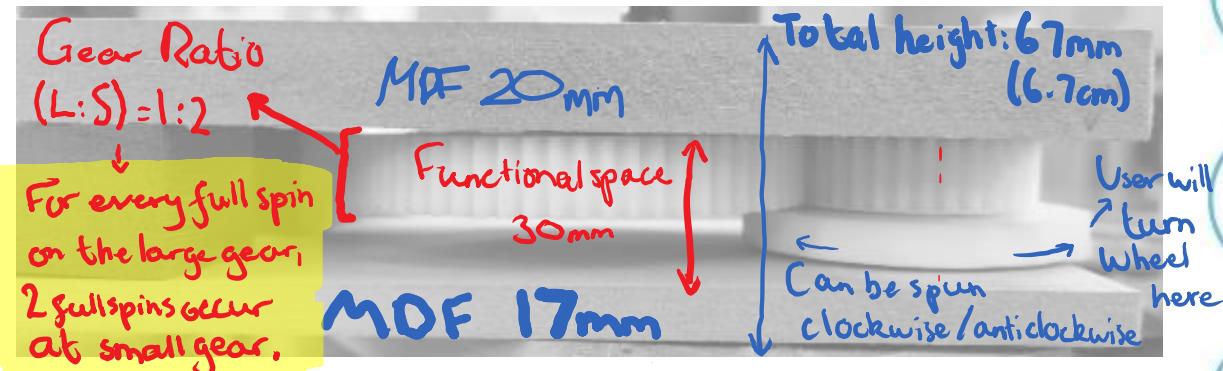
From the previous slide, I narrowed the options for this 360 function to focus on a mechanism that will perform such action. I will use CAD Software (Autodesk Inventor) and real life models to further develop this part of the design and have it evaluated by my client.

The physical model:

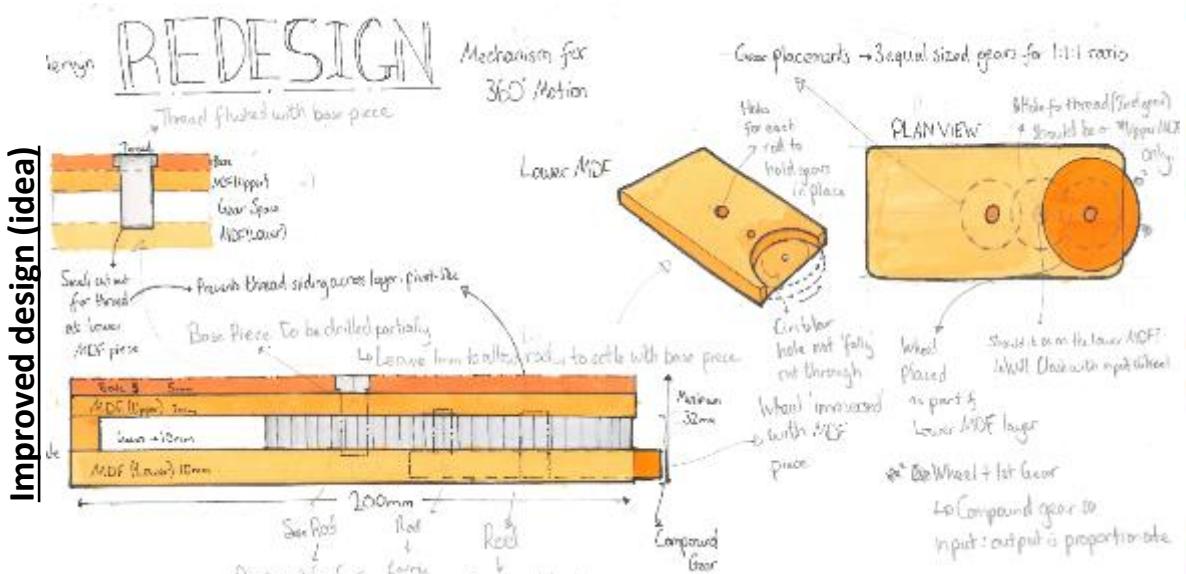


Play the video on the left to see the mechanism in action to spin the wood piece.

I encased the whole mechanism, as it will be the case in the production of the final product, and it was satisfactory enough to work, by spinning the mahogany piece – as a demonstration in the video. The length and width dimensions of the MDF are near to scale, allowing me to test it later with my client according to their anthropometric data, which I can amend these pieces slightly if needed.



Overall: Too thick; needs to be reduced in height.



In the end, my mechanism was generally satisfactory to be used in a product setting to spin with the clients and users desire for their learning experience - to present their work (on whiteboards) to the companion. However, there are still some flaws with it, such as the poor input to output by the user. This highlights the necessity of reiteration, which I conveyed as an improved idea above – though this may not be the final-final outcome for the end product. Regarding my specification, I have generally met F1, F3, U4 and E1, complying with the dimension restrictions and prioritising the positive outcome of the function. However, to be fully satisfactory, my client will physically need to try it to meet U1 and U2 – unfortunately can't be done now due to COVID-19 reasons.

Whiteboard and Storage (Function/Ergonomics)

Provided with guidance by teachers, whiteboards were a useful way to present information in a fun and engaging way, to write and read in order for the client to understand and put knowledge into practise with the Spanish language. This slide will focus on allowing the client to access this equipment, particularly on the lower half of my proposed product.

Whiteboards:

Whiteboards are an integral part to temporarily display a person's knowledge to practise, to be able to be appraised and critiqued for their work and show signs of development to overall improve their ability to understand and speak the Spanish language.

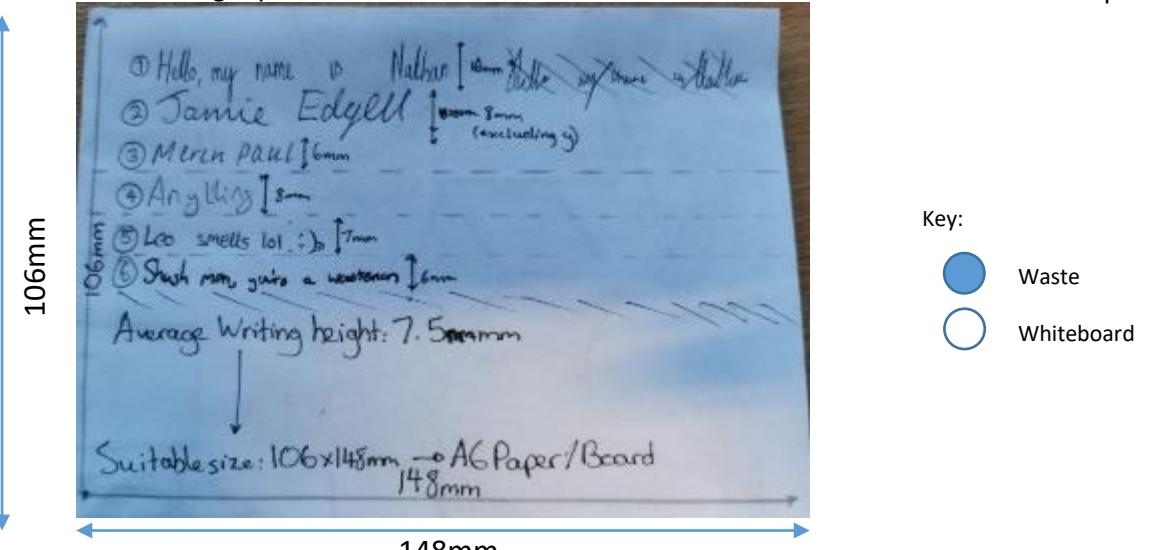
Background Research:

Typical whiteboards consists of multiple layers, from a wood (typically MDF – medium density fibreboard) as the base or core material, followed by a sheet metal of aluminium or nickel and a porcelain-coated steel sheet, that serves as the writing surface. A series of glue and pressure pressing are often used to stick these layers together, ultimately being cured to dry and use.

However, the range of sizes for these whiteboards serve for educational purposes for classrooms, from 30cm x 50cm to 100cm x 200mm, which is too excessive for the product I plan to make, which maximises the entire product size to 250mm (25cm) on all dimensions. From Amazon, the lowest price a whiteboard has been listed as is £2.99 for an A5 whiteboard.

Finding the right size:

As each successive (A1,A2,A3,etc.) paper/board size is halved each time, I folded an A3 piece of paper 3 times to represent a A6 paper size. I asked some of my friends to write anything on the paper as a test for how big my clients could write on the whiteboard I intend to make.



I found out that on average, the writing height in this sample is 7.5mm. The writing height is absolutely necessary to picture how wide I need to make the whiteboards that can supplement an extensive amount of writing. People, including my clients can have drastically different writing styles and I need to satisfy both their writing and sufficient space to work with. Hence, I intend to make it 148mm x 80 mm, to comply later when it comes to storing these as part of the final product.

The main aims to achieve for this section are:

- Find and design the optimal whiteboard dimensions sufficient for presentation.
- Discover suitable, visual presentations for the client and user to present their work.
- Provide an area of space for the user to access to easily store whiteboards and pens without risking the loss of those items.



Self-producing a whiteboard will be much more expensive and time-consuming, especially with the drying and curing process, so this shouldn't be taken to account – a minimum of £10 and at least a whole day to process.

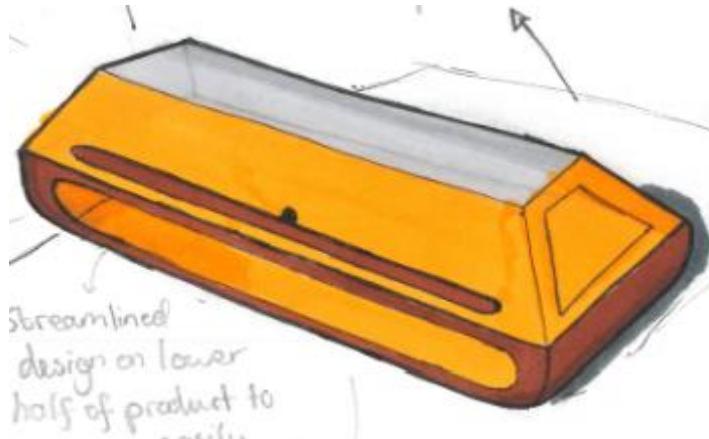
Instead, I plan to buy a thick, large whiteboard and cut to the dimensions, fit enough to be stored and used. This route is much more reliable as the company I buy it from are more professional, and the process to cut into shape takes much less time and money.

Environmentally, I need to consider minimal waste (even as a prototype) to reduce the negative impact of recycling material, such as CO2 emissions and difficulty to separate layers of the whiteboard, as mentioned in the research, a whiteboard composes of nickel, porcelain and wooden board that are stuck together very securely by pressure vacuuming.



The most effective plan is to buy an A5 whiteboard and cut into half, giving 2 A6 pieces, which can be altered accordingly to the storage space. Economically, this shouldn't cost as much as £5. Using the diagram above, it is inevitable that some areas will be wasted, but I should aim to use at least 75% of the board for use and display.

Storage Design and Development



My chosen design for development.

From second iterations:

Having received feedback about the lower half of this chosen design, my clients pointed out flaws, which includes:

- The lower half makes the product look more of a tank, with the over emphasised fillet shape on the edges.
- No consideration about the storage of whiteboard pens or rubbers, which are important for the Spanish learner to present their learning.
- If whiteboards were stored here, it prevents the client ergonomically to handle the whole product securely, as one less area of grip is removed – this is particularly the case if the user wants to carry the product around.

Overall, the clients were not pleased with this section of the design – neither is it feasible.

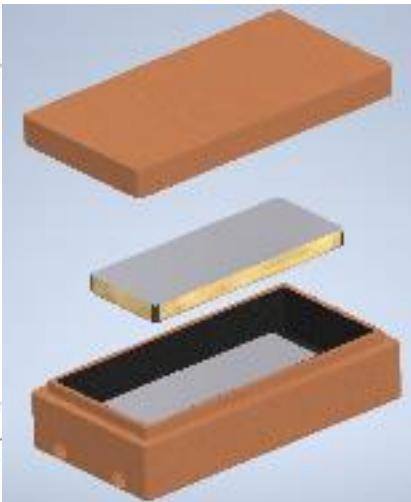
Aesthetics: The shape has no meaning or representation to the type of product it's supposed to be, which ignores A1 and A2 completely – the end goal is to make the shape simple, but to attract the idea of Spanish education.

Ergonomics: The smooth design on the outside partially fulfils the users idea, but should be improved at the forefront of the lower section. It has told me that the interaction of the users' hand and the whiteboard storage must be independent, by means, not interfering with each other.

Function: While it does meet the need for holding the whiteboards in a place that is easy to take out for use, it lacks the storage of other essentials, such as (whiteboard) pens and rubbers, so the client can remove and add detail to their temporary work.

Storage Design 1 – Box-like idea:

Inspired by wooden jewellery boxes, I treated the lower half as a separate piece to the product – a place to store.

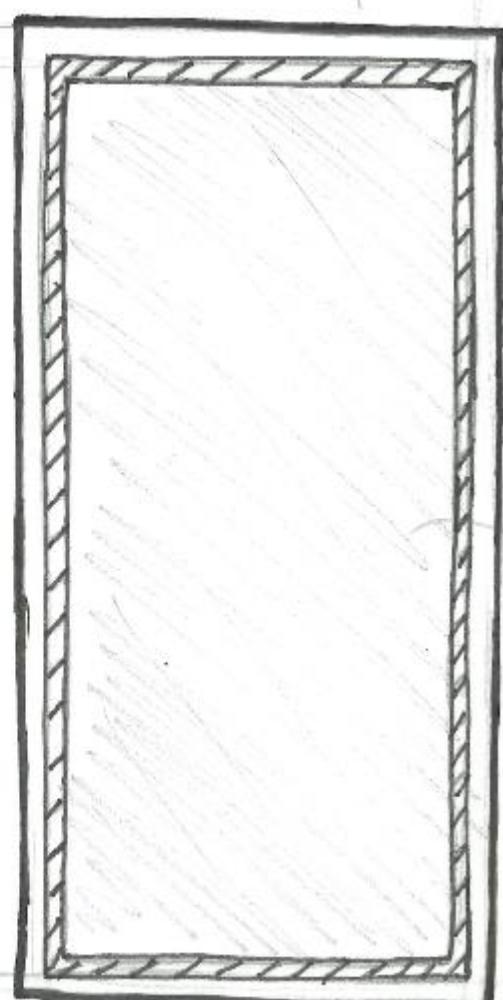
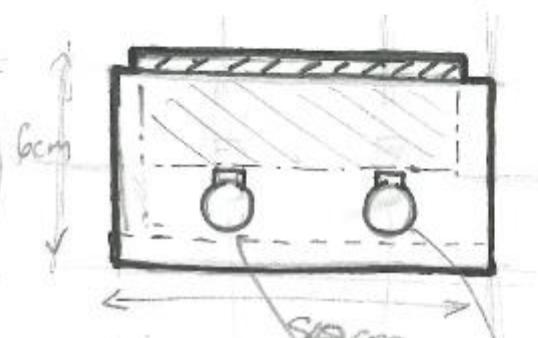
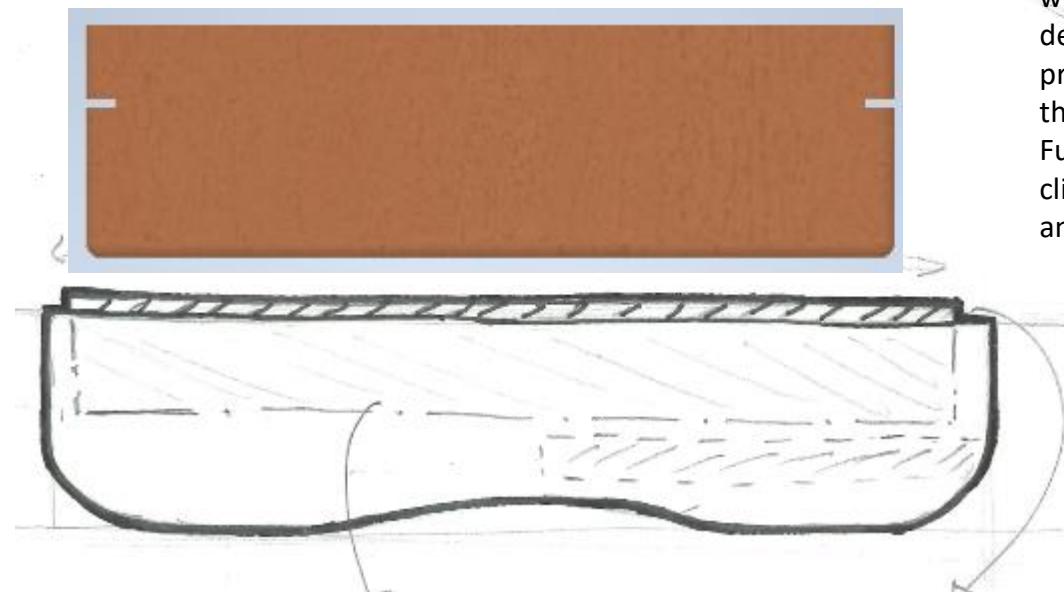


The exploded view shows how the design will be structured, layer by layer. The top piece is a demo piece, and in production, this will likely be the upper product (with the mechanism).

This box-like design has a male-female system, where the pieces will lock to each other. It will be able to store all whiteboards, pens and rubber all at once.



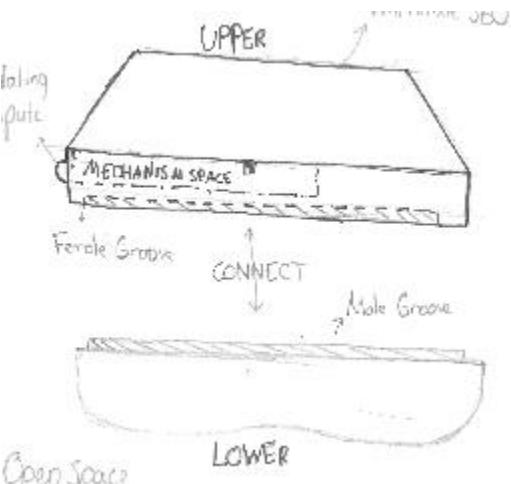
I included a hole on the side specifically to keep whiteboard pens. However, this is not a good design because the pens can easily fall out if the product tilts –the client could tilt it if they carry this physically from one place to another. Furthermore, 2 pens may not be enough for the client; they might want to use a 3rd pen or another colour for corrections to improve.



I need an area of space that will hold and keep hold of these whiteboards, given previously the desired dimensions that satisfy the user to write on. This slide will focus on a 'lower-half design', as my chosen design for development had 2 parts – a lower and upper product.

Storage Design and Development

Storage Design 1 – Box-like idea: (continued).

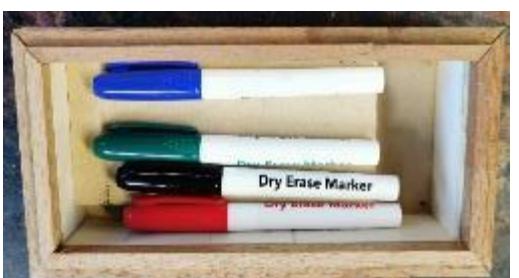


The depth of the box shape will need to sufficiently store two whiteboards of equal dimensions, plus pens and rubbers, which dimensions vary in many sizes. I will need to consider extra space for the client to put in their hand inside to pick up and deposit these learning equipment. Anthropometrics will play a factor on changing the overall dimensions of each side of the product, to meet alongside the shape of the upper product as well.

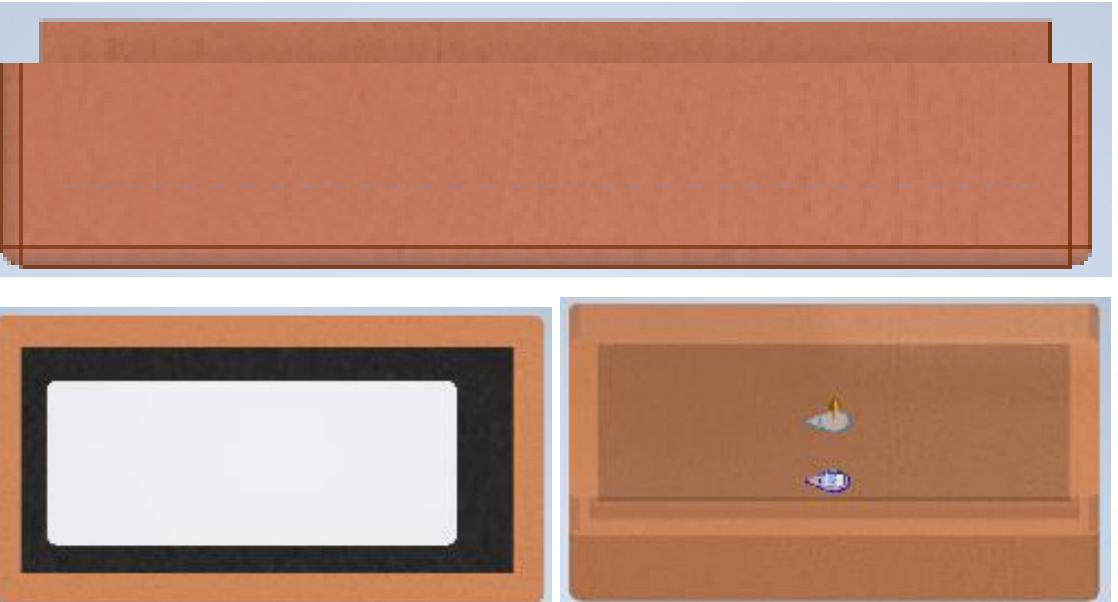
Modelling:

I glued layers together for a basic model, using various types of wood to experiment which material suits the product best. Out of these, the birch plywood was the most aesthetic for the main bulk of the product, but I may consider mahogany due to its rich, unique colour, especially when varnished.

I tested with this model the whiteboards, pens and rubbers and how they can fit into this simple box idea that I drew out. The dimensions of the open shape are 185mm x 75mm x 40mm.



I tested out how feasible my hand could reach the products inside this box. Overall, it was satisfactory enough for me to grab all the materials from the width, but found it difficult along the length.



Problems of this design:

I added the mechanical part of the product on top of the box shape, re-enacting the situation of the upper and lower design (top left). The main problems are:

Ergonomics:

From holding this, It was near unbearable to grip both parts comfortably and securely, due the extreme height and weight of it overall. Like the mechanism development, I will definitely need to reduce the product height, as in these pictures, I had to hold them with two hands, stretched. It was too heavy, due to the density of woods, so I may consider more lightweight woods or materials in the material testing. Having less dense materials will prevent the client and other users from having strains for inputting too much effort into lifting and carrying.

Function:

When testing to stack the whiteboard and its contents together, only 2 of the 3 parts can fit within the box, but this is mainly due to the height of the rubber, which I should try to find one with smaller dimensions overall. Alternatively, I can expand the size of the box, but this won't benefit, as previously mentioned, it adds more stress to the user for carrying with more material.

Client Feedback:

Clients (Nathanael) rating: 5/10

Comments:

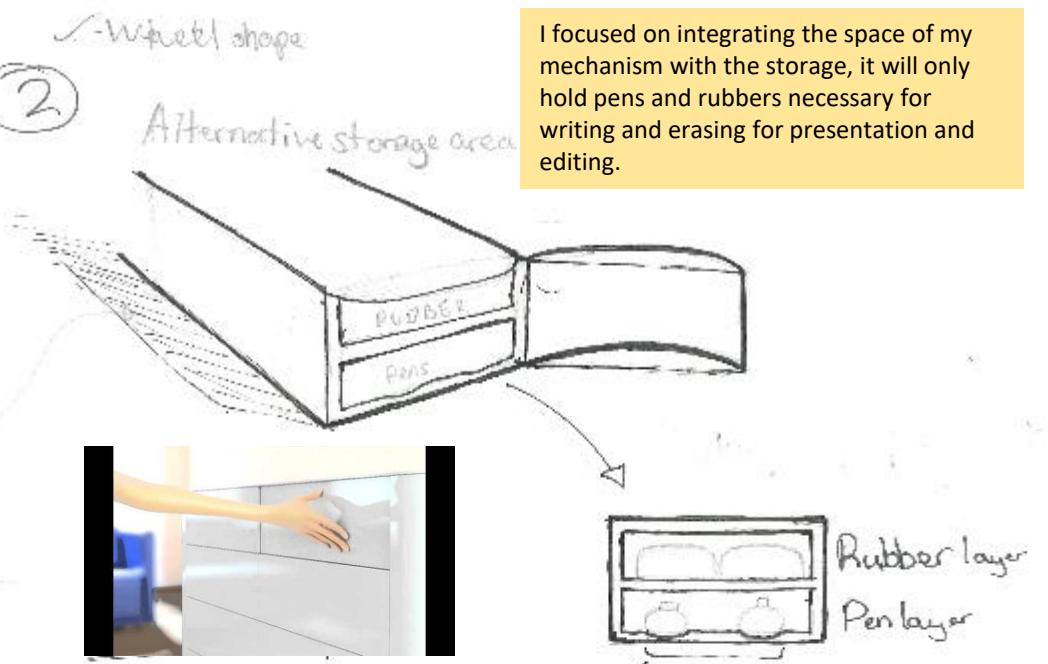
- X It is able to store the necessary products, provided that they are to size and fit well into the box.
- X The thickness (height) of the box is too much, and could be made much smaller or less bulky.
- X If the pieces are not modified for this specific product, normal whiteboards used from classrooms will definitely not fit inside.

Receiving this feedback, I can make sure to do the following adjustments:

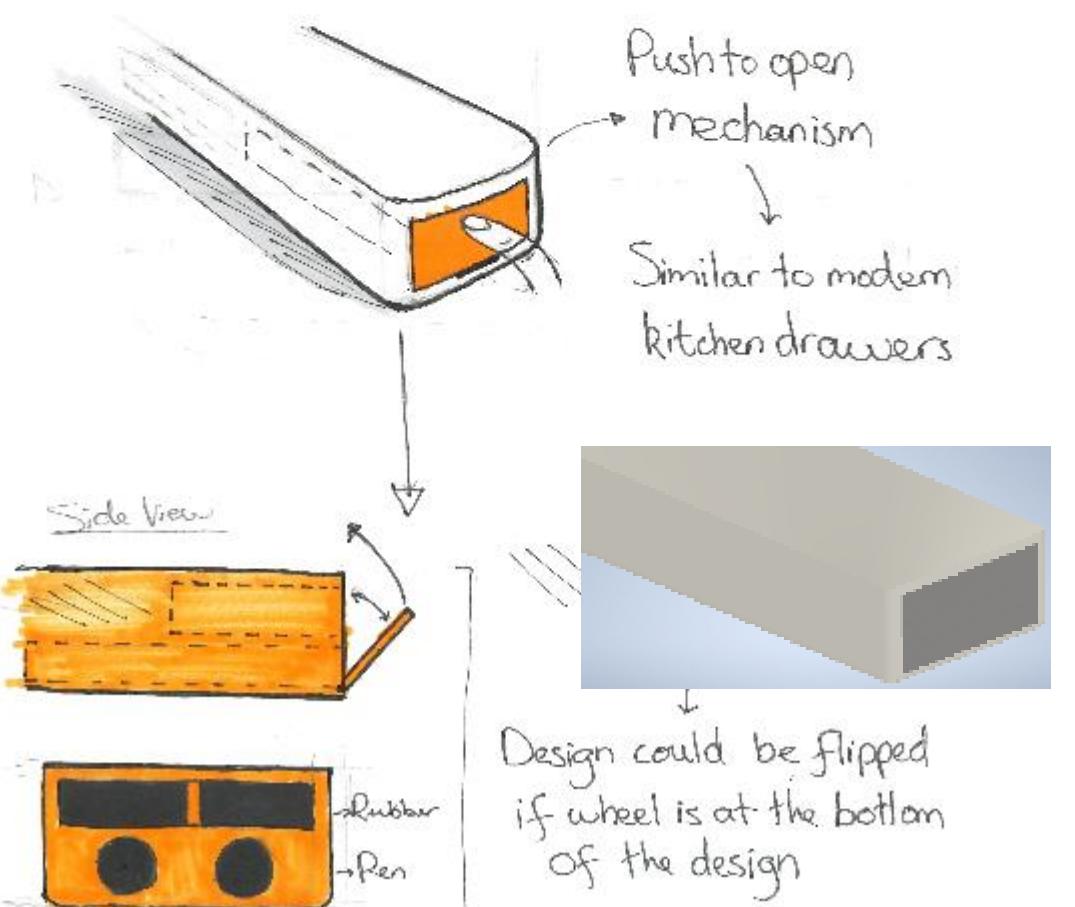
- The storage should not be dependant on the whiteboard size, and may be only be a place just to store whiteboard pens and rubbers, as they are much smaller and have a more definite size to work with. This will massively reduce the height, as I'm treating the whiteboards as a completely separate part of the product.
- I should move the whiteboards to the upper part of the product, but in a way that is presentable and recognizable for the user to place them. Aesthetically, this will be more easy to understand (meeting A1/A2).

Storage Design and Development

Storage Design 2 – Box-like idea:



This example shows how I would like the idea to function, a push to open system.
(<https://www.youtube.com/watch?v=gx3sXGJyvC4>)

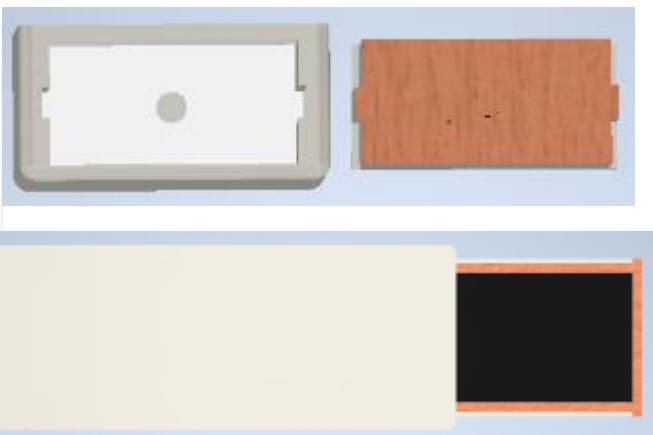


Why this change?

Because my first storage idea was not ideal nor feasible for the user, I will continue to consider another design idea that must be improving from that last design. Receiving the feedback from the previous slide, it has caught attention to focus on product sizing and storage of absolutely necessary items that will be used for Spanish learning.

What has changed?

- **Reduced sizing of the lower part of the product**
 - Height-wise, this new design will massively be reduced, as in this concept, I put this storage idea on the same layer as my mechanism, in the way this layer is utilised for work and access to educational material. By having the storage here, less material can be used overall, reducing cost and potential environmental impact overall.
- **A more hidden design**
 - The storage and the space it takes will blend in with the mechanism layer, allowing the product to be in one piece, rather than two that are detachable. In aesthetic terms, the general form of the product will remain consistent throughout its usage.
- **A drawer system**
 - Shown in the CAD (inventor) below, I took inspiration on drawer-like systems that I could incorporate into the product, and to structure the placement of certain material like excessive whiteboard pens and rubbers, and possibly other parts that are associated with the use of the product.
- **Abolished the storage of whiteboards**
 - The client was concerned about the whiteboard sizes causing the change of dimensions of the box in the previous design, so I will not consider any further trying to feature them into the storage of this idea. Instead, I plan to move this to the upper half of the product, as for the user, I think the placement of these whiteboards will be more feasible to work with.



Potential modifications:

The pieces along the lower part length of the product could be more transparent, so the client knows what exactly is inside.
The storage space can be divided into sections dedicated for specific equipment, for example one area is for pens, as another may be for rubbers – to support the user in organising.

Client Feedback:

Clients rating: 9/10

Comments:

'The push to open mechanism is quite cool and looks like a good idea for the whiteboard pen and rubber storage but to be honest I cant really think about anything wrong with it. Its quite good and more convenient than the last design.'

With this re-iteration, I have managed to improve the previous design with a more simple approach, as he continues to say that the storage weight will seem to be no different than if it were taken out.

I focused primarily on the potential user experience (ergonomics), and the function that will allow the user to access and use the whiteboard pens and rubber as easily as possible, while bearing in mind, keeping a simple aesthetic. The specification points I believe that were covered well during this section are F2, F4, E1 and A2. This has been done by redesigning an uncomfortable model of excessive height and immersing this design to the same layer as my mechanism. This way, my client wont have to worry about lifting the base of the product, and rather pressing, pulling or pushing drawer design on the side. This rethinking of the design has benefitted not only the user but also myself at manufacture, with less material and cost overall.

Upper Product Development

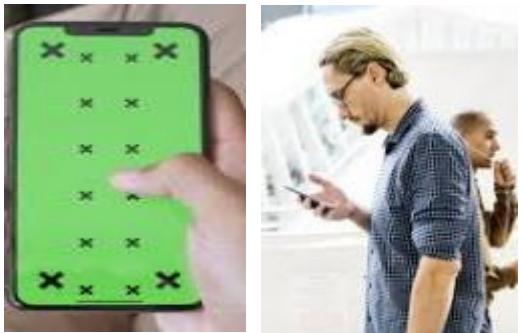
In this development, I will need to explore the upper design to allow the user to learn from the product as this upper half is where the education is revised or supplied to push themselves beyond the classroom. Ideally, with the help of my peers and clients, the upper product needs to support individually, but mainly multiple people at once, such as a pair. I will need to prioritise each aspects' function, from the general shape to communication token designs, while making it as aesthetic and ergonomic as possible to make the user experience unique and engaging to meet up to my specifications.

Presenting the whiteboard:

I intend to make my product stationary at work to provide service to benefit the users' Spanish ability. Since I have planned out the lower half of the product that has its own depth, it should allow the user to see the upper half where the whiteboard will be in front of their view. I need this factor to be as ergonomic as possible, while complying with the clients anthropometrics.

Ergonomics:

When presenting information to the client or any type of person through a screen or display, it should be in their line of sight all the time so that eye contact can be made to begin interest of what is to be presented.



In this example, by looking down on a display for an excessive amount of time may cause neck strains, and possibly a slouched position when getting up, as the human head or upper body will need to tilt downwards to allow the eyes to see.

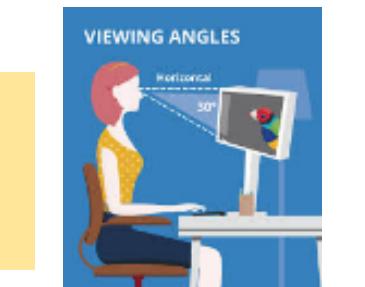
This means for my product, using my clients as examples, a minimum height that can prevent such action from occurring.

The infographic on the right suggests a recommended viewpoint angle to read. However, this is only dependant on:

- How far the display is from the person (sitting)
- The height of the product from a surface, such as tables.
- The anthropometric height of a person when they are sitting.

Example – UGREEN hands free phone stand:

Users have the freedom to adjust the height, up and down, to match their viewpoint to prevent the neck strain from happening. Furthermore, the phone holder can adjust in angle from 5 to 45 degrees, all in which gives an extra hand for the user to relax. This is a great example, as it's a desk product, which is similar to my product, which is most likely to be used in a similar environment. I can take inspiration of the adjustability and flexibility to allow the user to have a more comfortable experience.

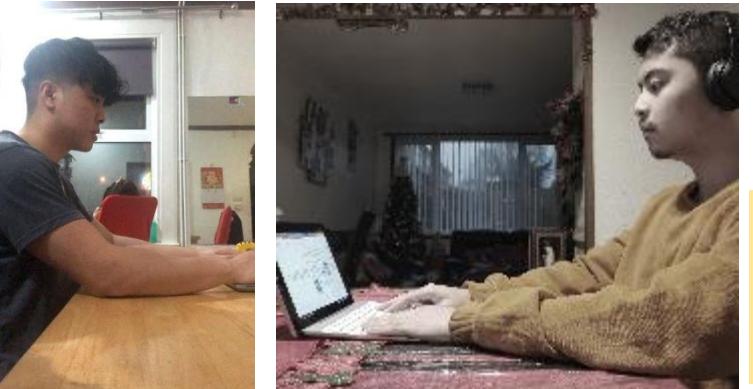


Multi-Angle Adjustment 5°-45°
Perfect angle of view when bingo-watching

The main aims to achieve for this section are:

- To find a design that is presentable for whiteboards (and possibly any device) for dual education.
- Discover possible token shapes related to the field of Spanish.
- Allow the user to easily add, remove or edit sections of the upper product to their liking.
- (if possible) Make a random distribution of the communication tokens to add diversity and bring the idea of 'something new every day'.

These points should be covered over the course of the next multiple slides.



These side profiles of Joseph and me respectively shows roughly a viewpoint angle from the horizontal to look at a laptop.

Experimenting possible user viewpoints:

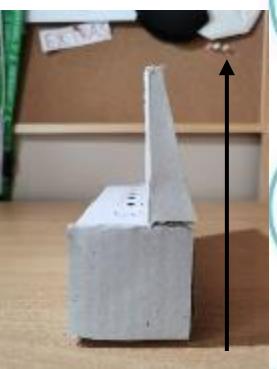
From my clients and friends (third party), I asked them for the following:

- The distance from their desk (or table) to their eye level
- Less than 50cm distance from the person to the object
- Sideways profile to see the visual angle these people do to look at the object they placed on the desk.
- Use a chair that is fixed to a certain height, and not to use an adjustable chair.

Using this research, it stood out that the surface of the table aligned to the chest of the user, therefore use anthropometrics to measure from the chest to the top of the head and correspond this to a suitable height of the overall product. However, these pictures confirm that a shallow product makes us look down more, hence more of a tilting head effect. Overall, I do believe a table setting is most appropriate for this product, especially considering most work, including Spanish learning uses this sort of environment.



The left is a 1st person perspective looking at the model. It is clear that the general size is too small, especially considering that the clients will need to read the writing that their companion has written.



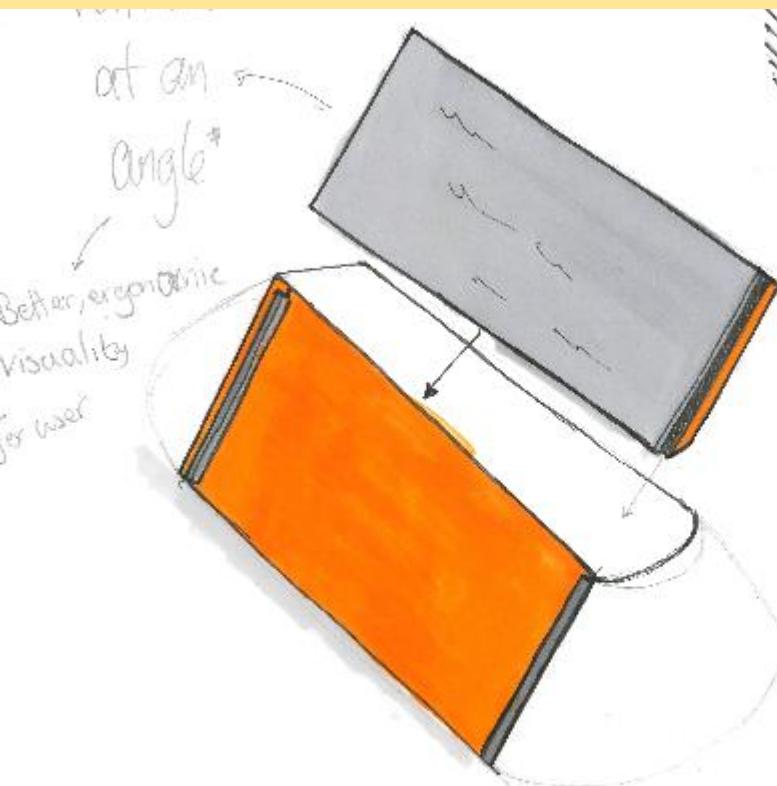
The right shows the height of the basic model, in which the length of the arrow is 130mm, which supports the fact about the scale is unsatisfactory.

This research has allowed me to ensure the correct approach to watch and view the clients visibility to see the product in action. This is solely based on:

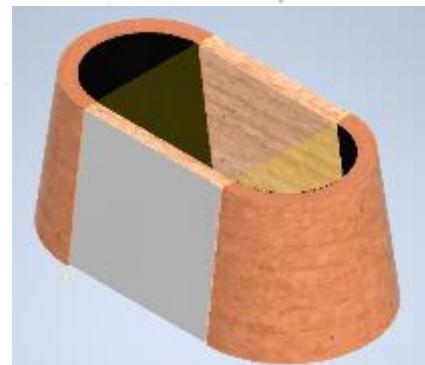
1. Scaling of the whole product – this includes how tall the product needs to be to suit the clients, and possibly considering the ratio between the lower half and upper half of the product.
2. Anthropometrics – understanding that my product needs to make the user read it from a range of distances, the next steps are to measure an average chest to head length to correspond to the product.
3. Viewpoint – the angle of how the writing will be seen from the user, enough for them to tolerate without having to move their heads excessively – this to prevent risk of injury from the neck down.

Presenting the Whiteboard

Taking in the square based pyramid shape of the upper product before beginning the development, I used these faces of this 3D object as an angular slope for presentation.



For the drawing above, I used the example product in the previous slide about the certain angle tolerance and implemented it on here. This design is intended to be at a fixed slope at 10 degrees from the vertical.



The picture on the left is taken from 1st person, as if you were the client using the whiteboard, which is the MDF piece, while the CAD model on the right shows how the form of the shape will be completed if both whiteboards were to be placed for use and presentation of work.

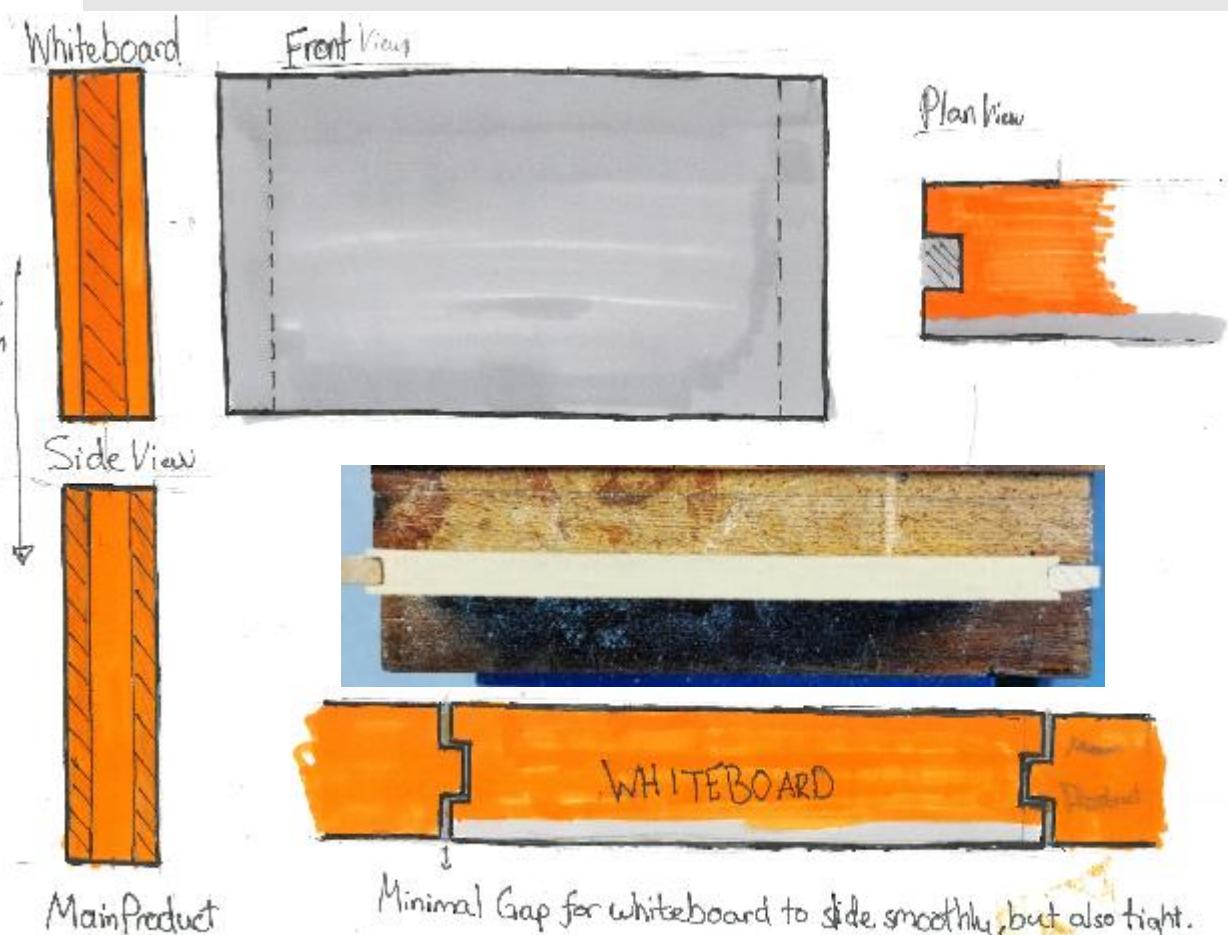
Client Feedback:

Clients rating: 8/10

Comments:

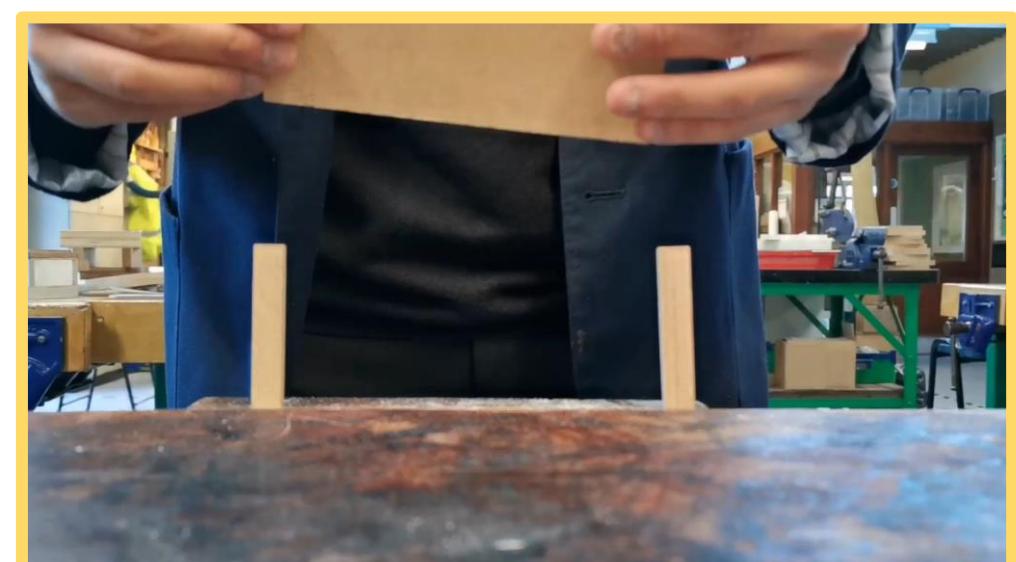
'It's a clever but simple design. Assuming there is a base material, which I believe is the piece is being suspended by the mechanical pivot, so it should firmly hold these whiteboards without breaking the tip of the slot or letting them fall out as a whole. It could be better if you could modify the base piece with a slight cut to give the whiteboard a much less chance of falling out, such as an inward cut. But overall, I think I can recognise the placement and structure of the product with this idea.'

Using the information about the suitable reading distance and height for the clients to view the whiteboards, I need an ergonomic and presentable design that will make them feel more comfortable to observe theirs and their companions work of Spanish without risking neck strain.



Minimal Gap for whiteboard to slide smoothly, but also tight.

The main concept here is a slide-and-slot; the whiteboard will be grooved in the middle of each end to a certain depth as it slides into the main bulk of the product, that completes the slot with the middle cross-section allowing the whiteboard to secure its place. The video below demonstrates how I ideally want to the user to insert the whiteboard for use:



(The thin oak slot pieces used to hold each end of the whiteboard only demonstrate the male-like tip of the main product)

Communicating Spanish

Making a token design:

I will take 2 designs to make a batch of tokens each, to present two important aspects of Spanish, and generally any language – tenses and communication.

1. Tenses – past, present, future

- These tenses are broad, there are specific tenses in each category: preterite and imperfect (past tense), continuous and perfect (present tense), near future (future tense) and conditional, which apply to all three main tenses.

Despite this, I should consider the fact my clients have a different range of ability of Spanish, so to make it fair, I should only put past, present and future tense.

2. Communication – speaking, listening, writing, spelling, reading, etc.

- These are the fundamental ways any person will try to attempt to practise their language to people, whether its with one person, like this product, or a bunch of people like a classroom setting. All parts will need to be improved if such person wants to be confident and secure with not just Spanish, but other languages too – taking English as a common example for foreigners.

Spanish Verb Tenses	
Indicative	Subjunctive
Past Tense	Present Tense
Future Tense	Conditional Tense
Present Perfect Tense	Past Perfect Tense
Present Continuous Tense	Past Continuous Tense
Present Perfect Continuous Tense	Past Perfect Continuous Tense
Future Perfect Tense	Future Perfect Continuous Tense



Designing the tokens:

From previous client feedback, particularly the second iterations, they exclaimed the possibilities of the tokens being a memorable part of the product that can assist them. However, they do mention strongly about the fact these pieces are not directly attached to it, and can be lost if not taken care of properly. In this case, I will try to, or consider:

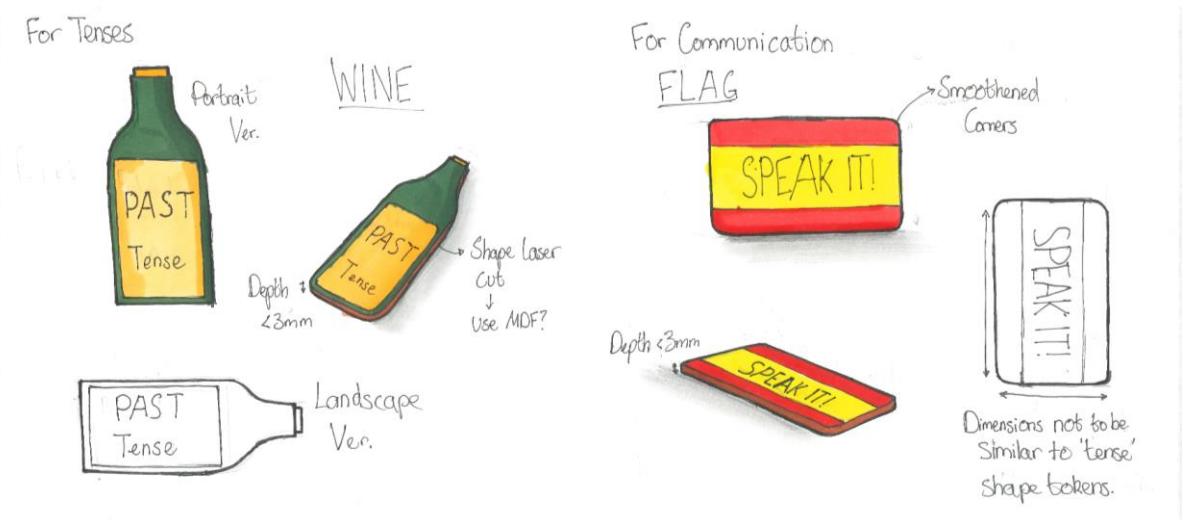
- Using abstract, unique but simple aesthetics for the overall shapes of these tokens.
- Deciding on colour scheme – this will be most useful for those who learn visually.
- Making them magnetic or similar that will be easily detachable from the upper product.
- It must be lightweight and big enough in size to be read by the client.

Inspirations – possible ideas:



As I will make a batch of tokens for tenses and communication each, the overall design should be simple, as I will most likely use a laser cutter to cut MDF of 3mm thickness (at most). For finishing, I will paint over the cut-outs to make it more bold for clients to see.

I will explore ways for the client and their companions to vary their use of Spanish, from the type of tense they speak, to how they will communicate this language – such as speaking and spelling. This is important to the overall design as this is the ‘teaching’ function of the product. Firstly, I will further experiment with the idea of tokens, if they are viable enough to help my clients to learn at a consistent rate.



If the tokens shapes are made, it should be dense and prone to bending easily - using a board (less than 3mm in depth) like MDF would be most appropriate.

Client Feedback:

Comments:

‘As it still is, the aesthetic does not change much to the risk of losing the tokens’ – Nathanael
‘For the contents, there are 9 tenses... (each one listed) that are mainly taught to us in lesson. For the communication style towards the product, I feel two out of four aspects will be improved, which is writing and speaking.’

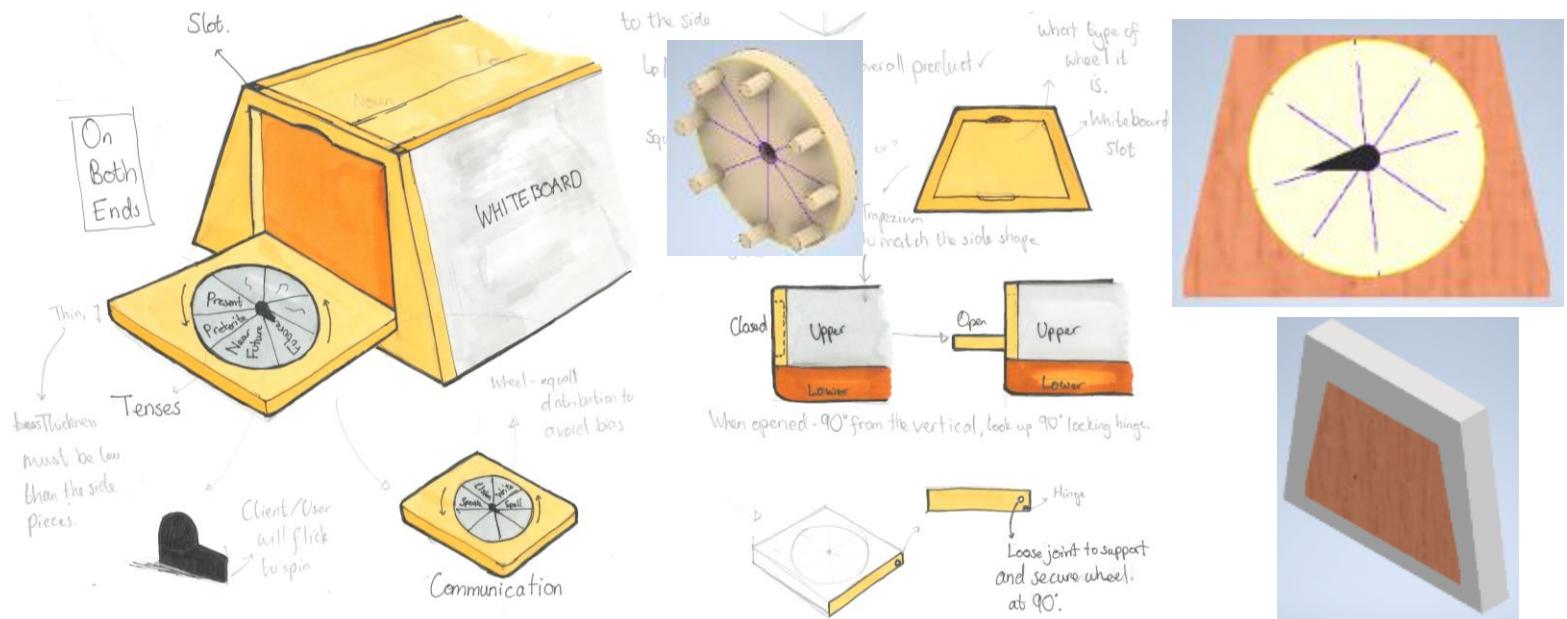
Ultimately the token concept is ‘not good but not bad’, as they value function more than the aesthetic. I will need to find another concept that can deliver the Spanish learning vibe from school that is functional, and not detached from the product.

Communicating Spanish

My client was not satisfied with the general idea of tokens, so I will look into a different concept, to determine how they will communicate and present their ability of Spanish. I hope by this approach, this concept is a bit more engaging and enticing to motivate them into learning the language as a whole.

Concept – making a wheel:

By using a wheel to satisfy the communication of language and the use of tenses, this gives a more unbiased choice for the user - they are likely to expect a challenge to broaden their ability exploring the Spanish language. Unlike the token design previously, the physical product will be directly attached to the product, and won't be lost unless the whole product was lost in itself. In hopes of this concept, this part will become a more interactive game as the client will play around it to determine their 'challenge'. These wheels will be in a bolder colour to the rest of the product to make it clear for the users to see and use.



How it will be placed and used in the product:

Like the storage redesign, it will be flushed on each face (left and right) of the trapezium form.

If the user or client requires to use it, they simply pull from the top and opens up the wheel. By either spinning the wheel itself or the pointer independently, they will determine what choice they get. This wheel will be made to evenly and equally distribute the probability of the event happening in a particular space of that wheel that the client or user will need to perform to their companion.

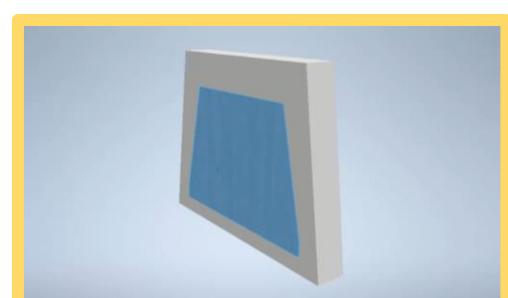
Determining the Spanish tenses and communication:

1. Spinning the wheel

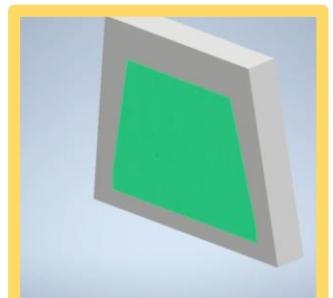
- Inspired by the game show, Wheel Of Fortune, they have metal rods that their contestant will grip to spin the wheel, with a stationary pointer. Using a similar idea, I will have rods equally spaced around the wheel that the user can flick to spin it – the size of wheel is small, so a whole hand of 12-16 year olds won't work.

2. Spinning the pointer

- The user will also flick to spin this part, while the wheel remains stationary. The benefit of doing this for the wheel is that it can be more visible for both users of the product to see, because the rods of the wheel may obstruct their view of what event is chosen.



1. Spinning the wheel



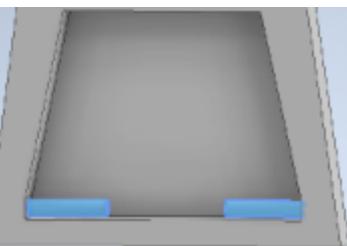
2. Spinning the pointer



Game show, Wheel of Fortune, has several metal rods around the circumference of the wheel to be gripped and spin to end up selecting a point value.

Restricting movement:

There are dowels on each side of the inside section, hopefully to prevent the wheel part from turning excessively or falling completely. This should restrict the turning motion to 90 degrees away from the vertical.



Client Feedback:

Comments:

'This is much better, I think it would be much more interactive and fun to play with' – Joseph
'Out of the developments, this is probably my favourite, although I am a bit concerned if the product becomes top-heavy if the materials associated around it are not light' – Nathanael

The positive feedback makes sure that this concept is definitely satisfactory for the final design, with a more balanced chance of getting a different skill per spin. This can easily be manipulated at the final design with a better placement to remain functional and ergonomic for the client.

Word Bank Storage

This word bank storage is to keep all the nouns and other types of words the users learn in their journey to Spanish, but also lays a foundation for the whiteboards to rest on from the back. I will focus on the general form of this part as it shapes the size of the product overall. I will try to explore making the design tangible for the users, in a way they can sort their words into groups.

Using 3D CAD:

I broke down the form of the upper product from a pyramid form to a trapezium form to make these shapes on Autodesk Inventor. Using this, my clients can see a clearer picture of the possible designs and animations to see how it will work when these are reflected into the real product.

The general form:

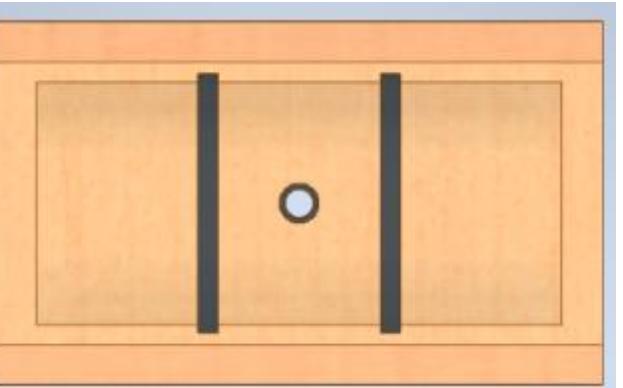
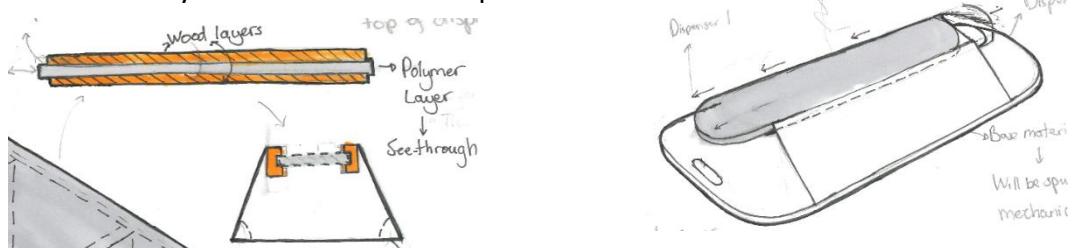
I made a simple trapezium and extruded it to the length of A6 board – around 150mm. I proceeded to cut out a cuboid box within the main shape as the space to store the words to be pulled out or placed inside.

At the centre of the part, a hole has been cut out precisely for the metal rod to pass through to allow the product to rotate, cause by the mechanism that has been mentioned previously. The majority of the cut is to perfectly fit the head inside, so the base of the inside of the box is flat, without anything overhead.

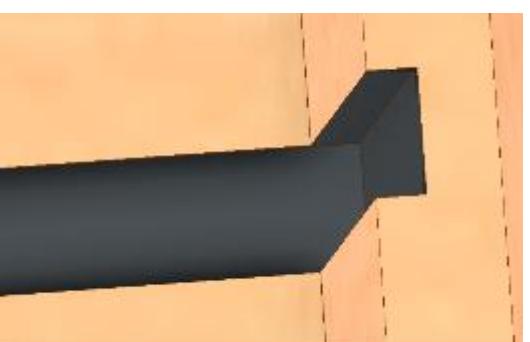
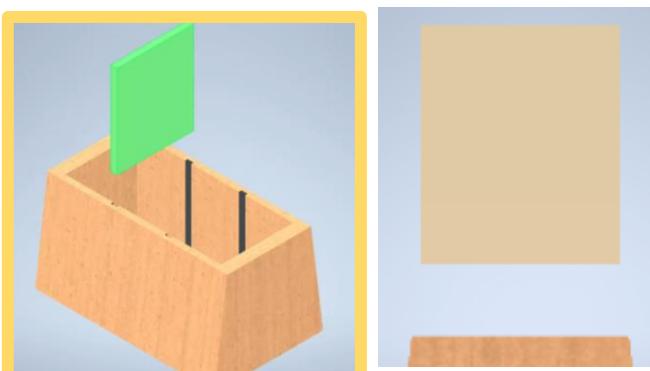
Covering the word bank: (possibility)

On an similar exemplar, I did a rectangular Boolean cut out on the top of the trapezium to the image on the left. Filling in that spot will be a transparent polymer that has a tip on the end that can be pulled to fill that area. This polymer choices could be acrylic (PMMA) or PVC – which should be easy to cut during manufacture, either by a laser cutter or by a hand tool, such as a coping saw.

The sketch below shows the layer by layer process from side view of how the plastic will fit, and serving as a cover for the nouns. However with this design, this could restrict on what can be put inside the box for the client to add words inside, as I am unsure what sized paper will allow words to fit inside. Although it can be convenient to prevent the words from falling out, the polymer can be lost, as its not directly attached to the main product.



The video above shows how the client and users will try to put in and remove the lid. This can only be done through one plane, in both directions.



The dividers will be inserted like a slot; they can be pushed in and pulled out to the clients need. The dimensions are made so that it leaves a flat surface on the top of the trapezium, but hopefully also to scale to be kept inside at the storage for pens and rubbers.

Dividers:

In the CAD design of the storage, the black area shows a partially Boolean cut out, around the inside faces of the cuboid space. This is where the user can install these 'dividers' if they desire to organise their word bank into groups, such as nouns or verbs. In this particular design, I measured dimension such that each divided section were equal to each other.

Client Feedback:

Comments:

'I think the dividing system is a bit unnecessary because we can use rubber bands to tie flashcards together.' – Joseph

'We tend to use flashcards a lot to learn new words for Spanish, so having a lid may not be to out liking if the height of the upper part isn't tall enough.'

My clients were fine with the shape of the product, but not the rest of the things added, for which I can abandon, as they have their own materials to help them learn.

Product Casing

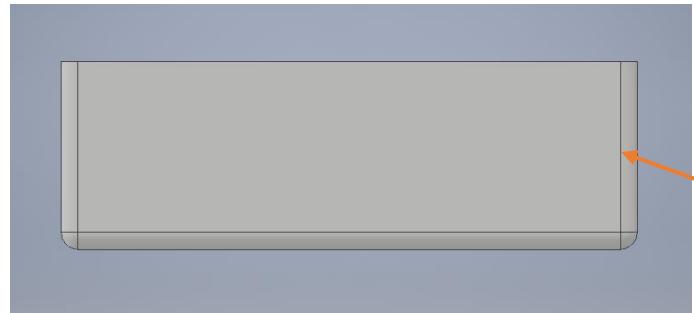
I will need to produce a suitable base for the product, given the shape and nature of the upper product, as well as fitting the other components into this space – the pen and rubber storage and the mechanism in particular. This part is important as it embodies the majority of the whole product, from aesthetics to quality to how it can sufficiently provide enough protection.

The main aims to achieve for this section are:

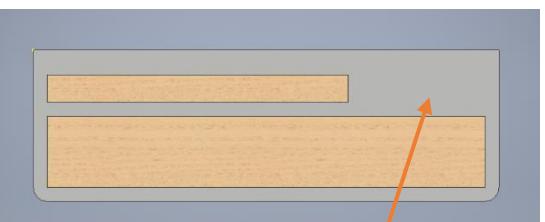
- Explore potential forms of the casing for the lower product.
- Plan out and explain possible materials suitable for this application.
- Find existing products for inspiration behind choices.

Form of the lower product:

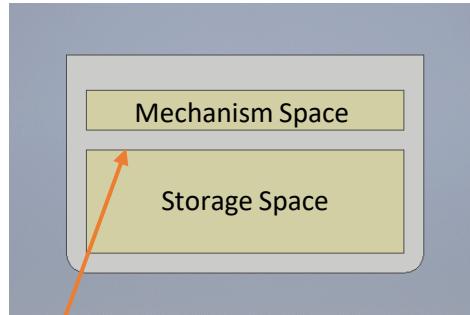
The shape of the lower product must be able to keep and protect the mechanism and the storages, while keeping it simple and easy to understand the components within the lower product as a whole.



The form is a cuboid that has been filleted on each edge except the top. This slightly enhances the ergonomics, as the user is able to grip the edges more comfortably around their fingers.

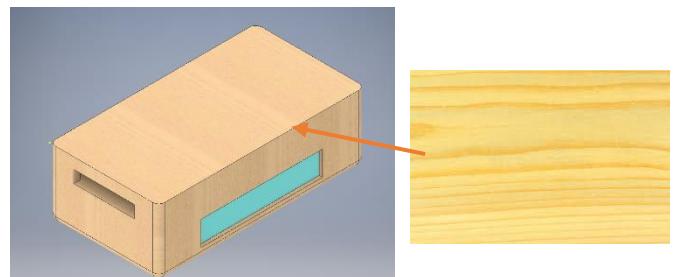


Inside views of the lower product.



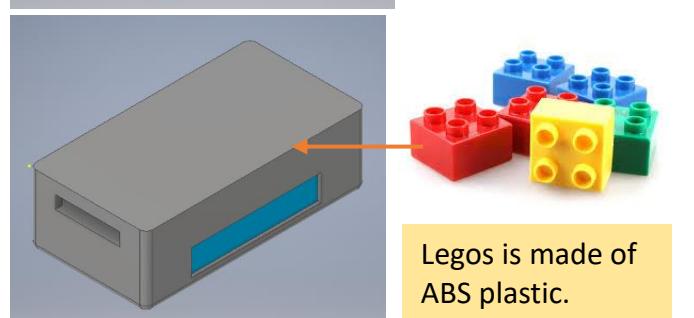
There will be a material, like MDF that will divide these sections off, as with most other shelves on the current market. MDF is cheap, and easy to work with in a workshop.

Materials and modifications:



1. Using pine:

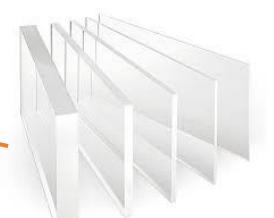
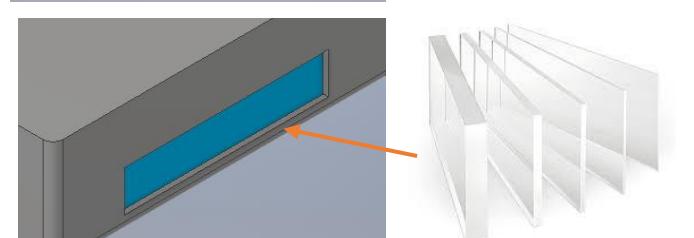
Pinewood is a softwood with lightweight and tough properties that is ideal for this product for the user to carry easily without stress, or having no worry about the product breaking off due to shear forces - e.g. dropping it at the floor.



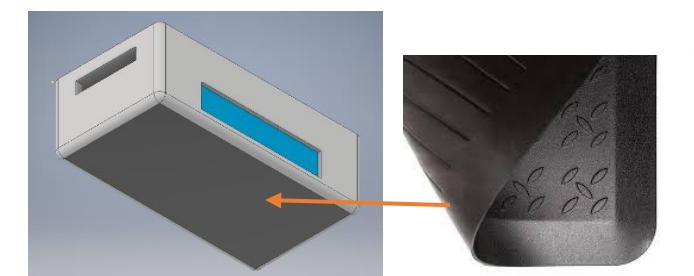
Legos is made of ABS plastic.

2. Using a plastic (ABS);

ABS is tougher than most thermoplastics, and mostly used on keyboards, computers and many more. The colour customisation is more flexible than any wood at production, using a coloured pigment to change the colour to the users desire. It would be time saving, as the form can be made using one piece of plastic, whereas wood takes multiple parts joint together.



For the user, the blue piece can be made of a clear, translucent polymer, ideally PMMA Acrylic. This helps the user view the storage inside from the outside to see if the pens and rubbers are inside. If it is a plastic, it will work well with the ABS casing.



The bottom of the product is to be made of natural rubber (polysisoprene). It has good hardness to prevent scratches from rough surfaces from the table, as well as a frictional insulator – the material is able to absorb the friction that it is against when the product is dragged across a surface.

From the chosen design, the bottom of it looks simple but impractical considering the fact I need to store other materials in the same space, for example the whiteboard pens and rubbers. The way it could be physically handled was questionable from my clients in addition to the issue.

Materials in an existing product – Sony Bluetooth Speaker:

The casing for this speaker is incredibly tough, but doesn't reflect much light with a smooth surface that is easy to hold onto and carry around the household. I believe that the outer material is a polymer-dip coated aluminium. When it comes to the final product, I should consider a finish for the material that allows an extra layer to toughness and reduce damage to the overall product.

At the bottom of the speaker is a ring made of rubber, which is useful when sliding on surfaces, as the material can absorb the frictional forces and without wearing or tearing off – it has excellent abrasion resistance.



My household speaker was a helpful product for inspiration to help me understand the combination of materials that provide different properties ideal to the surface that it is working on and against. Applying this to my product, it has helped me secure the idea that the final design should include a rubber layer at the bottom to reduce the friction and damage to the bottom if the material were different. I believe having this feature also prevents the product sliding off from the user.

However at a workshop and at production, I don't believe it is practical to use a plastic to form the whole lower product, as we don't have the equipment to make such shape. I will stick to wood, but always refer the finishing technique of filleting and colour to enhance the bright aesthetic and ergonomics.



A Level Product Design Coursework

Mervyn Ochoa - Dugoy

Part 3 – Final Design, Manufacturing Plan and Evaluations



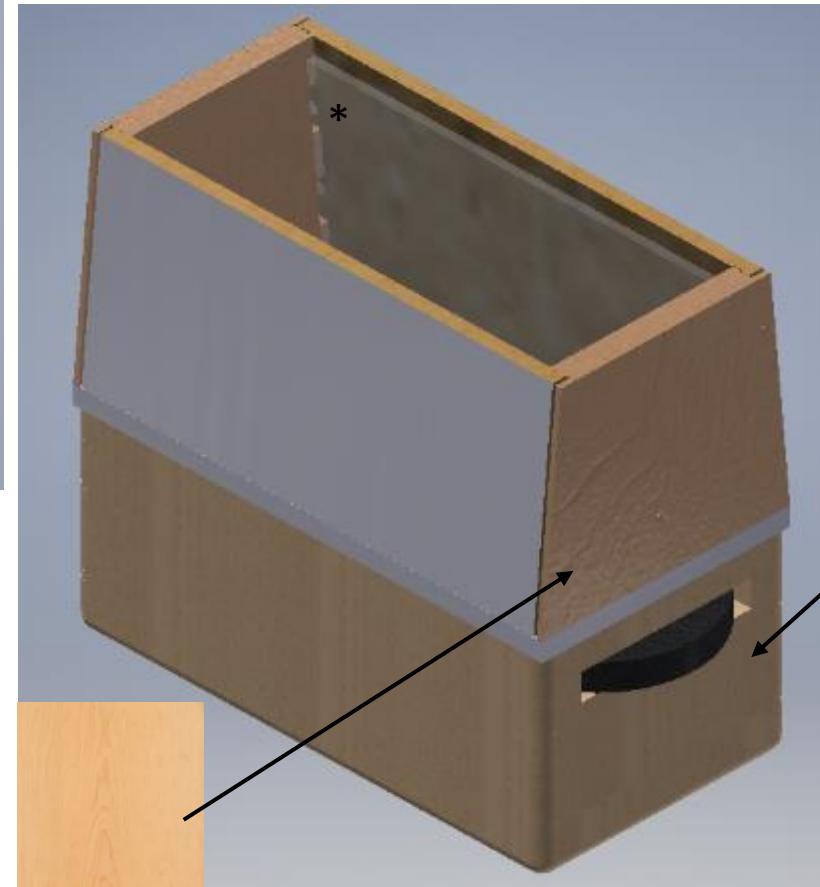
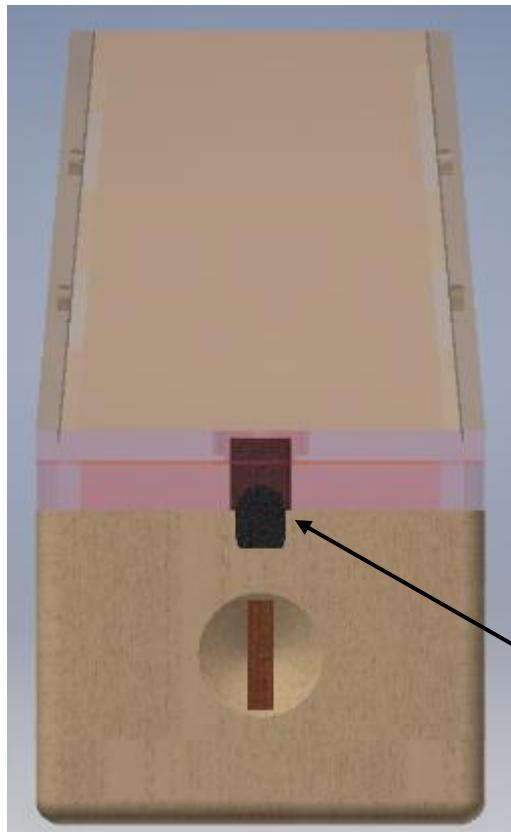
Final Design

This final design incorporates most, if not, all of the developments that I have worked on into one design. It includes how my product form as a whole, as well as individual parts that can be extended and released from the product, which my clients will likely do if produced from manufacture. To ensure all aspects of the design is finalised, I will receive client feedback to adjust minor and major aspects, particularly in material choice and aesthetics – these will be important to decide what processes each part will need to go through.



Fillets:

Every edge of the lower half has been filleted to enhance ergonomics, and less risk of self-damage by sharp edges.



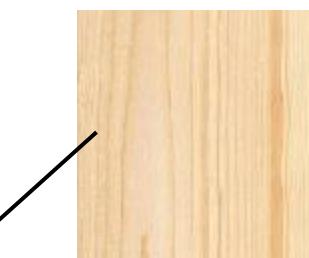
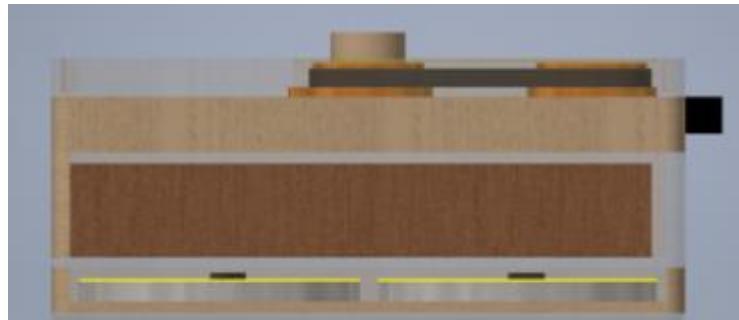
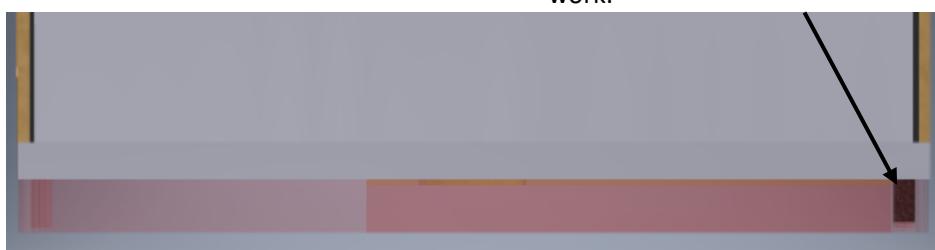
Maple wood for upper product:

Maple is a hardwood, but will only be used for the side pieces, with low thicknesses, so the weight is tolerable for the mechanism to work still.

In relation to aesthetic, the grain pattern is minimal but bright in colour, and it gives the sense of a classroom setting when putting this type of wood adjacent to the whiteboards.

Locking piece:

A small piece be made of opaque acrylic (PMMA). After discussing with the clients, they feel like the product had no security or stability of keeping still if they needed to show their writing and work.



Pinewood for lower product:

Pine will be used to cover the storage for pens and rubbers, the mechanism and the wheel randomiser – to restrict the parts' free movement, except in the plane they can move out to.

Pine is most suitable for this application because of its rich bright and straight grain aesthetic. This is ideal when applying any finishes, such as paint or lacquer – it will still remain light for the user to see.

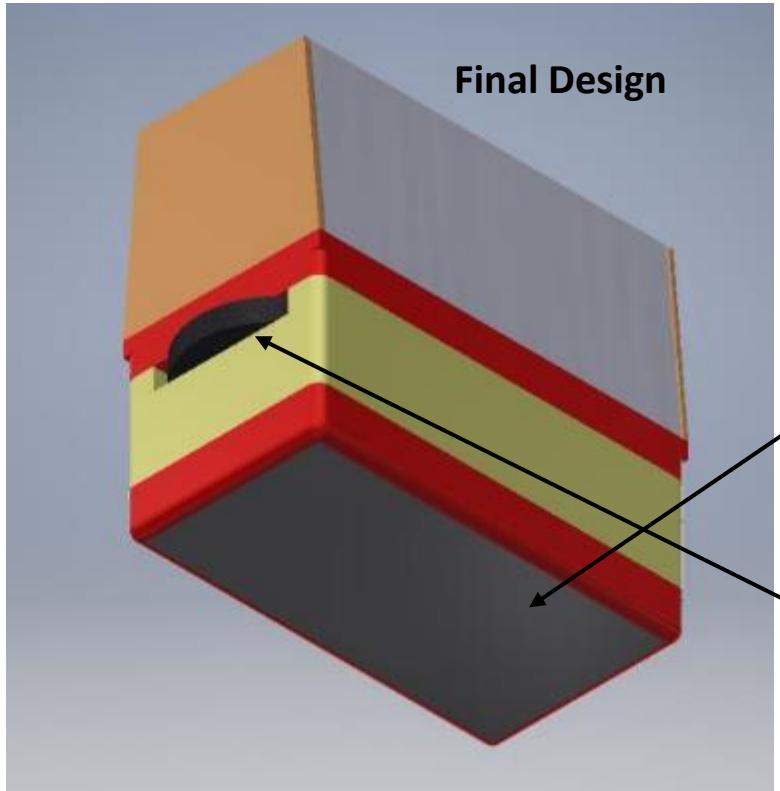
Furthermore, pine is a softwood and typically lightweight, so the user may not have to experience as much strain and effort to lift the product and carry it around. It is also tough, so it is able to withstand impact forces such as tension or compression. In terms of manufacture, this casing will need to be made of several pine pieces jointed together with dowel joints to make it more professional-looking.

From the Client:

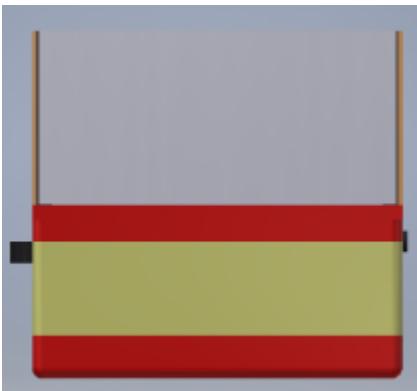
They were generally satisfied with the form of the product – a relatively simple design that isn't over-the-top. However, they pointed out the colour and overall aesthetic of it is rather boring and bland, with no visual indication what the product is meant to be for. From my view, I had to explain to them the product from the pictures shown here in detail, which isn't ideal, so I will use brighter colours to engage them into using it, and somehow make the visual of the product appeal to the Spanish learners, as its supposed to be intended to be.

The colour choice has also led the clients to dislike the material choices in the upper product, from the base to the whiteboard. The worst of these is the side pieces – a pinewood piece jointed 'loosely' to a transparent acrylic piece.* With the whiteboard, it is unescapable to change the material it has been made from because I will buy it online, and second, it is incredibly difficult to separate the writing surface from the material itself – the only solution to this in manufacture is to put a thin wood laminate to cover the original material, which we are not able to do in the workshop. Dense pieces of wood on top makes it harder for the user to execute the mechanism, so lightweight materials should be used, like ABS or pine.

Final Design

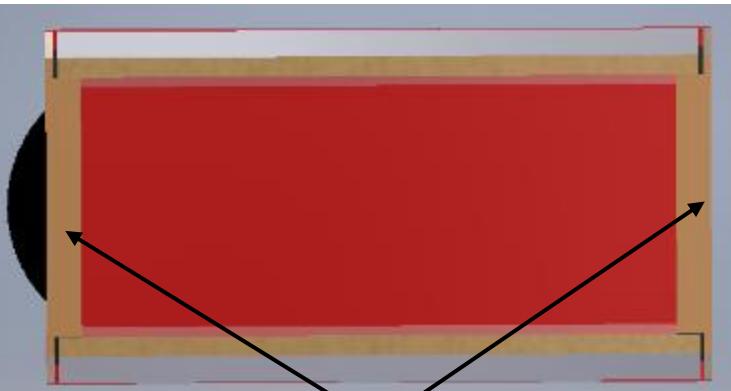


Final Design



Colour changes:

Using client feedback, the colours now reflect the Spanish flag at the lower half of the product – this will likely be done by painting on the pine wood. The ABS will be red to match.



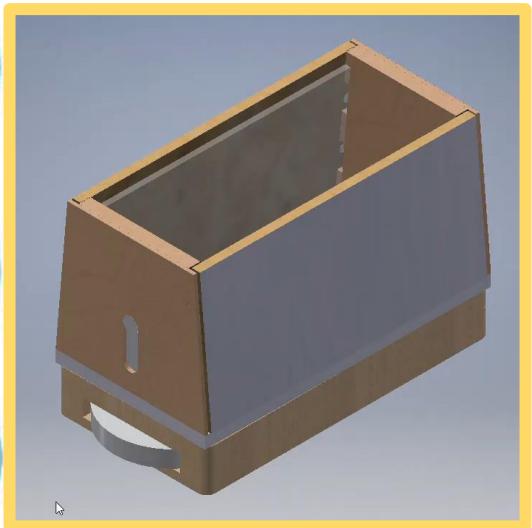
ABS:

The side pieces in the upper product will be using ABS, which is lighter and more flexible in colour in comparison to maple wood, which is heavy and dense. I can still manage to create the classroom environment with the light orange colour.

Acrylic:

These two pieces of translucent PMMA acrylic will be slanted to a small angle, with its purpose to see the flashcards inside - it also has good hardness, so scratches won't be easy to see if the whiteboard ever scratches its surface.

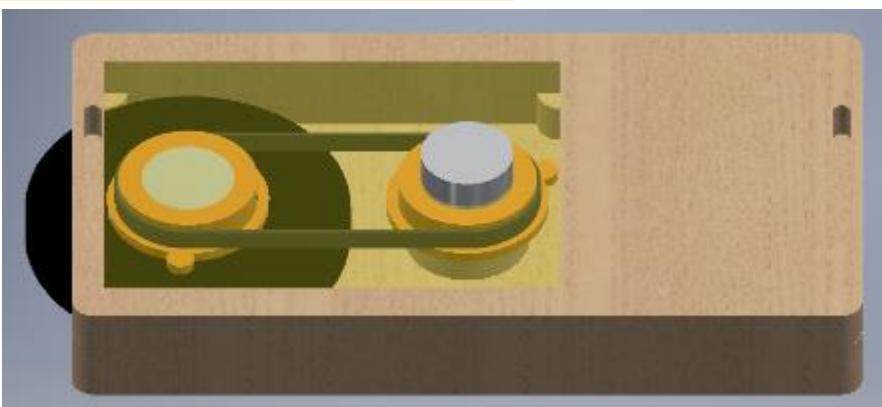
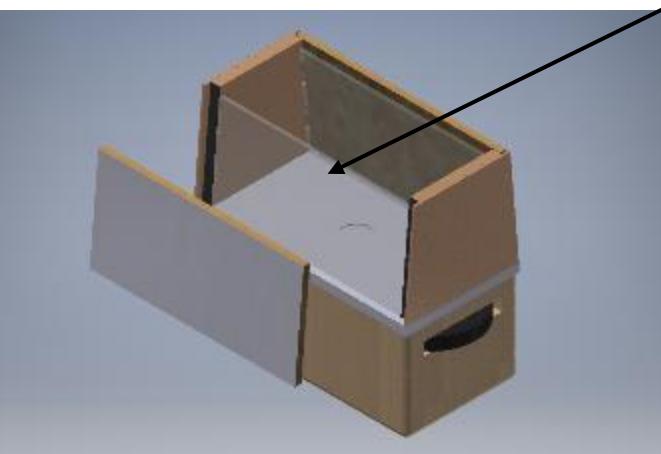
In manufacture, I plan to make a finger joint between these pieces to the adjacent, opaque ABS pieces to secure its placement, in which the joints are hidden by a magnetic strip for the whiteboard to attach to. Also, these pieces are thin and made to a height where the user can pull off the whiteboard from the top to take away for use.



Mechanism:

This will be placed just below the upper product, to make the rotational efficiency from the input (by spinning the silicone wheel) to the rod that turns the product.

After iteration, I have used a mechanism similar to ones used in bicycles. Here I'm using a rubber belt to transfer the energy between two wheels to produce the spinning output.



Transparency:

A PMMA, transparent acrylic piece will be used to cover the mechanism. It also allows the client and users to see the mechanism in action, and to check for any faults in the spinning process.

Whiteboards:

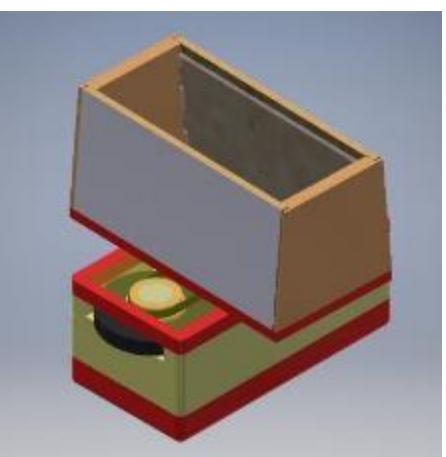
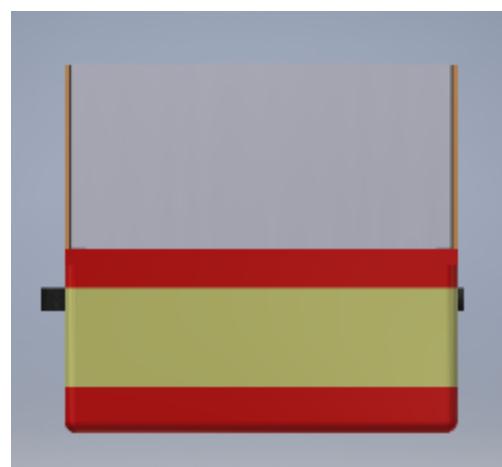
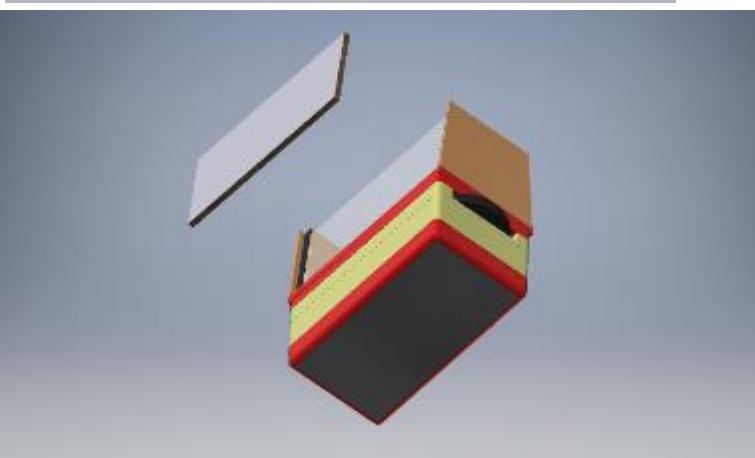
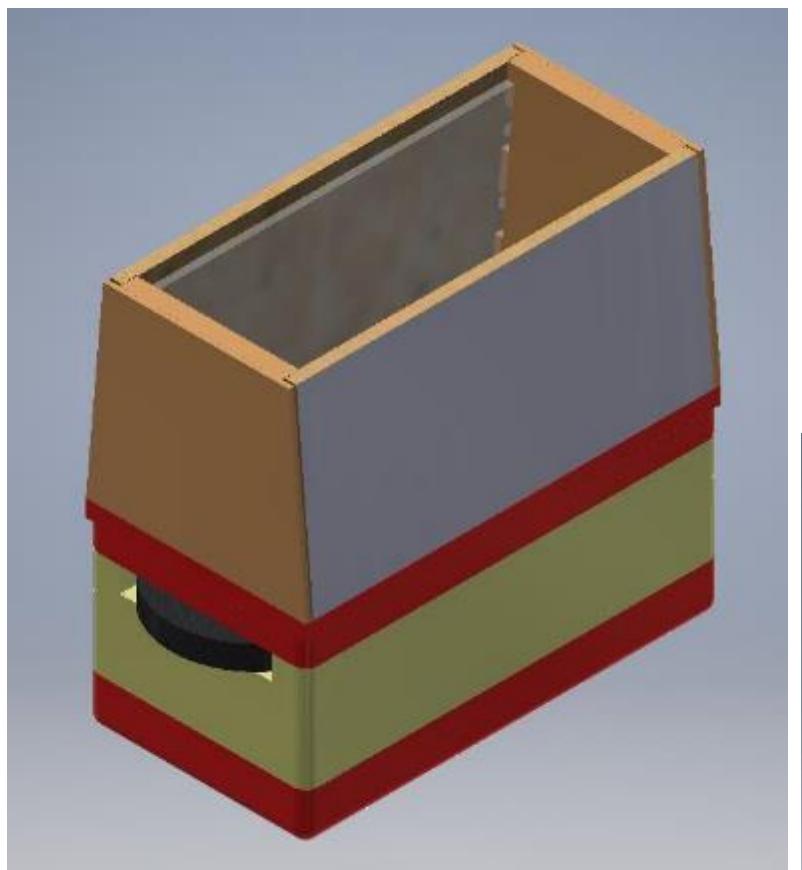
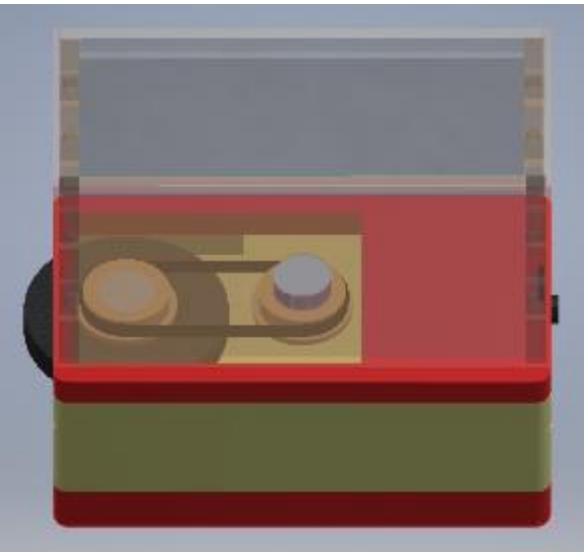
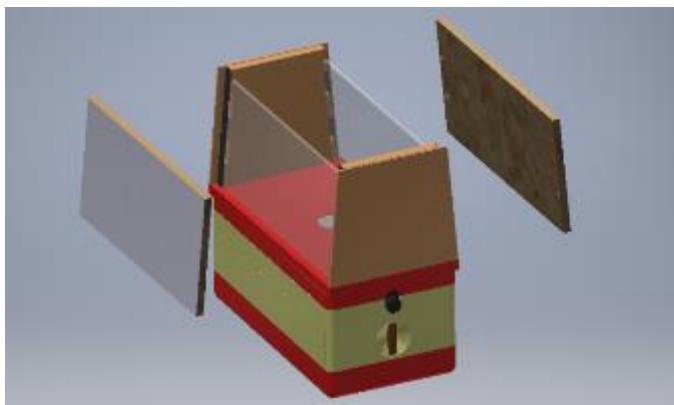
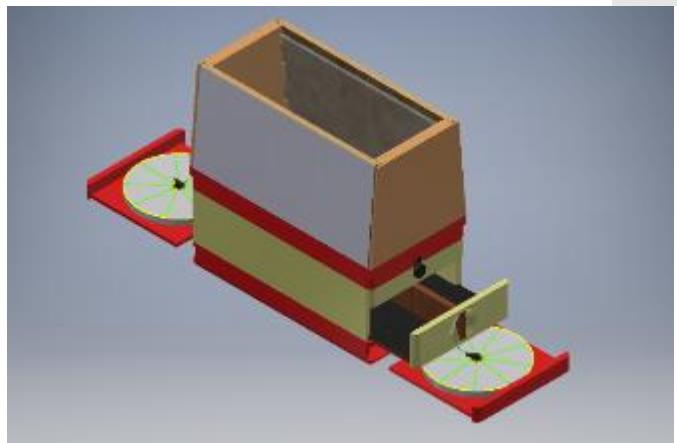
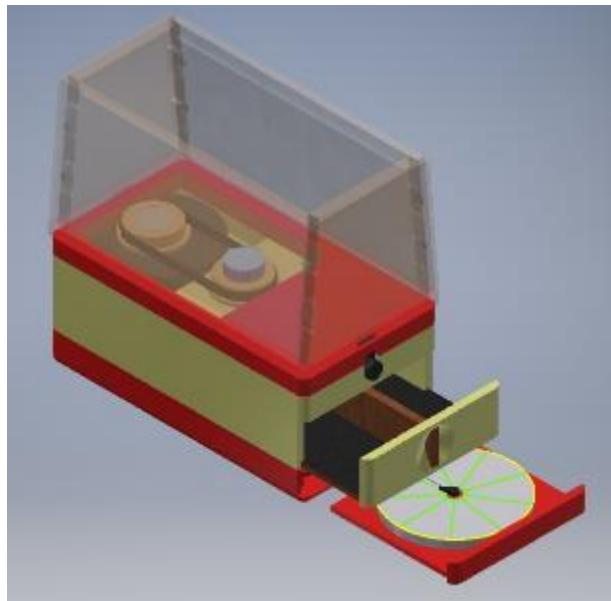
Neodymium magnets are embedded inside and close to the side edges so that they can be attracted to the magnetic strip. Its main use is for writing to present the user learning to their peers.

From the Client:

'It is more understandable on what the product is now with the bolder colours, arranged in a way that makes the Spanish flag. The material choices all around seem reasonable, and if produced in real life, I wouldn't face the stress of using them when carrying or spinning the wheel. Overall, I think the small changes are good enough.'

Final Design – Final Photos

The slide shows photos of the intended design, given all the client feedback, for manufacture. It also contains photos of other external views.



Revisiting Aspects

The final design mostly uses the aspects that I have produced in the development leading towards it, in hopes to meet with my specification. However, between then developments and final outcome, I have changed some of these without clear clarification. These will be explained in this slide with its reasons of the sudden change.

The main aims to achieve for this section are:

- Make a table of aspects I've used and not used in the final design
- Explain any new features and changes thoroughly
- Provide client feedback to support the previous issues and existing parts.

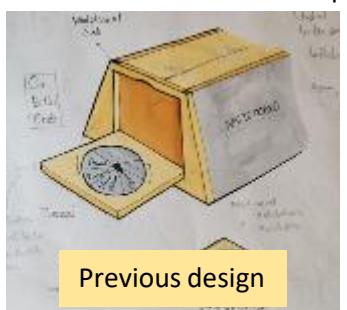
Final Design Feature	Included in Development?	Any change from development?
Spinning Mechanism	✓	✓
Language/Communication Skills	✓	✓
Whiteboards	✓	✓
Pen and Rubber Storage	✓	✓
Word Bank	✓	✗
Product Lock	✗	✗
Lower Product Casing	✓	✗

This table helps to visualise the sections of my development that have or have not been included or modified when adjusting towards the final design.

Language/Communication skills (wheels):

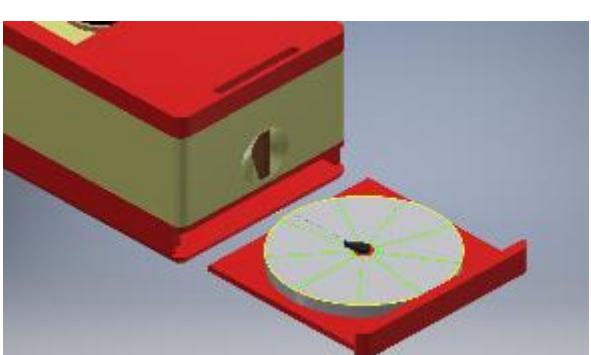
From my clients, they were concerned with the upper product being top-heavy and unstable due to the wheel placement. In the final design, I moved the wheels down to the lower product so that:

- The upper product is lighter, allowing the mechanism to be more efficient in rotating it.
- The user can take the entire wheel out, to bring them closer to themselves to spin.



Previous design

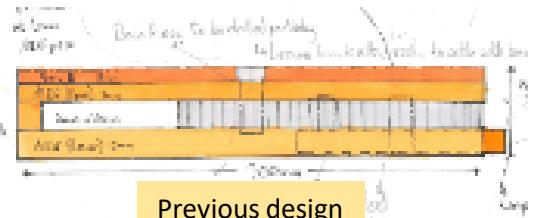
The functionality and the spinning still remain the same.



This design allows the user to push and pull the wheel in and out for use.

Spinning Mechanism:

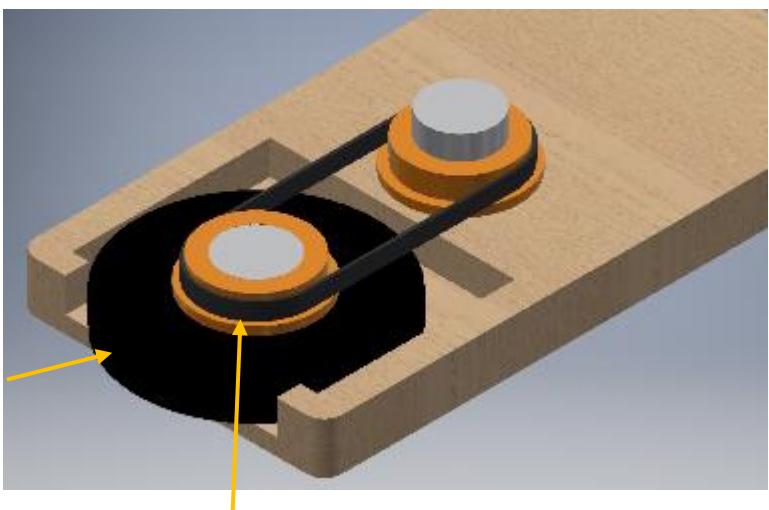
I felt that my redesigned idea was similar to its previous design, in terms of performance, so I had further iterated it using other types of mechanisms. The mechanism now used in the final design is minimal, using two basic wheels connected to a belt – similar to ones used in bicycles.



Previous design



The black wheel will be made of a silicone rubber. It is formidable in ergonomics with good flexibility for the user to grip and spin it to rotate the upper product.



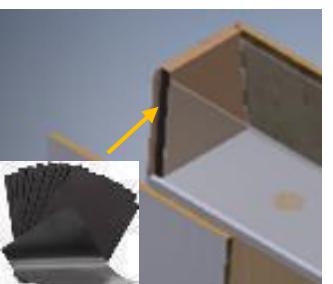
I will use a rubber band to transfer the energy from the silicone wheel to the upper product to produce the rotational output. At work, it will move around the orange wheels' circumference. The orange wheels will be 3D printed, with a wider base to prevent the rubber band to twist due to friction.

Whiteboards:

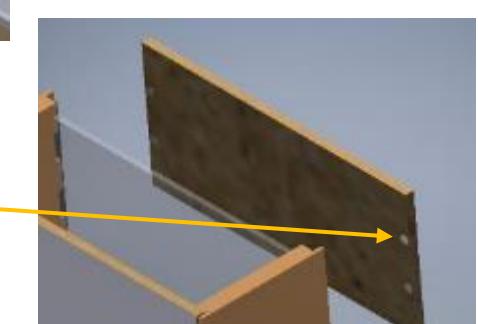
From the intended design, the user could only insert the whiteboards into the upper product through one plane arising into these issues:

- The user may need to reach out further to slide it in, if the product is a distance away from the user.
- The thin, exposed ends of the upper product is vulnerable to snap.

Hence, I changed it to a magnet system, using a thin magnetic strip and neodymium, a strong magnet that can be attached together.



To be put on both sides, the magnetic strips are relatively cheap (around £2.90 per A4 sheet) and are 0.5mm thin, equivalent to paper. It can cause a dipole interaction causing magnets to stick to it.

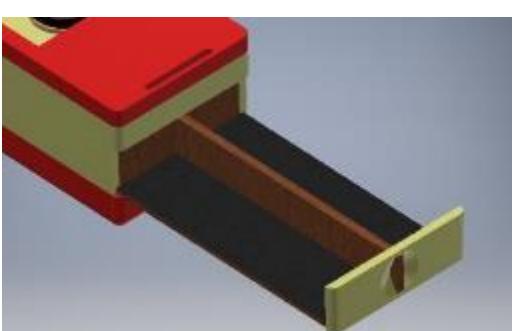


The neodymium magnets will be drilled into the whiteboards, attached to its ends.

(Whiteboard) Pen and rubber storage:

Within the space provided in the final design, I divided the area into two, each space providing the necessary equipment for writing. I has been divided in a way that as soon as it is pulled out, it's ready to be taken out, facing directly to the user.

I used this divider piece to enhance aesthetic as well, by purposely exposing a part of it as a way to provide a handle to pull the part out of the lower product.



The base has a wide base to hold against the side casing of the lower product. This prevents the storage from the tilting effect from pulling it out.



Product Locking

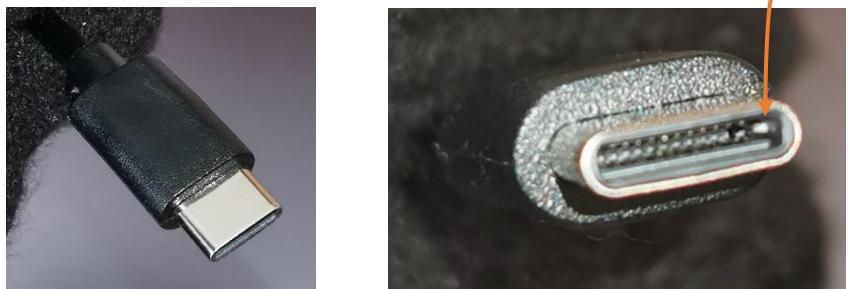
Product Insight – USB Cables:

USB cables can have different ends, which connect in a male-female manner. For my product, I intended to make a 'connection' system to lock my product using this as inspiration. I've taken my locking design from type C cables, which is mainly produced and distributed from China, including Huawei phones and laptops.



USB Cable – Male part:

The type C male piece is shaped like a slot with an integrated PCB board that electronically transfers energy and power to the female part, in this case, to charge my earphone case. There are two thin wires (one shown in picture), made of nickel, that are attached on the ends of the inside which allows the two parts to connect firmly, once enough effort is used to push the cables together.



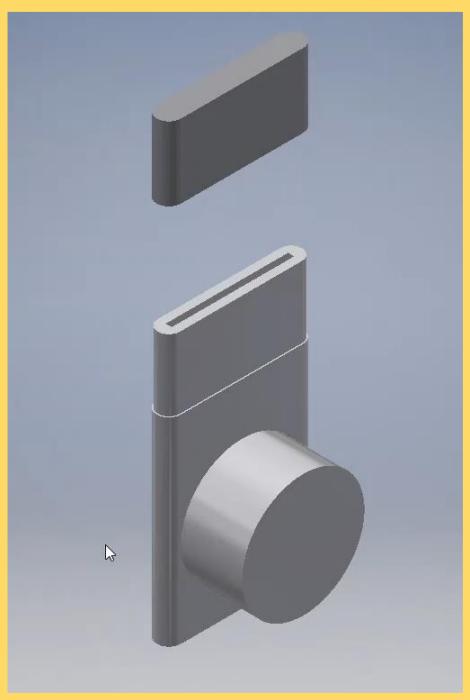
Earphone Case – Female part:

It has an open slot shape to receive the male part to form the connection. Zooming into the female part holds a small conductive piece that sticks out in the middle to secure the position of the joint parts.

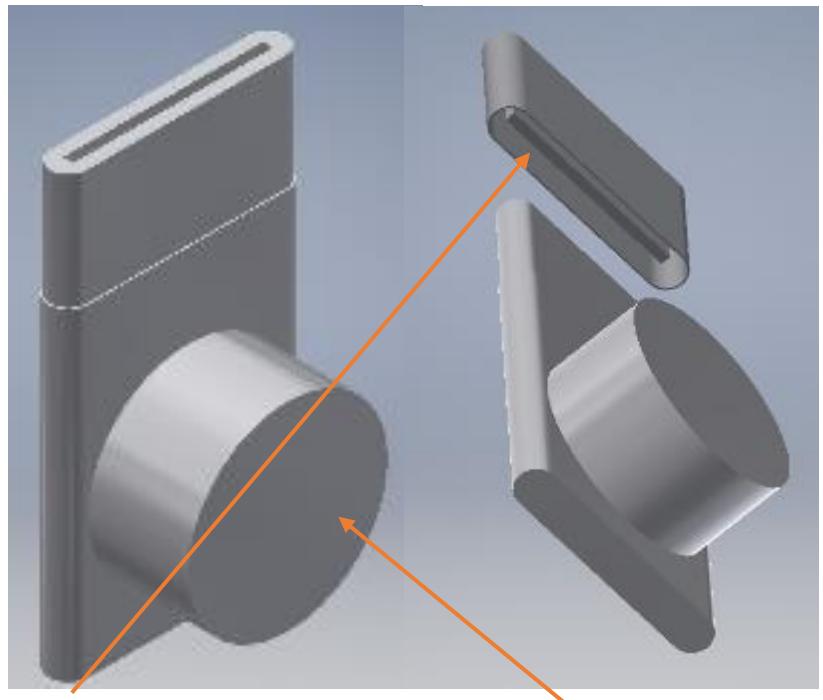


My final design includes a locking system that will secure the upper product position from excessively spinning, allowing the client and user to have more control on the product. This was added to the clients desire.

Locking Design:



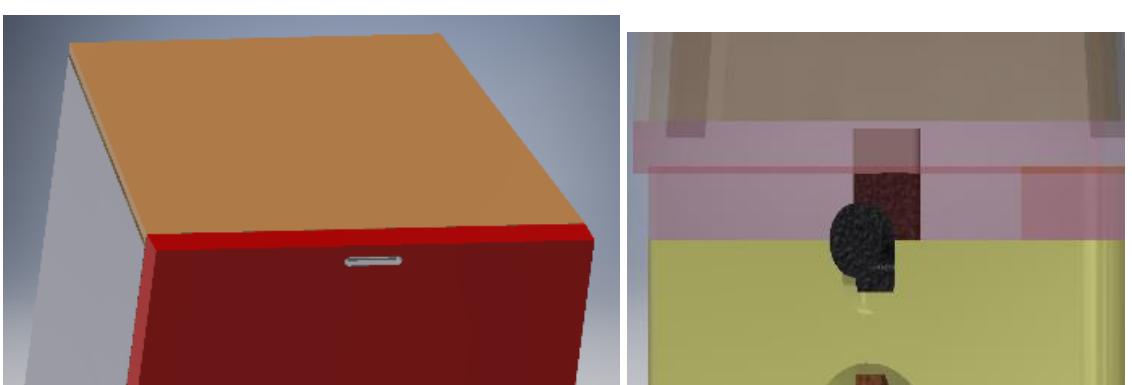
How the locking mechanism will function.



The female part has a middle part to help fully encapsulate the male part to flush together. Furthermore the male part has an exposed round shape that the user can hold to slide it up.

Both pieces will be made of the design are to be made of PLA, polylactic acid, which is eco-friendly (sourced from sugar cane and corn starch) and recyclable after the products lifetime. It is lightweight, therefore easy to lift and drag across the side of the product, shown below.

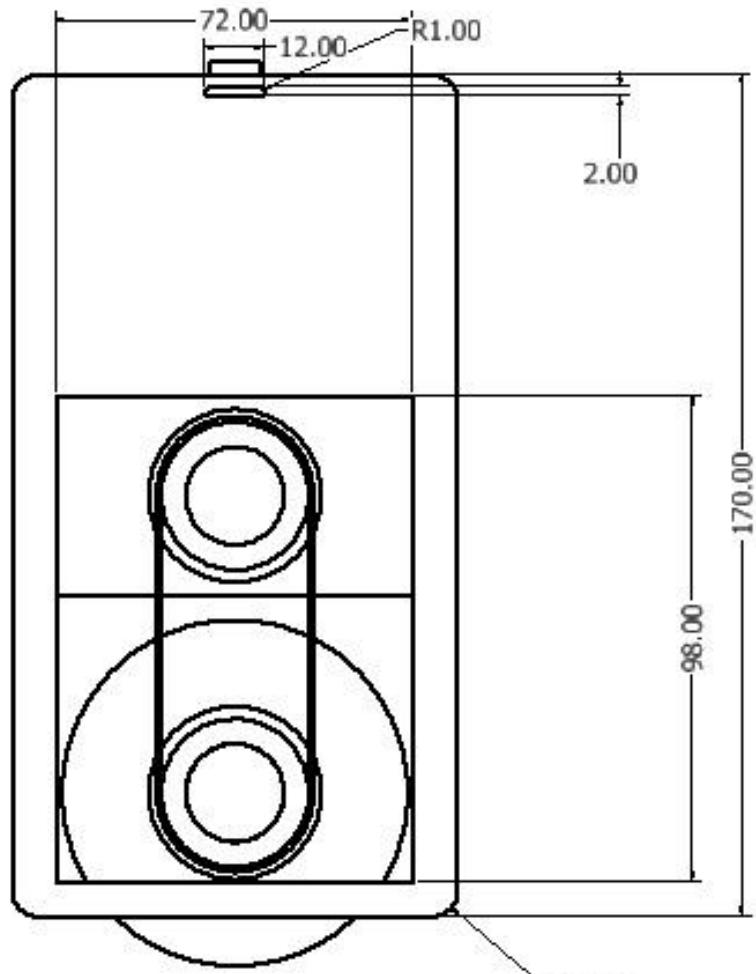
In terms of manufacture, I will use a 3D printer to print the parts, smoothen them if necessary, and use a polymer gluing agent to attach the parts to their respective places – the female part at the spinning base, and the male part against the side pieces. Prior to their placement, I should ensure the parts are accurately to scale.



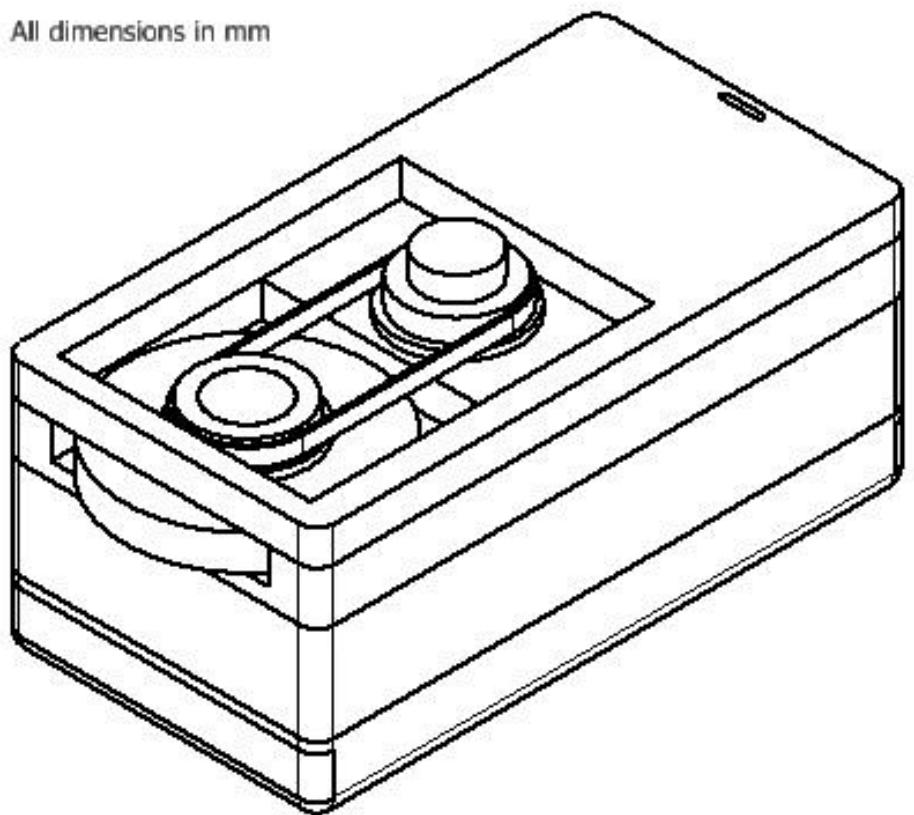
← Connecting the USB cable (male) to my earphone case (female).

Working Drawings

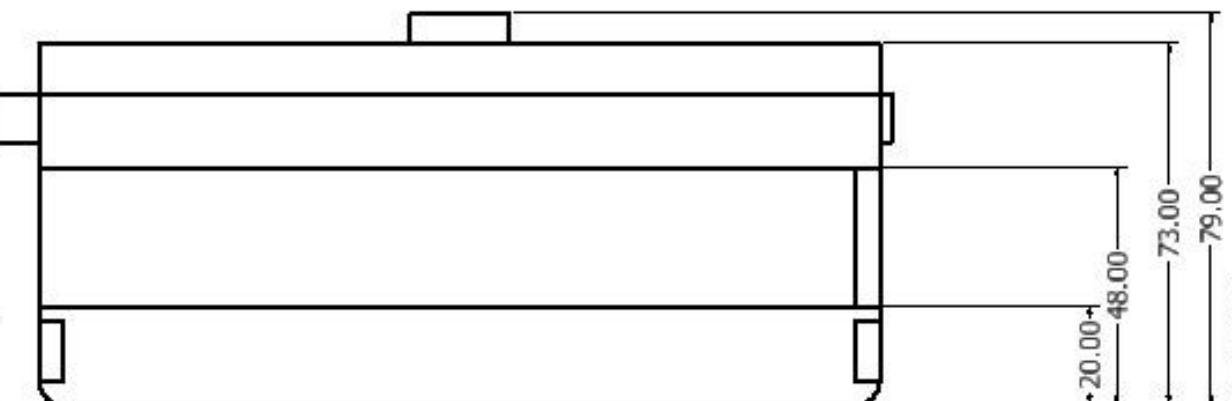
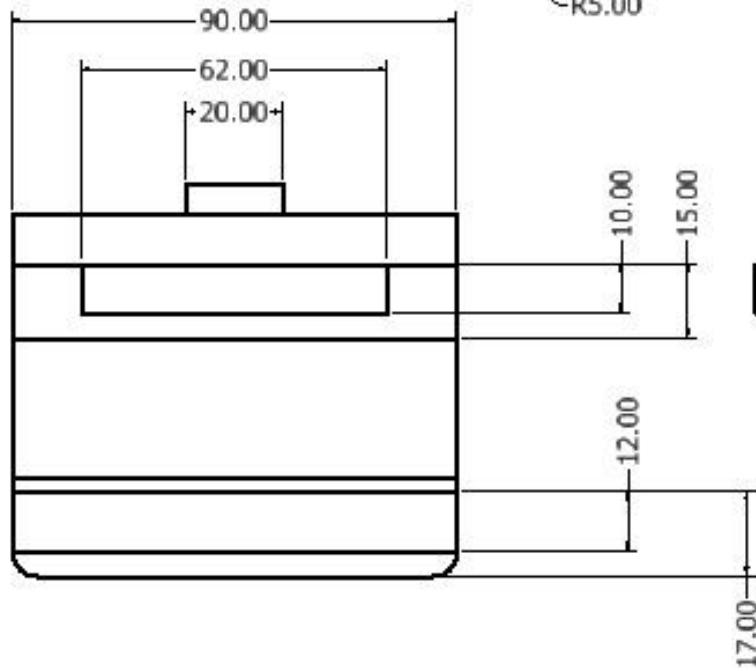
The working drawings are a way to easily represent the scale and size of a product to a third party or manufacturer for them to understand and produce. The majority of these drawings in these slides are third angle projected orthographic drawings, showing the plan, front and side view of the structure of the product.



All dimensions in mm



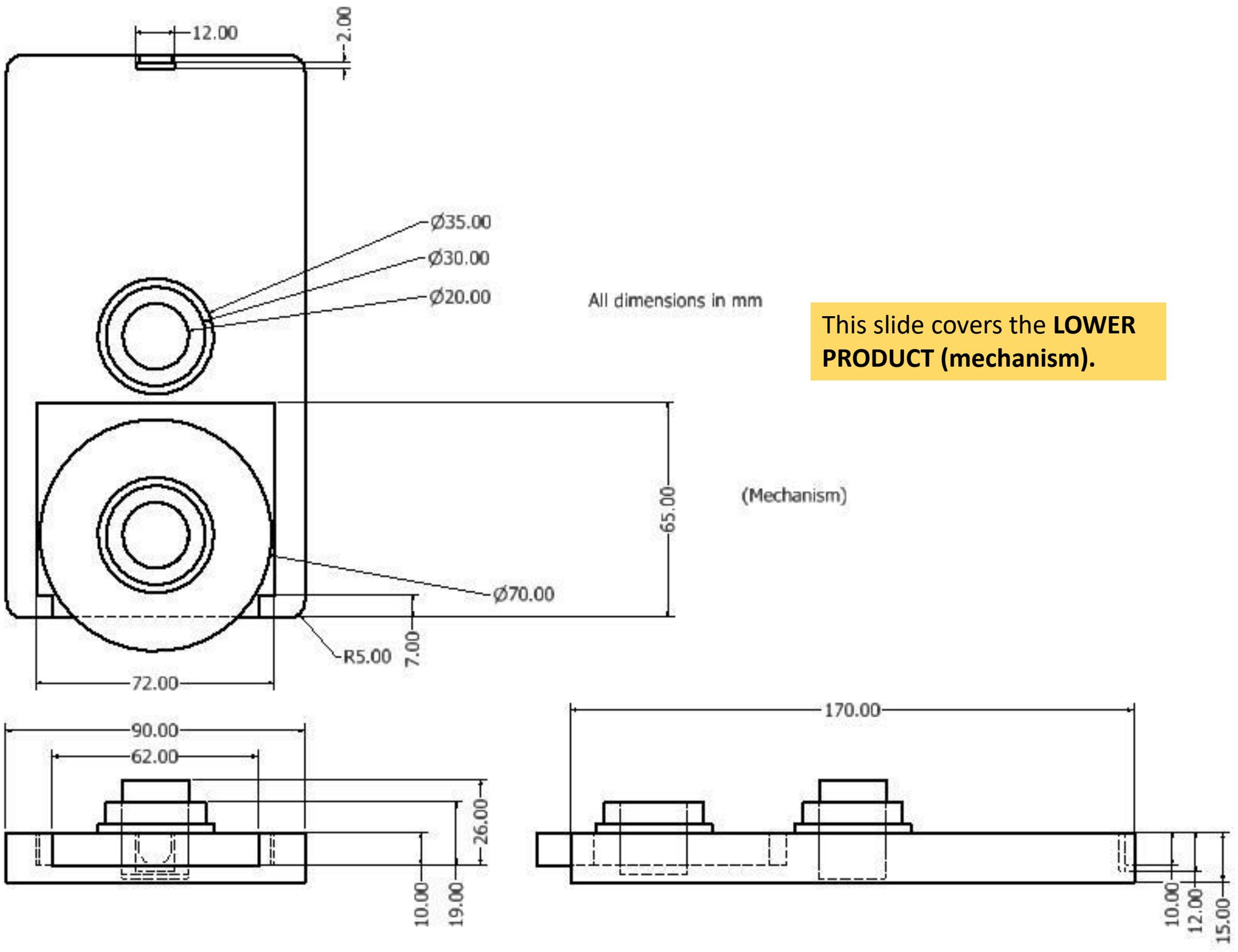
(Lower Half)



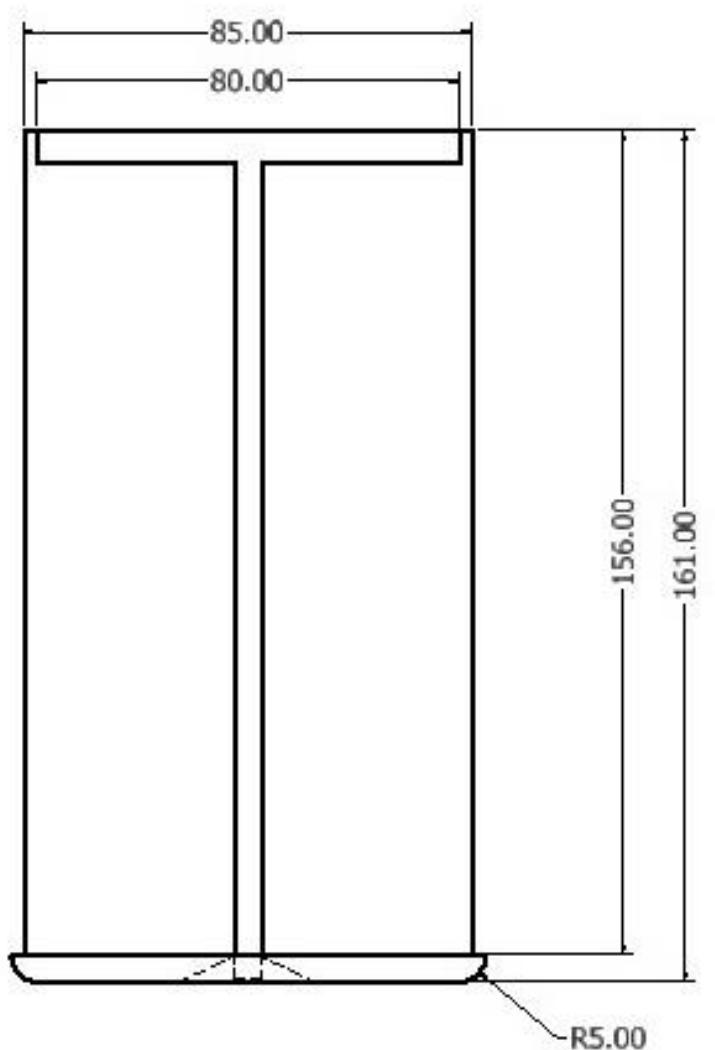
This slide covers the **LOWER PRODUCT (casing)**.

Design Check	04/02/2023
CHECKED	
QA	
WHS	
REVIEWED	
APPROVED	

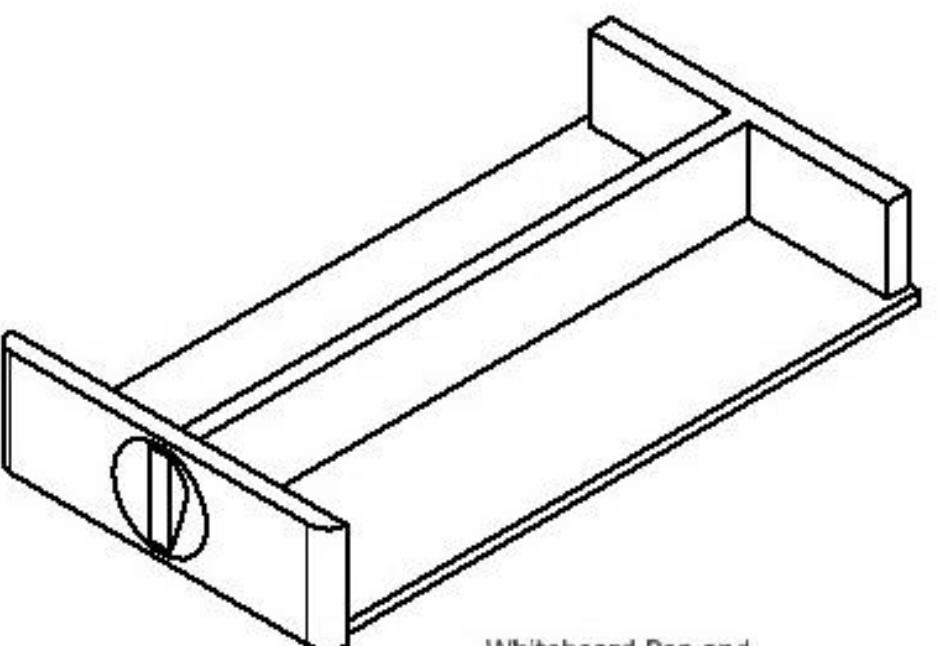
Working Drawings



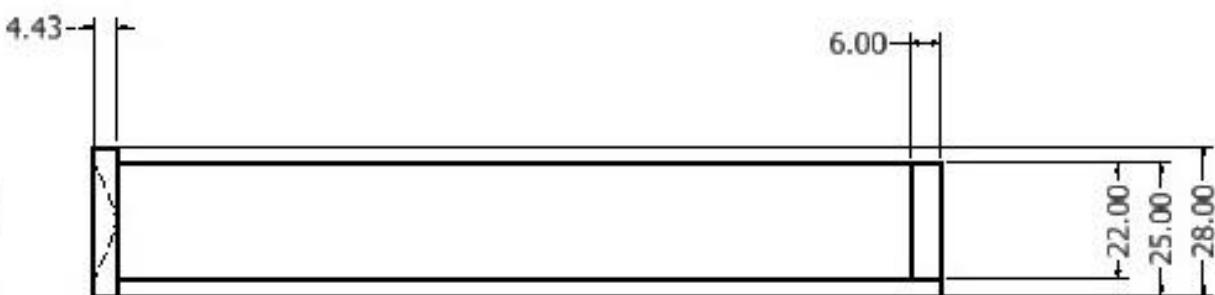
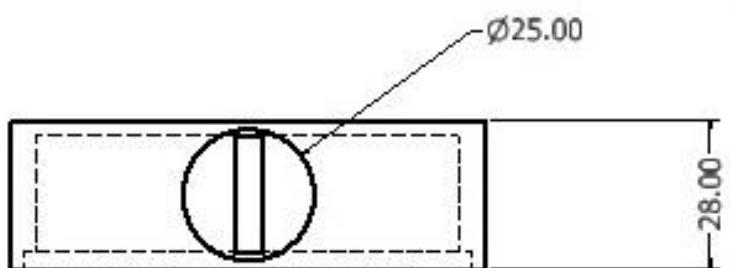
Working Drawings



All dimensions in mm

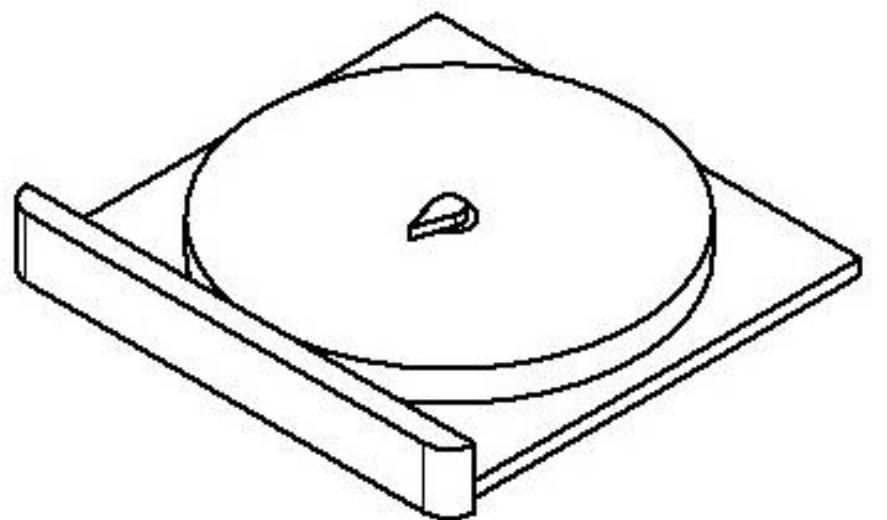
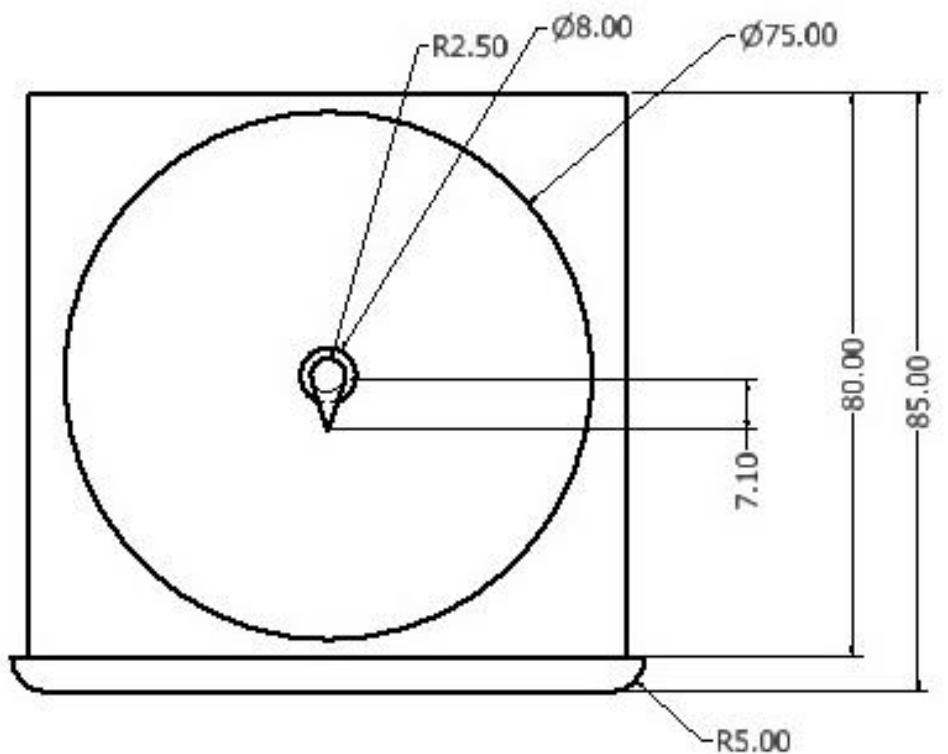


This slide covers the **LOWER PRODUCT** (Whiteboard pen and rubber storage).



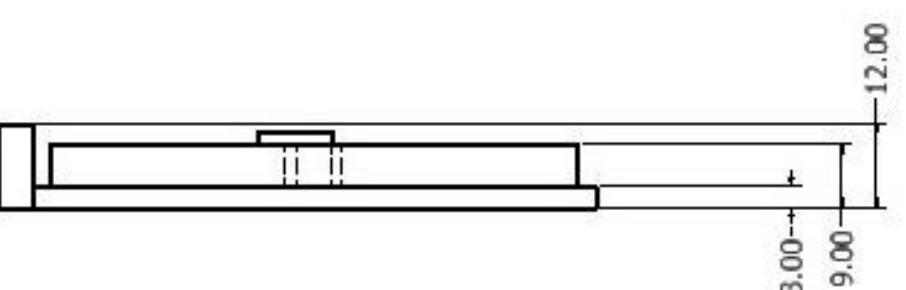
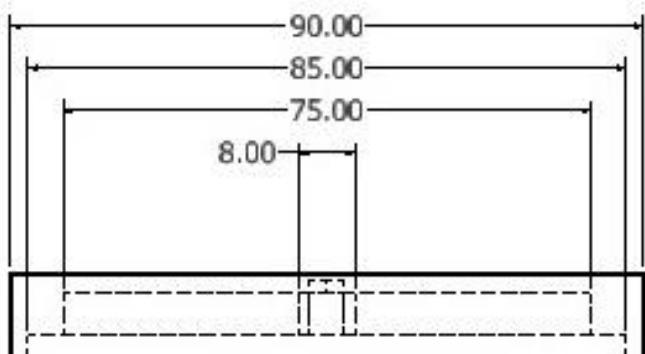
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Working Drawings



All dimensions in mm

(Wheel)

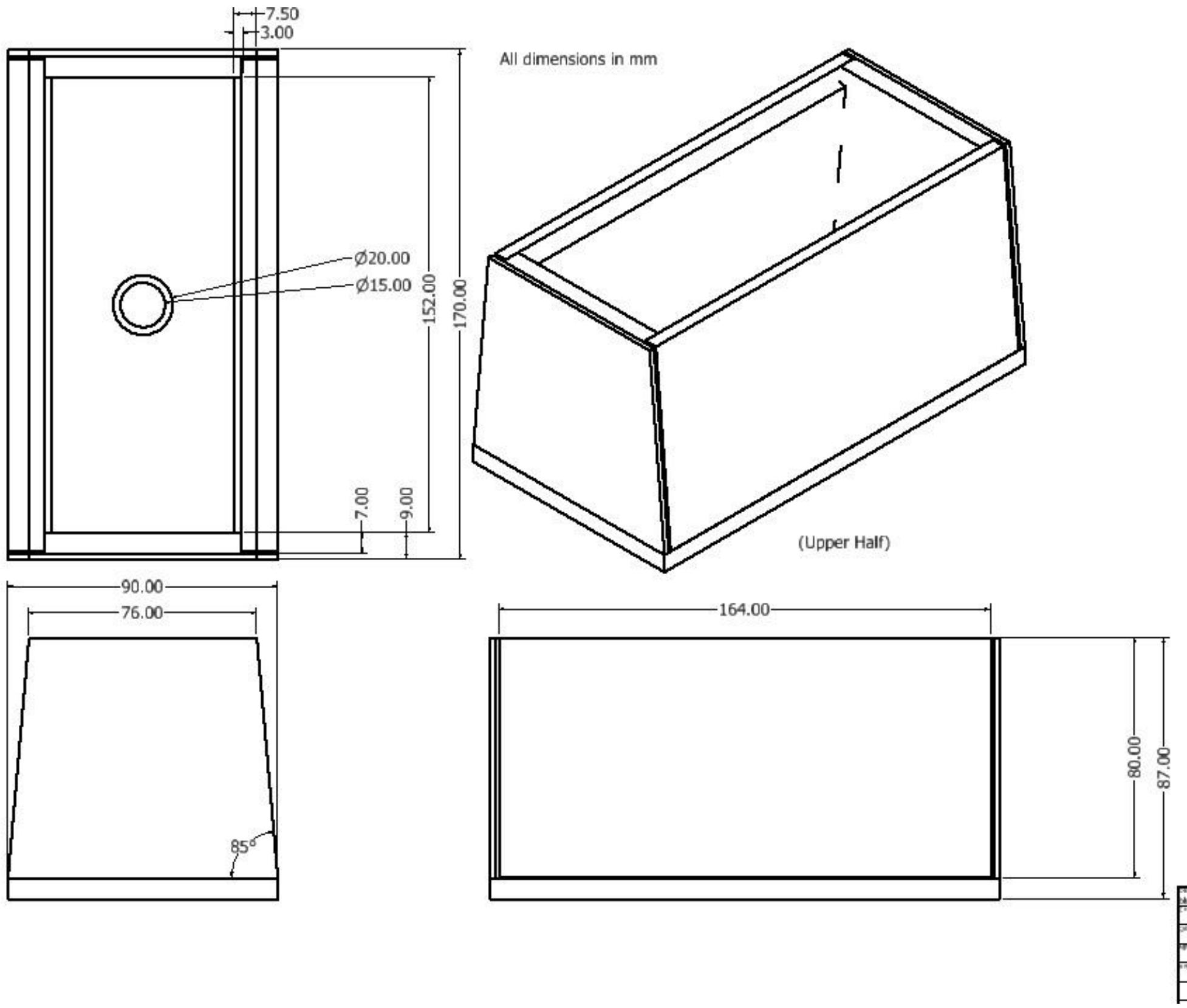


This slide covers the **LOWER PRODUCT** (Communication wheels).

Version	05/03/2022
Author	John Doe
Date	2022-03-05
Comments	Initial version
File Name	Wheel Assembly

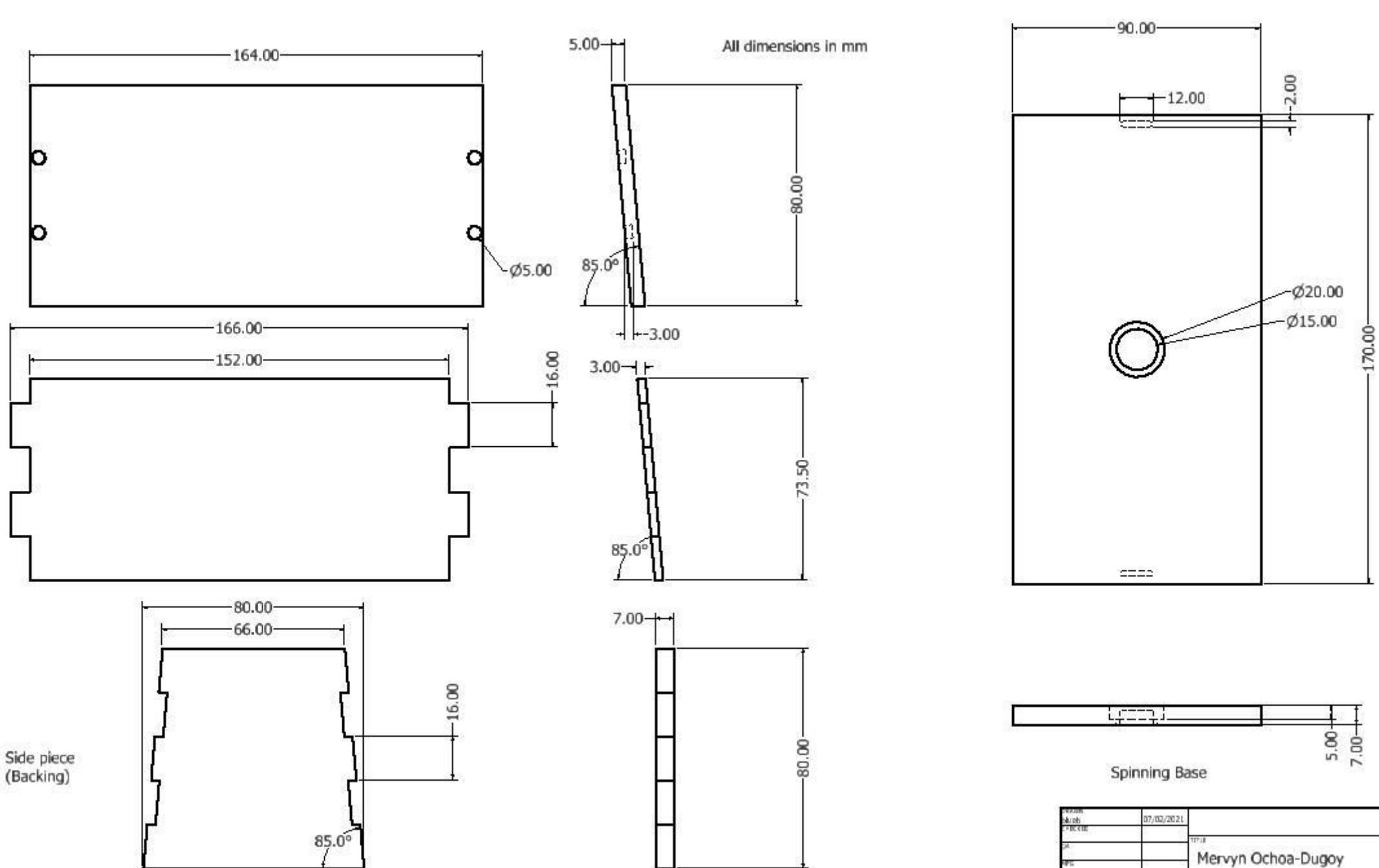
Working Drawings

This slide covers the **UPPER PRODUCT (casing)**.



Working Drawings

This slide covers the **UPPER PRODUCT (inner components)**.



Version	07/02/2021	TP18
Author	Mervyn Ochoa-Dugoy	
Date		
Comments	D	DWG NO Upper Product Components

Manufacturing Plan

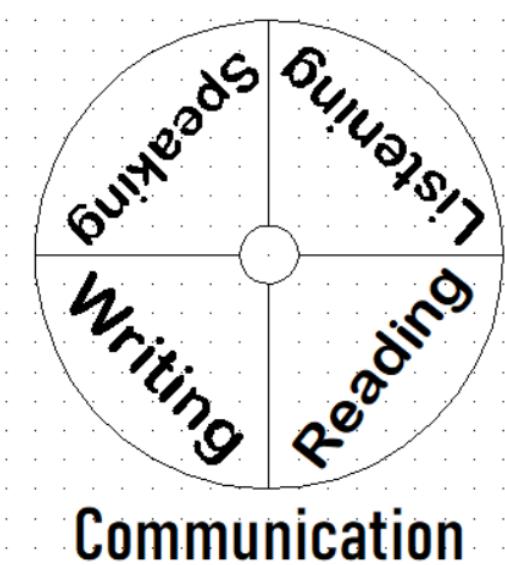
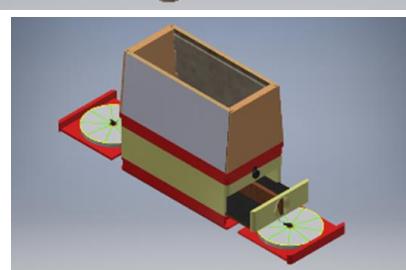
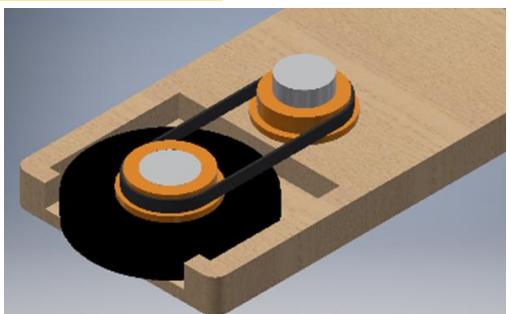
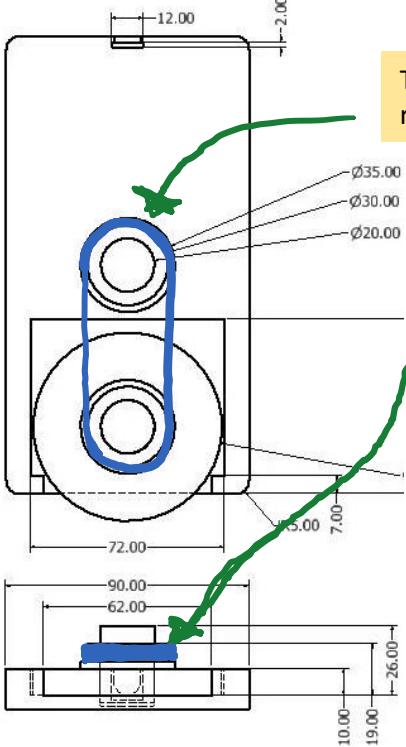
A manufacture plan sets out how I intend to produce the product in stages and steps. Alongside the essential steps, I will state and explain briefly: the equipment needed for the particular step, the time it takes to complete and any essential quality checks. Having these properties at each stage ensure I am following the correct procedure and maintain high quality for the final product from start to finish at manufacture.



Section	Stage	Tools, Materials and Equipment required	Time (minutes)	Quality Control – how to ensure quality
(Turning) Mechanism	3D print mechanism parts from CAD software: 2 rings - ø25mm x 20mm (with ø20mm centre hole) 2 rods - ø20mm x 27mm	3D Printer (Tier Time 'Up Box' with software) Autodesk Inventor 3D Printing Bed, ABS (granules to be melted)	200	Make sure the print-out is to a one-to-one scale at the Up Box software, when transferring the CAD model. Upon printing, ensure the mass of the granules (to be molten) is greater than the mass displayed on the screen.
	Remove parts from the printing bed	Heat gun Bed scrapper	25	I must make sure the heat gun gently warms up the printing bed (from below) and heat at areas at a time to scrape the parts off individually.
	Smoothen 3D printed parts	Sandpaper Hand drill with rotary drum sander	30	Insert rods through the rings repeatedly until the rods are thick enough to pass through. Use a vice to lock the printed parts in place for sanding with the hand drill.
	Prepare jig for the interactive wheel: Wheel - ø70mm x 10mm (with ø20mm centre hole)	Waste/ Used up material Clamps Fretsaw Nails (with hammer)	20	Make sure the inner circle is ø70mm with a ruler – otherwise, measure 35mm from the centre point for the radius. Place a base material so that the silicone mixture doesn't stick to unwanted surfaces, like a worktop. Find suitable materials from the waste box in the workshop.
	Dye the silicone black and pour the mixture in the prepared jig	Silicone mixture Black dye (with stirring rod) Leveller or scrapper	60	Stir thoroughly so the black dye is spread evenly across the mixture. After pouring, use the leveller to scrape off excess silicone, and ensure there is a flat surface on top. You may wish to use a heat gun to speed up the process.
	Remove jig from the silicone material	Claw Hammer	10	Minimise pressure on pressing the material to remove the jig – it may crack the silicone. Use the back end (claw) of the hammer to pull off the nails.
Lower Product (Exterior)	Cut outer face pieces with MDF (mm): Sides (2) – 90 x 70 x 5 (2) – 170 x 70 x 5 Bases (2) – 170 x 90 x 5 (1) – 100 x 80 x 10	Band Saw Jig Saw Wooden File (and sandpaper – P240 grit) 5mm thick MDF (Medium Density Fibreboard) 10mm thick MDF	30	Use measuring tools like pencils and tri-square to accurately form rectangular shapes when cut out – with 90 degree angles.
	Create 3 straight cuts (5mm width, 2.5mm depth) across sections of the long sided pieces using a router. Cut placement from bottom of side piece: 0mm, 15mm, 45mm.	Router (Use router table if appropriate) Straight drill bits	20	Use measuring tools like pencils and tri-square to draw a straight line at 15mm and 45mm of the side pieces to indicate direction and alignment of cut. Check for the correct straight drill bit that will perform a rectangular cut through the side piece. Use the cut-out base piece to test if it fits inside the made slot.
	Route and sand off all exposed edges of side pieces to make a curved edge.	Router (and sandpaper if needed) Roundover drill bit	25	Setup the router in a flat surface to prevent uneven wastage across the edges. If necessary, use sandpaper to further smoothen them down and feel it to check.
	Drill a hole 5mm above the centre of both short side pieces (mm) - Partially drill a 2.5mm deep hole at right side piece.	Pillar drill (with 5mm drill bit) Clamps	5	Pre-mark the centre of the MDF side pieces, then use a ruler to cross mark the drilling spot. Make sure the clamps are adjusted tightly to the wood to prevent the drill from wobbling the piece.
	Cut out a rectangle shape around the cut holes (mm) Left piece – 62 x 10 x 5 Right piece – 10 x 15 x 2.5	Coping saw Wooden files Sandpaper	15	If the coping saw blade does not fit in the drilled hole, refer to the previous step with a bigger drill bit. For the left side piece, insert the mechanisms' wheel and measure how much of the wheel is exposed on the other side of the MDF piece.
	Drill a 12mm x 2mm slot on the side piece.	Hand drill Wooden files (rounded and flat) with sandpaper	3	Ensure when drilling, the drill's position is perpendicular to the surface of the MDF piece.
	Cut out sections on each piece (mm): Left piece – 90 x 15 x 5 Right piece – 90 x 15 x 5 - 90 x 28 x 5	Band Saw	5	Mark on each piece where to cut the parts for the staff to cut out for accuracy.
	Drill a 3mm hole on the 90mm x 28mm x 5mm piece at around its centre.	Hand drill	2	Ensure when drilling, the drill's position is perpendicular to the surface of the MDF piece.
	Cut a rectangular slot, 5mm x 20mm x 5mm at the same piece at the centre.	Coping saw Wooden files and sandpaper	5	Pre-mark the centre of the MDF side pieces to cross mark the drilling spot.
	Drill a ø25mm hole at the centre of the cut-out 90mm x 28mm x 5mm side piece.	Pillar drill (with 25mm drill bit)	5	Make sure the clamps are adjusted tightly to the wood to prevent the drill from wobbling the piece.
	Prime all MDF pieces	Primer spray paint	840	Apply an even coating for each layer (7 layers minimum). Leave each layer to dry for at least 2 hours before recoating on MDF.
	Smoothen surface of MDF pieces	Wet and dry paper (supply water bath) - P280 to P2000 grit in gradual increments.	60	Feel the surface of the primed MDF pieces. If the surface isn't smooth enough, re-apply wet and dry paper until it becomes plastic-smooth.
	Dowel pieces together, except the cut out 90mm side pieces. - Join the side pieces to the long sided pieces. - Then join them to the bottom base piece.	Pillar drill (or hand drill if not available) 3mm dowels PVA adhesive	40	Pre-mark the centre of the MDF side pieces, then use a ruler to cross mark the drilling spot. Make sure the clamps are adjusted tightly to the wood to prevent the drill from wobbling the piece.

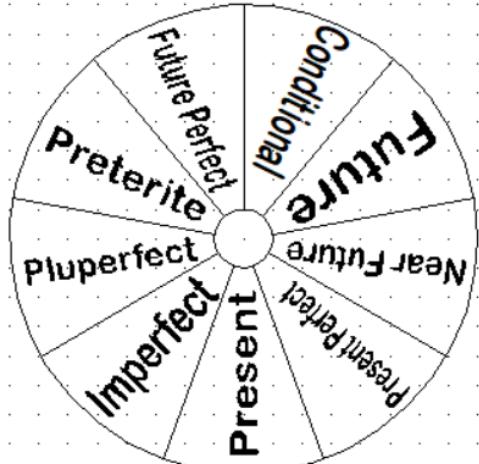
Section	Stage	Tools, Materials and Equipment required	Time (minutes)	Quality Control – how to ensure quality
Pen and Rubber Storage	Cut storage pieces (mm): Back (1) – 160 x 22 x 5 (Pine) Middle (1) – 80 x 22 x 5 (Pine) Base (1) – 155 x 85 x 3 (MDF)	250mm x 25mm x 5mm Pine plank 160mm x 100mm x 3mm MDF plank Jig saw Belt sander	25	Draw lines using a try square to accurately mark out the dimensions before cutting on the band saw. On the belt sander, judge carefully by eye to sand the excess to the drawn line.
	Create a dovetail router cut along the middle of back piece	Router (with dovetail drill bit) - A jig may be made or use router table.	5	I should use a steel rule and a try square to mark the middle of the length of the back piece to make it easier for me align my router cut.
	Create a dovetail joint between the back and middle pine pieces.	PVA Adhesive (gorilla glue)	10	Use a flat surface in the workshop to join the pieces together. Then if the wood pieces are not level by eye, use a belt sander to remove any excess material.
	Drill pilot holes at the pine pieces and drill clearance and countersink holes on the MDF base.	Hand drill 3mm drill bit (pilot) 4/5mm drill bit (clearance) and countersink	15	I must ensure the drill is perpendicular to the thickness of pine surface and the length of the MDF base piece. When drilling on the base piece, it must start with the clearance holes, followed by the countersink.
	Insert screws to join the base to the pine pieces.	Hand drill 4/5mm screws	5	The edge of the back piece must align with the edge of the base piece.
	Glue the primed 90mm x 28mm x 5mm side piece with the screwed components.	PVA Adhesive	10	I must ensure the middle pine piece fits perfectly inside the slot made at the primed side piece.
Wheels	Laser cut 2 wheel shape designs on 3mm MDF (One wheel also with suggested websites)	2D Design (CAD software) Laser cutter	50	It is important to look at the manual or guide of the laser cutter to modify the intensity and position to prevent risk of flames or wasted cuts when program is active.
	Cut wheel storage pieces (mm): Base (2) – 85 x 80 x 4 (2) – 85 x 80 x 3 Wheels (2) - ø75 (with ø10 hole)	Jig saw Bob-in / belt sander 170mm x 80mm x 7mm Pine block (base pieces)	30	I should not cut too close to the line as I may go over the line, ruining the dimensions slightly. I will allow a few mm gap to sand down.
	Create a ø75mm hole with the 3mm base pieces	Pillar drill Jig saw Wooden files, sandpaper (P240 grit)	20	Use the pillar drill to make a small temporary hole for the fretsaw blade to cut the inside circle shape. Use the wheel pieces to see if they fit through the hole.
	Drill ø10mm hole at centre of 4mm base pieces	Pillar drill (4mm drill bit)	5	Make sure the clamps are adjusted tightly to the wood to prevent the drill from wobbling the piece.
	3D print pointers from CAD software	Autodesk Inventor (CAD software) 3D Printer (UP Box with software) Printing bed with ABS	60	Make sure the print-out is to a one-to-one scale at the Up Box software, when transferring the CAD model. Upon printing, ensure the mass of the granules (to be molten) is greater than the mass displayed on the screen.
	Remove and smooth pointers from printing bed	Bed scrapper Sandpaper – P240 grit (Belt sander if necessary)	25	Use the heat gun on the printing bed, and heat up a certain area to allow an easier access to scrape the parts off individually.
	Join parts together to make the wheel storage	PVA Adhesive Tensol cement Primed 90mm x 12mm x 5mm MDF (2 pieces) Quick grip clamps	120	Use Tensol cement to join the pointer parts together, and the PVA for the rest. Glue the base pieces together on its flat surface, then glue it to the primed pieces, then the wheels last. Shake the glued components to see if any loose parts need further gluing.
Upper Product	3D print upper product parts (mm): Base (1) – 170 x 90 x 7 (with ø15 and ø20 hole) Side (2) - 90 x 80 x 9 (with 7mm thickness used for finger joint) +Side pieces printed with 5 degree angle	Autodesk Inventor (CAD software) 3D Printer (UP Box with software) Printing bed with ABS (orange colour)	500	Use the CAD software to make the printed shapes as hollow as possible, each with their modifications to reduce time and material in the long run. I must ensure the dimensions are to a one-to-one scale, and that there is sufficient printing material (ABS).
	Cut dimensions (mm): Acrylic (2) – 75 x 164 x 3 Whiteboard (2) – 80 x 166 x 5 (thickness depends on bought product) + All pieces to be cut with a 5 degree angle	Jig saw Straight edge files Wet and dry paper (sandpaper with high grit) 160mm x 180mm x 3mm sheet acrylic A4 whiteboard (bought)	30	I must ensure the dimensions are marked clearly. For acrylic, it better to use a thin surface marker to temporarily mark. I should not cut too close to marked line as I may go over it, ruining the dimensions slightly. I will allow a few mm gap to file and sand down. Observe the line pattern from the cut acrylic, and should be parallel to the piece itself, and near-invisible to the eye.
	Cut edges of the width of acrylic pieces for finger joints	Coping saw Files	20	Refer to the printed side pieces to evenly mark the acrylic into spaces. Mark clearly which spaces are to be cut.
	Drill 2 ø3mm holes along each width of the back of the whiteboards	Hand drill (3mm drill bit)	15	Use clamps to secure the whiteboard's position. I should space the 2 holes evenly to drill.
	Join parts in order: 1. Base to side parts 2. Acrylic to side parts (and base)	Tensol cement Brush (paintbrush)	200	Brush the Tensol cement evenly across all necessary faces of the parts. I should ensure that the side pieces align right against the width of the base.
	Install neodymium magnets inside holes inside whiteboard	Neodymium magnets (ø3mm diameter) PVA Adhesive	5	I must ensure parts of the magnets are not exposed , otherwise redrill until the magnets 'flushes' inside the whiteboard.
	Cut 4 magnetic strips to 80mm x 7mm	Cutting mat with Stanley knife A4 magnetic sheet (0.5mm thick)	5	Use a ruler or straight jig to cut the sheet. The end result should be 4 rectangular strips.
	Apply magnetic strips over the main faces of finger joints		3	Peel off the backing to reveal the sticky surface which will attach to the assembled upper product.

Section	Stage	Tools, Materials and Equipment required	Time (minutes)	Quality Control – how to ensure quality
Lower Product (Interior)	Gather layer dimensions (mm): Layers (2) – 160 x 85 x 5 Support blocks (1) – 80 x 30 x 10 (4) – 10 x 10 x 10	Jig saw Belt sander 5mm thick MDF 10mm thick MDF	30	Use a try square to accurately draw a straight line for the cut dimensions. Use a belt sander to remove excessive wood that doesn't align with the dimensions.
	Plane one layer piece to 3mm thickness and reduce width to 80mm	Planer machine (or planer tool if unavailable) Belt sander	5	If using the thickness planer machine, I must reduce the thickness in gradual steps, i.e. every 0.2mm to prevent clogging up the machine or breaking the MDF itself.
	Drill ø20mm holes on all pieces (Marked on each pieces at different areas)	Pillar drill (with ø20mm hole drill bit) Clamps Waste block (wood)	15	Use the waste block underneath the 5mm and 3mm thick MDF pieces to prevent drill bit clashing against the work surface. Clamp each piece tightly so that the wood won't 'wobble' when drilling.
	Insert and glue 5mm layer piece on the highest routed (primed) long sided MDF pieces	PVA adhesive (gorilla glue)	15	I should ensure that I apply enough PVA adhesive on the 5mm thickness (non-primed MDF) piece. It may need to remove the side dowel joint temporarily to perform this action.
	Glue support blocks on the 5mm layer piece -> (4) 10mm x 10mm x 10mm blocks on each corner -(1) 80mm x 30mm x 10mm block at centre, along the width	PVA adhesive (gorilla glue)	30	When gluing the longer MDF block, I must make sure the face that's glued is the non-drilled face, so that the hole is facing upwards to allow the mechanism rod to be placed inside.
Final Assembly	Trim 160mm x 80mm rubber sheet and install to the bottom of the formed cased product.	Natural rubber (polyisoprene) Cutting mat Stanley knife PVA adhesive (gorilla glue)	45	Use a ruler or try square to cut the rubber sheet to a rectangular form with greater accuracy. Use clamps to apply pressure on gluing the sheet onto the base.
	Insert mechanism parts at the top of the layered interior MDF piece (Refer to lower half working drawing)	Silicone wheel 2 rings (rotating wheels) with rubber band	3	
	Stick 1 rod to the compound wheel	Tensol Cement 1 rod (ø20mm inner, ø25mm outer diameter)	10	Insert the rod from underneath the MDF so that the thinner diameter fits through. I must add plenty of the additive to where there should be minimal gaps in between the cut holes and the rod itself. Once dried, spin the wheel if all pieces rotate in unison.
	Install 3mm MDF layer piece on the top of the lower product	160 x 80 x 3 MDF piece PVA adhesive (Gorilla glue) Quick release clamps	20	Apply the adhesive on the support blocks as much as possible to ensure the parts are stuck tightly. I should follow it up with the clamps holding the piece in position, but put the clamps directly on top of each corner to pressure the glue to stick.
	Insert 1 rod through upper product base and attach it to the mechanism	Tensol cement 1 rod (ø20mm inner, ø25mm outer diameter)	30	I should apply the Tensol cement inside the empty ring space of the mechanism then on the thread (after passing through the upper products' base) and put them together in rapid succession. Otherwise the compound may dry too early and may need to restart.
	Install storage units on the lower product	Pen and rubber storage unit 2 Wheel storages (1 communication, 1 language)	3	
	Smoothen down any non-finished pieces (if any)	Sandpaper Wet and dry paper (P280 grit and above)	15	I must not mix up the sandpaper on plastic and wet and dry on the primed MDF pieces.
	Place whiteboards to the upper product	Whiteboards (with neodymium magnet backing)	2	



Communication

How each spinner (wheels) would have been made – each aspect with equal chances of occurring..



Language

Risk Assessment

When producing my prototype, I will need to be aware of the machinery and tools that I would use in the workshop, by assessing potential areas of danger or risk when performing tasks on them. A risk assessment will line out particular risks, and safety protocol and measures to keep me safe at work.

Machine/Equipment	Associated risks	Safety precautions / Quality control
Band Saw	<ul style="list-style-type: none"> - Thicker pieces will have more tendency to fly out of the band saw, potentially hitting others' eyes within the machines' vicinity. - Fingers are vulnerable to cuts and bleeding if blade is too close. - Hair can be trapped in machine when working closely. 	<ul style="list-style-type: none"> - Ask a trained employee or person to cut the required wood pieces to size if you are not trained. - Wear safety goggles when at use - For very short pieces (if needed), use a jig to carry the wood forward - Tie hair back to prevent it from being tangled in operation.
Jig saw cutter	<ul style="list-style-type: none"> - (Loose) blades can snap or fly off when working with pieces. - Saw dust can fly off, irritating users eyes. - Hair can be trapped in machine when working closely. 	<ul style="list-style-type: none"> - Ensure the blade is sturdy and rigid, positioned vertically with the sharp edge facing you. - Wear safety goggles to prevent saw dust entering eyes. - Tie hair back to prevent getting tangled in operation. - Enclose the blade with the given plastic cover to prevent the blade flying.
Belt Sander Bobbin Sander	<ul style="list-style-type: none"> - Fingers can burn if working too close to machine if it is active. - Dust particles can fly off freely, irritating the user's eyes. 	<ul style="list-style-type: none"> - Wear safety goggles to prevent dust particles entering eyes. - Ensure the workshop is well ventilated with dust filter. - If cutting pieces to an angle, use an angular jig, set to the particular degree.
Hand drill	<ul style="list-style-type: none"> - Drill bits can fly off when at use if loosely connected to the drill. - Hands can burn and be injured if holding the drill from its neck or the drill bit it's attached to. - Hair can be tangled into drill if not taken carefully. 	<ul style="list-style-type: none"> - Position the hand drill downwards, perpendicular to the surface the materials is being worked on. - Use a vice or waste material block to drill holes without damaging the work surface. - Tie hair back to prevent getting tangled in operation.
Pillar drill	<ul style="list-style-type: none"> - Drill bits can fly off when at use if loosely connected to the drill. - Waste wood pieces can fly off when drill cuts through. 	<ul style="list-style-type: none"> - Wear safety goggles to prevent waste bits flying into the eyes. - Secure the drill put position tightly to prevent it falling or flying off. - Use clamps to secure the material position to be drilled without wobbling or falling off.
Router (wired)	<ul style="list-style-type: none"> - Exposed wire can cause tripping accidents to people in the working area. - Dust particles can fly off when cutting through pieces. - Router can be wobbly or shaky if not held properly, risking damage to wrist or hands. 	<ul style="list-style-type: none"> - Coil wire cord or use an extension to prevent wire hanging in the air. - Wear safety goggles to prevent dust particles entering the eyes. - If available, use a dust bag to pick up the dust with vacuum mode on. - Grip on the router handles tightly, use a jig to assist the direction of the cutting motion.
Laser Cutter	<ul style="list-style-type: none"> - Burnt gas material from laser cutting can be inhaled by the users or people near the machine. - Laser cut pieces can catch fire in the machine, and can spread quickly if not taken considerably. - Laser cuts can burn and injure the user's hands if active and powered on. 	<ul style="list-style-type: none"> - Close the laser cutter with the lid to prevent gas from escaping to prevent inhalation. - Ensure a fire exit is nearby and accessible if pieces are set on fire. - Turn on the vacuum/suction chamber before operating the machine for gases and waste material to be taken away safely. - Set material pieces in position before turn the machine on.
Heat Gun	<ul style="list-style-type: none"> - Touching a surface heated by the power tool can be hot, and may cause skin irritation. - If wired, it can cause tripping accidents if the heat gun is far away from its' plug. - Heat applied to a metal or plastic may produce toxic gases that may be inhaled by the user (example: PvC – polyvinyl chloride) - The wire may shock the user if wire is exposed. 	<ul style="list-style-type: none"> - Set the heat gun at a low temperature if possible to prevent excess heat burns and skin irritation. - Coil the wire or set the wire close to the power source to reduce tripping risks from happening. - Wear a gas mask when working with toxic-producing materials – check material property before heating it up. - Use insulating tape on exposed wire before powering the heat gun.
Planer (powered)	<ul style="list-style-type: none"> - Reducing wood thickness produces dust particles that can be inhaled by anyone near the machine. - Hands may be seriously injured when placing smaller pieces of wood through – the blade cuts from the top. - The machine at work produces an deafening noise, and can affect the user's hearing ability. 	<ul style="list-style-type: none"> - Turn on the vacuum chamber and the air filter in the workshop to collect dust particles safely without the user from inhaling. - Only use the machine for plank-like wood shapes, to deliver the wood on the other side. - Reduce wood thickness by intervals, to prevent machine from malfunctioning due to tight spacing at the cutting area. - Wear ear muffs to suppress noise entering the ear (canal).
Stanley knife	<ul style="list-style-type: none"> - Sharp blades can cut open skin, and cause bleeding to the user if not careful. 	<ul style="list-style-type: none"> - Only open the exposed blade if cutting material, and immediately draw it back when not in use or carrying it around the workplace.
PVA Adhesive (Gorilla glue)	<ul style="list-style-type: none"> - The liquid compound can be irritative, meaning it can cause rashes or scratches on the skin if scratched on excessively. 	<ul style="list-style-type: none"> - Wash hands immediately to rinse off the glue from sticking to skin permanently. - Call any emergency available to assist if irritation becomes extreme.
Tensol Cement	<ul style="list-style-type: none"> - The liquid compound can be irritative, meaning it can cause rashes or scratches on the skin if scratched on excessively. - It is a flammable substance, can cause flames that can spread to nearby people and can get seriously burnt. 	<ul style="list-style-type: none"> - Wear protective gloves (non-thin) to prevent liquid entering into skin through the hands. - Wash hands thoroughly if the Tensol cement reaches your hands or skin. - Do not use the substance near naked flames or machinery that produces flames, as they can make the substance set on fire.

Comparison against Specification

Comparing my final product features and aspects against my specification is vital to see if I have met or not met the points that I plan to achieve by the end of this project. I will assess each point and justify if I achieved it or not and give reasons why thoroughly.

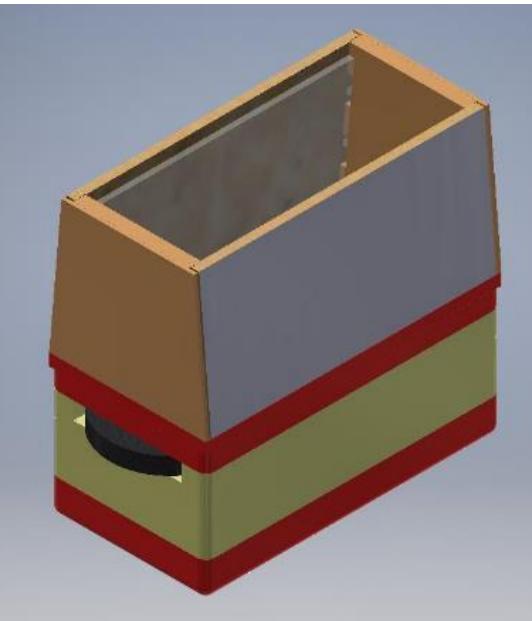
No.	Specification point	Achieved? Y/S/N	Explanation
F1	The product function must be interactive and easy to recognise for all clients and users between 12-16 – there should be at least one physical action.	Yes	My product has storages and whiteboards that can be pulled from and pushed into the product with relative ease. The main mechanism is exposed on purpose to spin, and the client can see the effect when they rotate, hence it will be easier to understand its function the more it will be used.
F2	The product must use successful (and familiar) teaching techniques used similarly to those in classrooms, to allow the Spanish learner in focus of studying well.	Sometimes	The whiteboards still remain the priority to present learning on paper to the companion, as well as the wheels that decide the type of Spanish language and communication, but they can get too repetitive. I could have done better to add more variety such as listening and reading exercises directly, than using a website to teach them. At the final product's state, it isn't the most interactive source for learning.
F3	The product should freely rotate 360 degrees to allow ideas and learning to be presented using whiteboards or a temporary writing surface.	Yes	I have made a mechanism in the style of a bicycle gear to produce the rotary motion. This involves having a compound gear of a silicone wheel that is exposed as the input device, connected to a simple ring using a rubber belt.
F4	A successful storage system could take place in my product, to allow the user to keep organised with equipment in place for them, ready for learning.	Yes	My lower product has a dedicated pen and rubber storage system, set up in a way each side holds a whiteboard pen and rubber ready to be taken out when it's pulled from the product itself. There is also space for flashcards to fit at the upper product if they do not have any space in their environment to store them.
F5	The users could be given flexibility to manipulate the product by editing, adding and removing items associated with the product (such as tokens to help widen learning ability).	Sometimes	I discontinued the idea with tokens after client feedback as they were likely to be lost. This was replaced by the spinner wheels, which in the final design, has no space to write extra language or techniques. Other features like whiteboards can be taken out easily to write on and then present to the companion on the other side.
U1	The product's outcome must leave the user thoroughly engaged, satisfied and possibly motivating them to pursue learning the language (for as long as possible).	Yes	From the client, they were thoroughly impressed and happy with the final product, particularly the mechanism and the spinning wheels that determine their Spanish learning, as it gives them a challenge to broaden their knowledge, and keep up with the Spanish language constantly.
U2	For the majority of the product, the user should be able to recognise and use each separate function so it feels like muscle memory for them.	Yes	The majority of the product is a simple push and pull motion to access the certain storages and whiteboards, and the mechanism that requires a swiping motion with their hand.
U3	There should be a companion simultaneously learning or assisting with the user to guide them in peer-assessment to critique or appraise their learning.	Sometimes	The product can also be made for an individual as part of revision, or a subsidiary product to display their whiteboard to them while looking at another educational source.
U4	The user should be safe using it with no state of emergency or danger, ensuring that the product does not harm them or their properties due to material, functional or ergonomic choices.	Yes	I ensured by changing the exterior lower product from pine to primed MDF, which is a much lighter material than pine, as MDF is engineered. The majority is encased, and the materials made for those pieces are harm-free.
E1	The product should be easy to carry around any environment by users and clients aged between 12-16 by having a good grip or holding motion to carry the product. It should not exceed 250mm on any sides (length/width/height)	Yes	The external edges of the whole product will have been routed and smoothed down to make it curved and comfortable to hold – it has not gone to the extent it becomes slippery or it would slip off their hands if it were to be carried.
E2	The product must be able to differentiate between the full age range of 12-16 to allow them all to learn at their own rate based on their personal ability.	Sometimes	I believe my product can be understood first time by the older ages (15-16) as they know more about the tenses. For the younger ages, they might not have learnt about this, leaving a learning gap that needs to be taught first.
Q1	The product must be finished with a high quality standard to engage the user's attention, but also to protect the materials associated with the product.	Yes	The lower product has been spray painted in Spanish colours after priming it, so it will stick to the MDF surface relatively well. Furthermore, the ABS printed parts will already be self-finished.
Q2	A high quality product should be minimising the risk of danger or threat to my client, in any given environment from illness or injury.	Yes	The materials have been selected carefully as they have tough and chemical resistant properties, so they won't dissipate harmful chemicals that can be inhaled.
A1	The design must appeal and gain attention by the client and users to use the product. Using colours, it should let them identify the product and its usefulness for their learning.	Yes	The lower product has been spray painted with the colours of the Spanish flag (red-yellow-red), as a symbol for the product's purpose – to learn Spanish.
A2	I must keep the form and shape of the product relatively simple and easy to recognise (and use) by all clients.	Yes	The general form of the shape is a cuboid at the bottom, merged with a prism on top – inspired by the Memphis design movement in the post-modernism era.
M1	Materials used in the production should be durable, lightweight and worthwhile, and able to withstand against different environments.	Sometimes	MDF is a lightweight material, and with the priming process, it extends its durability and useful lifetime without breaking down chemically. ABS has a similar property to this.
M2	The materials to make the product should be easy to work with, and that most of these are available in the workshop.	Yes	MDF was also used knowing that it is very versatile in the manufacturing process – it is not too dense so cutting pieces won't be too difficult to do.
Env1	The product may include materials that are easy to recycle when the product is no longer useful – in order to protect the environment.	No	ABS as a polymer will be broken down by heat, which does cause pollution with CO2 emissions when burnt. Furthermore, the primed MDF will be hard to separate the raw material from its finish, so this was poorly thought out in the environmental sense.
Env2	The product should be versatile in use, where the client is able to study the language wherever they go.	No	The product has a lot of pieces together, so it adds more weight overall. Also, I think that the storages may slip off if the product were to tilt excessively.
T1	I must keep track of time for all development stages leading towards the final product before the deadline date, using a Gantt chart.	Yes	For the majority of this project, I have been able to keep up with time, by updating the Gantt chart weekly to check my progress is stable.

Product Evaluation

This slide focuses on the final product and its evaluation, whether it was generally good or poorly done against the design brief and specification. I will explain reasons why a particular part was good or not so that I can make amendments in the improved design.

Brief:

Design and manufacture an educational and entertaining product that will satisfy the learning of young children aged 12-16, in order for them to help improve their independent ability on Spanish. It must be easy to carry and comfortable to use, while keeping them motivated to gain experience in the long run.

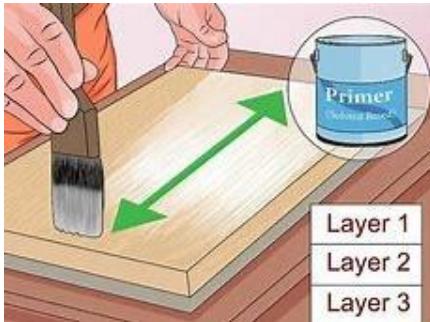


Overall rating: 7.5/10

The product has generally covered most specification points, with quality and aesthetics being the biggest achievement – points Q1, Q2, A1 and A2. However it could have done much better in the functional aspect and the environmental aspect – as I believe I disregarded F2, M1 and M2 over time.

Quality:

I have ensured in the manufacturing plan that with the MDF, they are primed and sanded down evenly and repeatedly, and ensure quality checks by touching the surface (when dry) to check for smoothness – the end result should have a plastic-like feel, which would reflect slightly, and be much easier to grip on. Furthermore, by gradually increasing the P size of the sandpaper, it prevents scratch marks from being shown boldly if I were to jump between sandpaper sizes – for example, from P240 to P2000. These smooth edges prevent sharper edges causing potential cuts for the user, while making the product look more streamlined.



Aesthetics:

The form of the shape is as simple as a prism on top of a cuboid, which reflects similarly to the Memphis design era with their style of shapes to form a product. The colour choices for the bottom represent the Spanish flag and the spinning prism is similar to a traditional teaching board in classrooms – to show an educational purpose to learn the Spanish language.

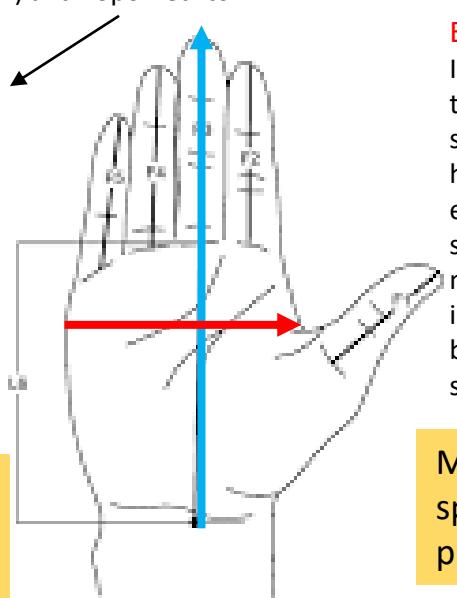
Function:

Most functional aspects were well achieved in the final design. The mechanism was re-iterated 3 times before the bike-like concept that was able to spin the prism above to present the user's learning on the other side. However, I could have put more consideration in the teaching aspect, as there was not enough variety to expand the users' ability – this also affected their satisfaction as the client mentioned they feel it can be too repetitive being taught in the same approach to learning with the spinner. I could ask teachers, not just language specialists, but other subjects to give ideas on ways to teach than just whiteboards.

Ergonomics:

The ergonomics factor was considered well physically because I was able to make the general product within the size restriction – 170mm x 90mm x 160mm. However, I am uncertain how the client or other user may be able to handle the product. In this state, it seems that two hands at the base are needed to hold the product. It doesn't think it can be kept in a backpack or handbag as the shape can stick out or make the user uncomfortable. This is in addition to the uncertainty of how heavy the product would be, as I have not conducted any full testing on material weight or (in-person) anthropometrics.

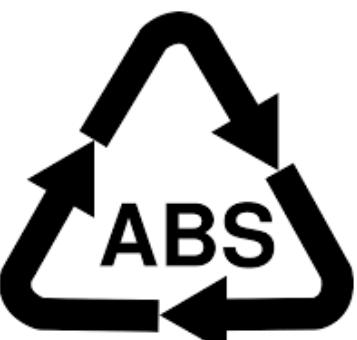
For anthropometrics, some data I should take more into account is the palm width (red) and the maximum hand length (blue). This would help me determine what precise width the base of my product should be – alongside the ergonomics of the material choice. I should take these data directly with my client group first, then with the data source.



Source: [Hand anthropometry in patients with carpal tunnel syndrome: a case-control study with a matched control group of healthy volunteers \(google.co.uk\)](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1000000/)

Environment:

I found it hard to balance quality with the environment, as the majority of the materials that will be used to make this product will have a finish – and they can be difficult to separate from the raw material at the end of its lifetime. For the MDF, each piece will have multiple primed layers which would dry and be absorbed by the material itself to enhance its glossy feel and harden the material. Like paint, it requires a lot of effort to scrub it out, with the risk of damaging the MDF. Furthermore, the upper product will mostly contain of plastic, ABS and acrylic, which needs to be clearly separated and indicated before breaking down after the product lifetime. I could improve this aspect by looking up more eco-friendly, lightweight materials that can perform to the same standard – not biodegradable because they can only last a finite amount of days.



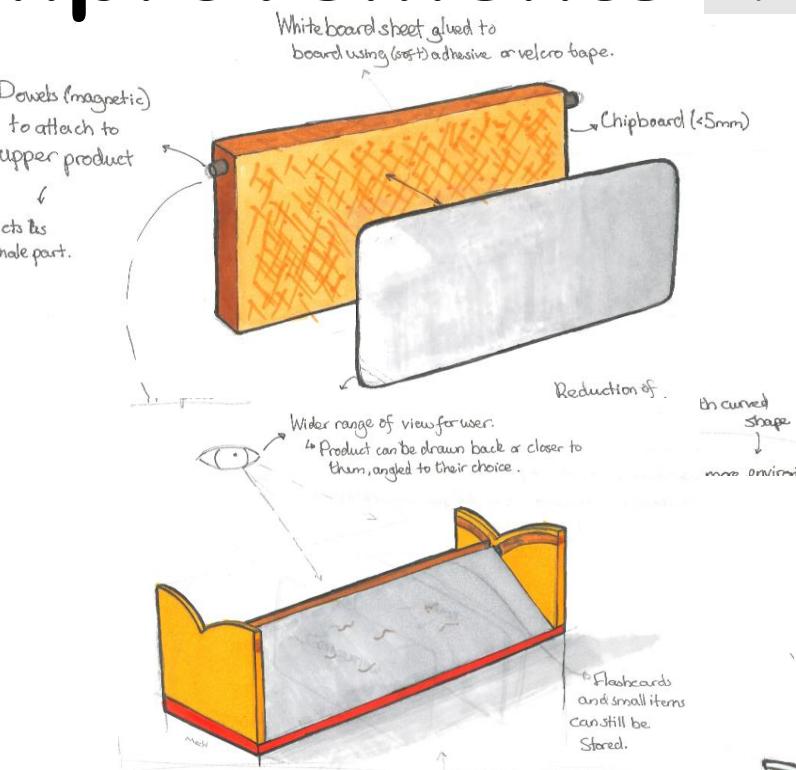
My product mostly managed to meet the demands of the client and user group, but some specification points have not been met well, in which I will focus on in the next stages of the product life cycle – improvements (reiteration) and scaling up to batch/mass manufacture.

Product Improvements



OTHER

The ABS plastic used in my product should be indicated with the '7' recycling sign to prevent mixing with other plastics and their chemicals.

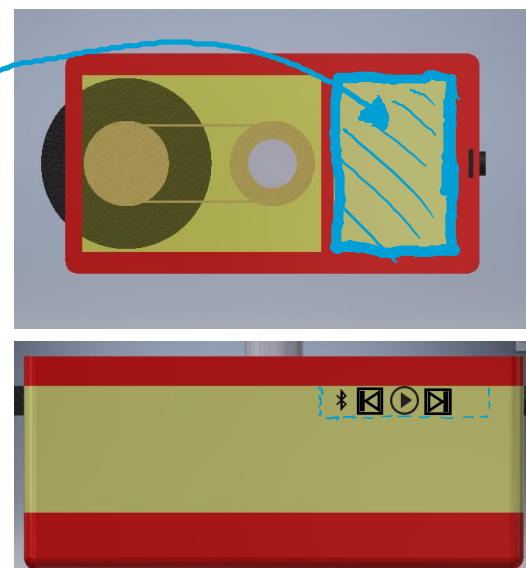
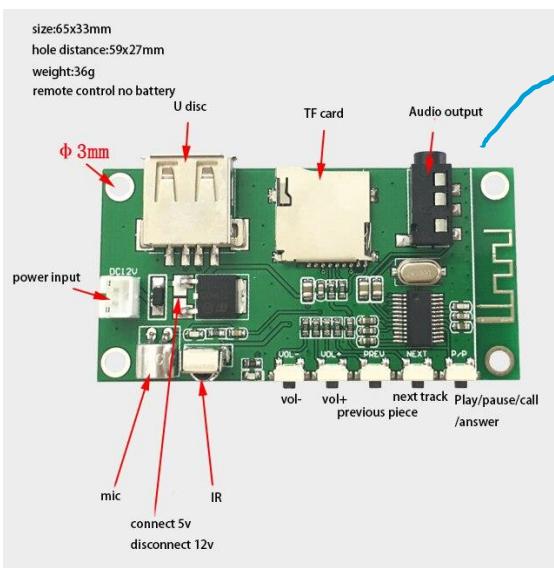


Ergonomics:

The whiteboard field of view could be enhanced, as my product is restricted to a fixed position, 5 degrees from the horizontal. The drawing on the right illustrates how the user can angle the whiteboard position up to 30 degrees, for their comfort, whether they place the product very close to them, or further away.

Function (F2):

Individually, the teaching aspect feels more like a revision session than learning something new, such as extended vocabulary or verbs. In addition to the lower product, I could add a Bluetooth system that allows the user to listen and speak with the product. Using this, they can access Spanish teaching resources online with the provided websites.

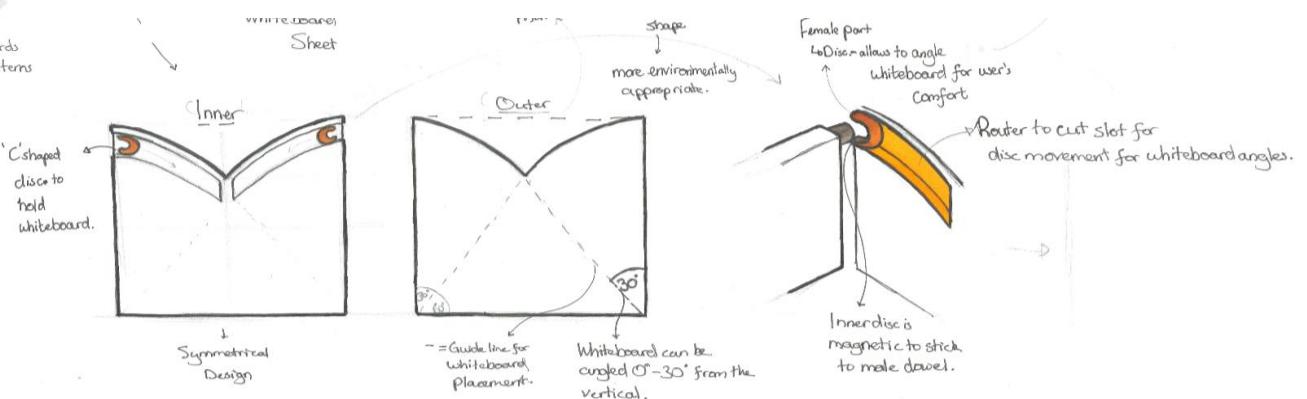


I will use the information from the evaluation, alongside the client feedback to provide suitable improvement to enhance this product to make it more ideal to their wants and needs. These improvements should be more in line with the brief and the specification points.

Environment:

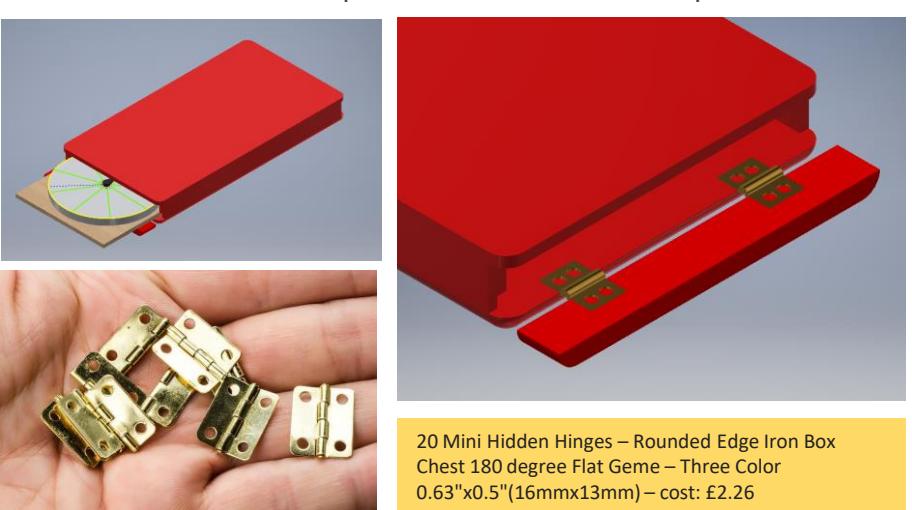
My final design used MDF that was primed and spray painted multiple times, which is hard to separate the man made material from its' finishes. I could replace each external MDF piece with **ABS** (Acrylonitrile butadiene styrene), similar to the material used to the upper product, as it is self-finishing when processed in industry. It also can be coloured easily, using a pigment to dye the polymer. To make it more feasible for recycling, I must label or mark each ABS piece with its appropriate plastic mark to prevent mixing it up with other plastic materials at the recycling (and end of life) stage, like acrylic.

Furthermore, the whiteboards supplied should be given as a sheet, because when integrated to a board, separating the individual material from the wooden board will be difficult due to the unknown strength of the adhesive used. Either I could leave the sheet alone or stick it to a lightweight, recyclable board, for example chipboard.



Function:

My clients somewhat disliked how the side pieces were attached to the spinners, and prefer it separate because they could flick at the MDF unintentionally. To solve this, I would add hinges along the edges of the side pieces and the base of the lower product, so that they are connected. This means the spinner, the wheels and the bases are their own component towards the whole product.



20 Mini Hidden Hinges – Rounded Edge Iron Box Chest 180 degree Flat Gage – Three Color 0.63"x0.5"(16mmx13mm) – cost: £2.26

Scale to Batch Manufacture

This slide will show how I would make my current prototype to a batch scale product, which includes changes in the industrial processes. I will explain each scale-up process that will also keep in line with my brief and specification.



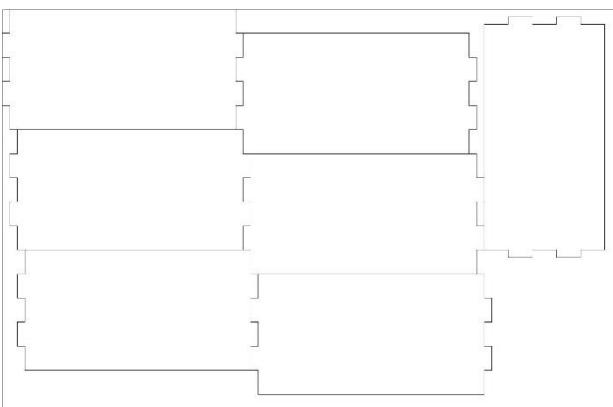
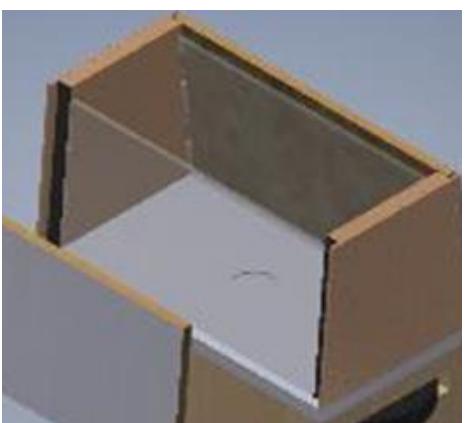
The Lego product is injection moulded using ABS.



- Lower product exterior:

In an industrial scale, each individual product can be made with ABS through injection moulding – this process is able to form complicated shapes such as this lower product, using a pre-made mould of aluminium. The lower product consists of multiple shelving spaces, including space for the mechanism and the Bluetooth system mentioned previous for product improvement.

In terms of quality checks for injection moulding, a injection monitor should be present to ensure enough ABS (minimum amount) is added to make the complex shape. Through this, the product can be made consistently in material and also it's physical properties.



Tessellation example.

- Translucent / Transparent acrylic for storage:

For batch production, the acrylic pieces (allowing the user to see the word bank) would need to be tessellated under the laser cutter program to benefit environmentally. Using tessellation, the computer can maximise the number of identical finger-joint shapes that can fit with one large acrylic piece – therefore minimise the amount of waste material that will be recycled, reducing the carbon footprint overall.



Due to a larger scale of production, adhesive and additives should be bought in bulk supply.



- Adhesives and gluing agents:

Workers should be able to carry out the joining processes using adhesives like PVA or Tensol cement as this would be more economically appropriate for the production of the product. The risk of error is not serious at the gluing stages, and using machines to join plastic would not be ideal, despite the flawlessness they bring. If workers were to do this stage, they must be in a safe, well-ventilated environment to prevent health issues or injury.

- Use of workers:

For a batch (or mass) scale production, workers should only be used if a machine is not physically able to observe or proceed quality checks. For this reason, workers should only be hired to check with material supply and computer based-systems to ensure a smooth production.

- Use of CNC machines:

CNC machines will be used for the majority of a batch scale production, as computer-controlled machines are much more accurate and consistent than humans, who are more prone to error. Furthermore, they can reduce the production time, allowing a more efficient production of numbers of product-time ratio. Another advantage of CNC machines are their versatility and adaptation to change, as a worker can modify the design or shape quickly in record time to get the product formed faster.

However, these machines will be expensive to install and set up, due to their technology and intelligence, so at the production line, a certain amount of these machines (routers and drilling) should be made in order to make a profit.