

ROBOTICS: TEACHING EQUIPMENT PROJECT

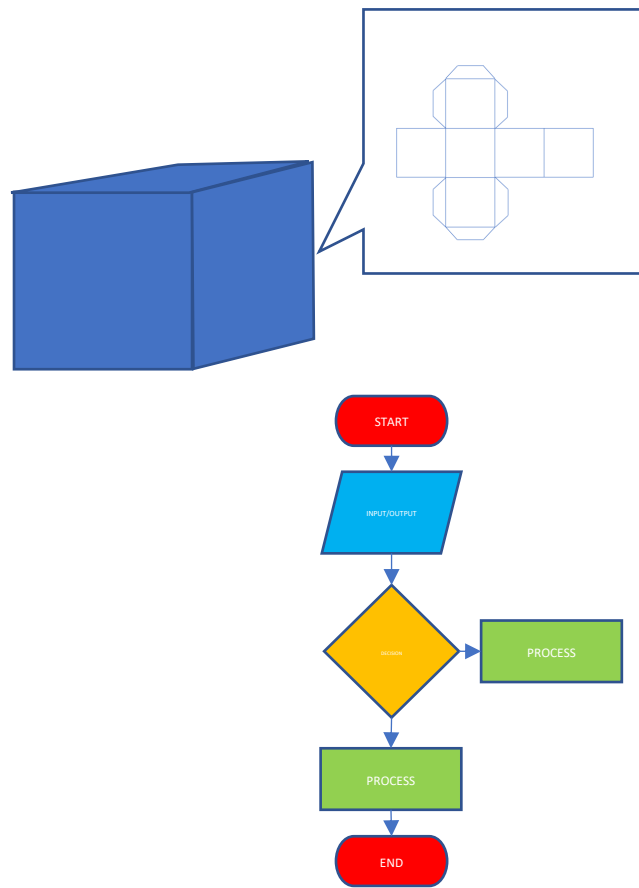
PHASE II

NOND PHOKASUB



FEEDBACK

FEEDBACK



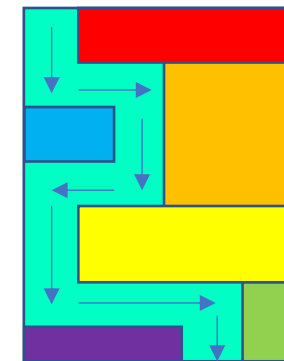
NET & APPLICATION ACTIVITY

Feedback from clients for this activity include:

- + Clients said that this activity was a good idea with what it is capable of teaching.
- + Clients said that the Net Model was a good design and activity as it certainly helps students to see how a net works.
- However, clients said that this activity may be complicated as it may be hard to explain to teachers of how this activity works and conveying the key learning to students may be challenging.
- An easy way students learn is by seeing an example and following. This net activity of designing nets may be slightly hard as it is a new topic that students have never learnt before.
- Also, this activity of nets may slightly exit the learning area of robotics as it may be hard to link to programming.

Overall, this activity seemed to be slightly too complicated for the target age group, so a redesign may be required or a deletion of this activity.

Overall, the activities were effective, with the flowchart activities ranking the highest in efficiency. The Magnet Maze may need to have clear instructions, whilst the net activity may require a redesign.



FLOWCHART ACTIVITY

Feedback from clients for this activity include:

- + Clients said that this activity was effective and engaging.
- + This activity offers an effective sequence as the difficulty slowly begins to increase as students proceed through the activities.
- + Clients said the most effective activity was the jigsaw.
- Clients did not offer many negatives for this activity, but one proposal included example questions for the activities to help teachers (and even students) get an idea of what types of questions can be used.

Overall, this activity was rated the most effective as it should help with teaching robotics.

MAGNET MAZE ACTIVITY

Feedback from clients for this activity include:

- + Clients said that this activity was engaging and could be an effective way of teaching basic programming whilst allowing students to have fun.
- + If this activity is introduced to schools, it will be an effective material to lead to robotics.
- There were not many improvements for this product but some possible alterations include:
 - Inclusion of 'BACKWARD'
 - Merging FORWARD, RIGHT, LEFT, and BACKWARD into one piece.
 - A change in the way this is taught e.g. teachers begin with their design of the maze and let students think about how they will solve it. Students would need to write on paper what they think is the shortest route and then execute their plan on the maze.
 - In terms of budget, this could be minimized by reducing the number of mazes produced as all classes will not have a robotics class at the same time. Additionally, the magnet maze could be produced by seniors as a senior project followed by younger students using the maze in their robotics classes.

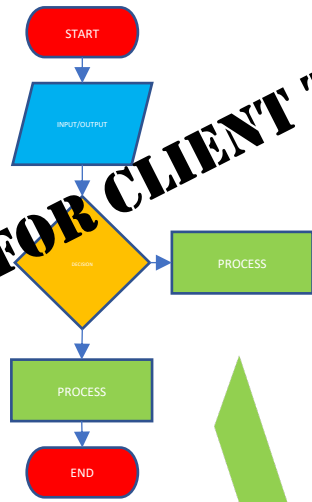
Overall, clients said that this was the most engaging but it would be critical to have a clear plan of how this activity will be taught would need to be clear.



PLANNING

IMPROVEMENT PLAN

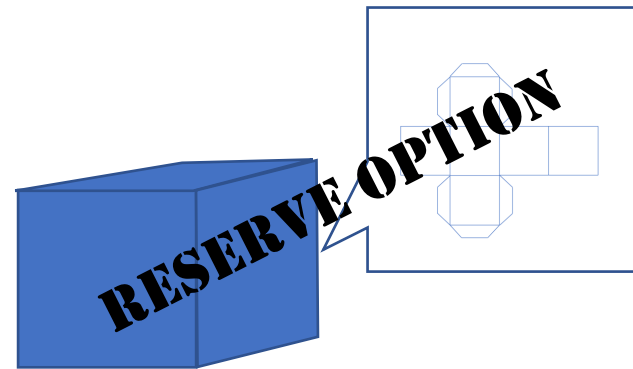
FLOWCHART ACTIVITIES



READY FOR CLIENT TESTING



NET & APPLICATION ACTIVITY

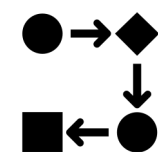
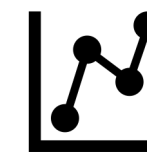
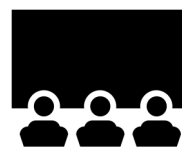
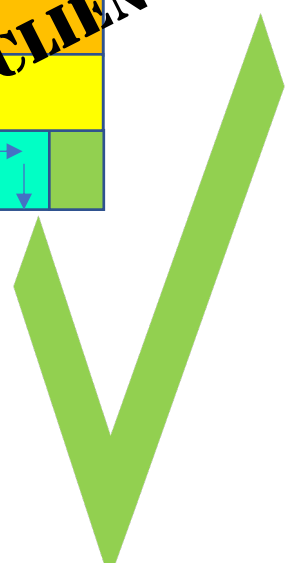


The Net and Application activity may have to be turned into a reserve option as the building of nets may be a stretch out of a robotics course. Also, the complex aspect may make it less effective in teaching. If this were to be redesigned to match the robotics course (in terms of teaching structure), the design will be similar to existing products of block-building activities/games.

MAGNET MAZE ACTIVITY



READY FOR CLIENT TESTING

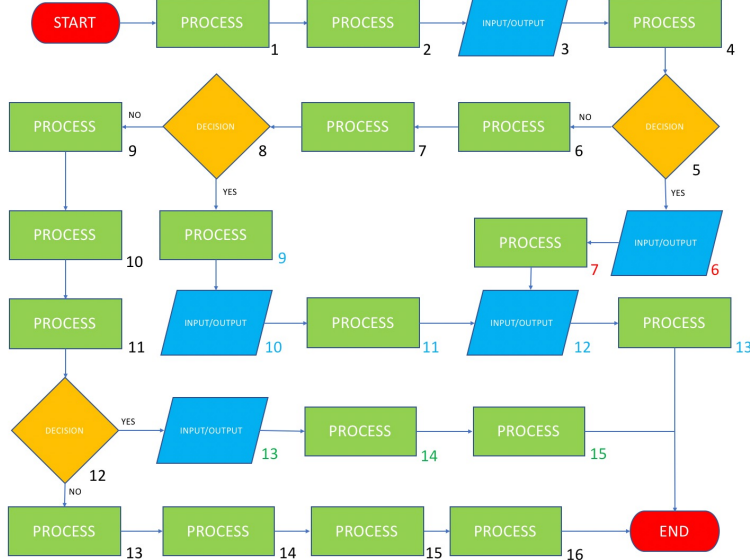


ACTION PLAN

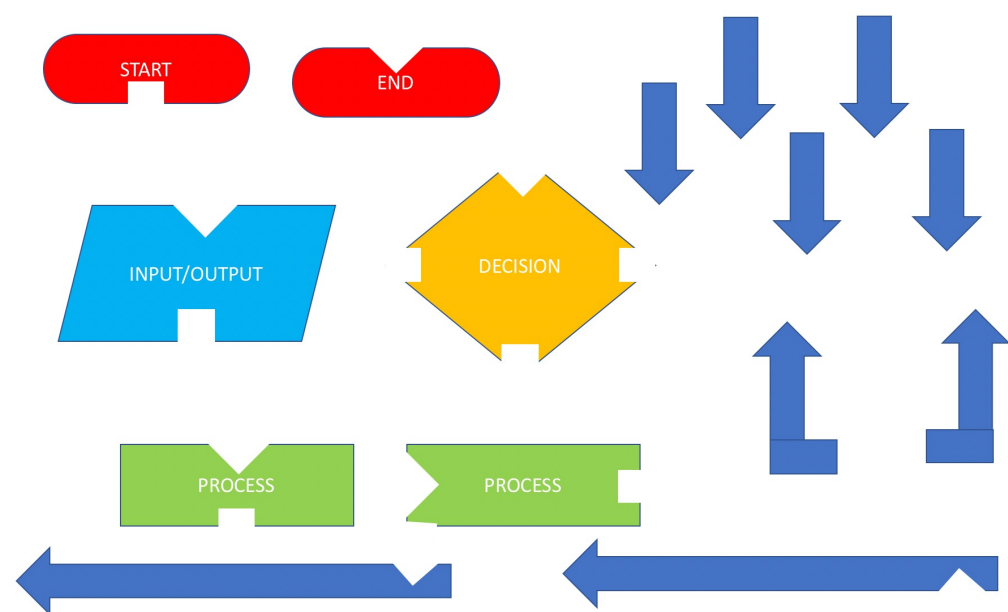
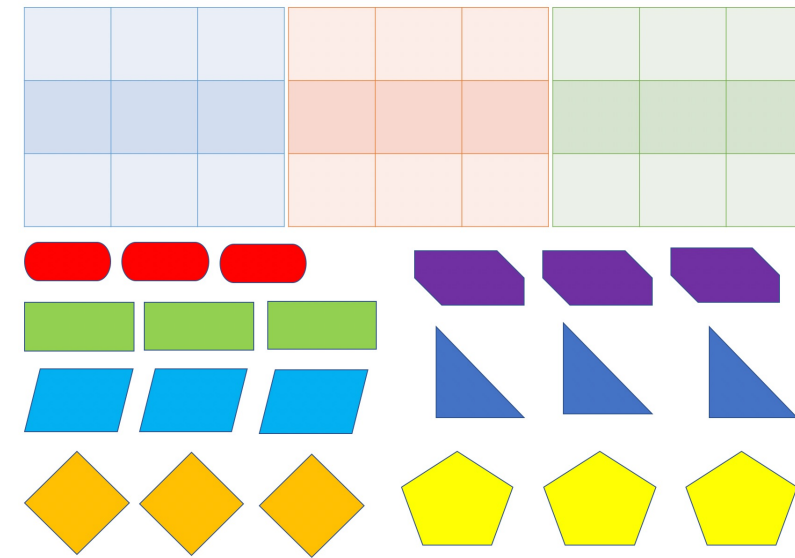
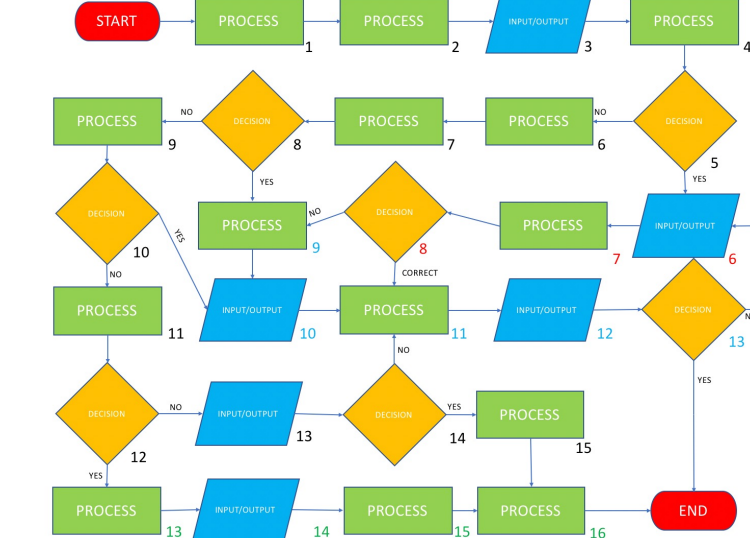
Due to the current COVID-19 situation, the process of testing will have to be altered. The alternative plan for testing will include testing by teachers as they examine the activity alongside Kit Lists. A survey can be sent out to the teachers to receive their feedback on the activities and teachers could take a video of their experience with the activity. The flowchart activity will be the easiest to test at this point as it is mainly printing but the Magnet Maze testing will have to be postponed.


FLOWCHART ACTIVITY

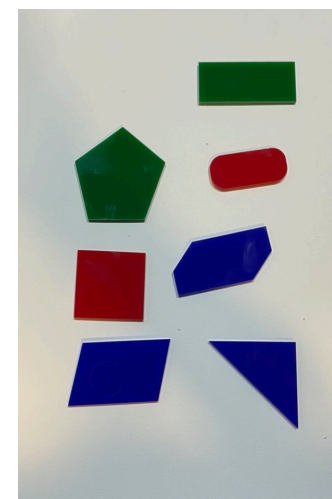
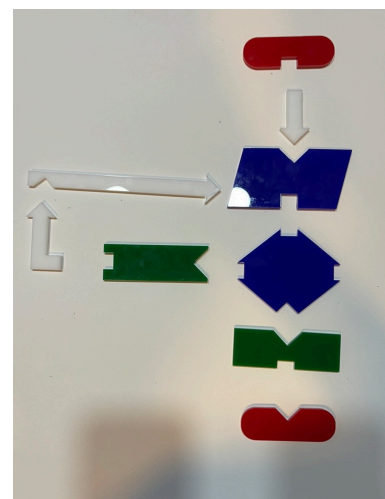
FLOWCHART ACTIVITY – BOARD GAME LEVEL 1



FLOWCHART ACTIVITY – BOARD GAME LEVEL 2



The different activities in the FLOWCHART section will be sent to a group of teachers to test along with the Kit List and guide. 

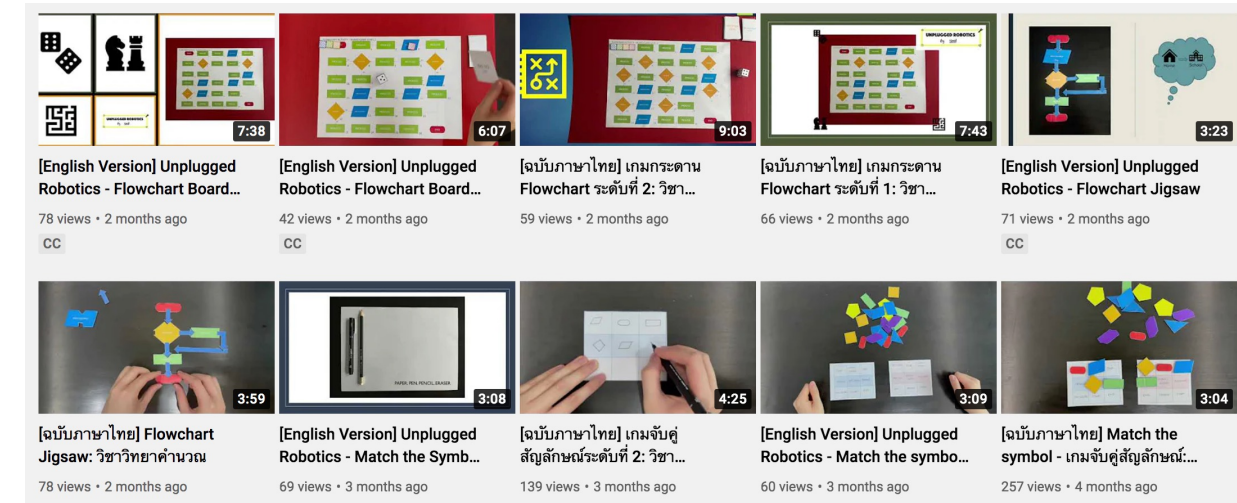
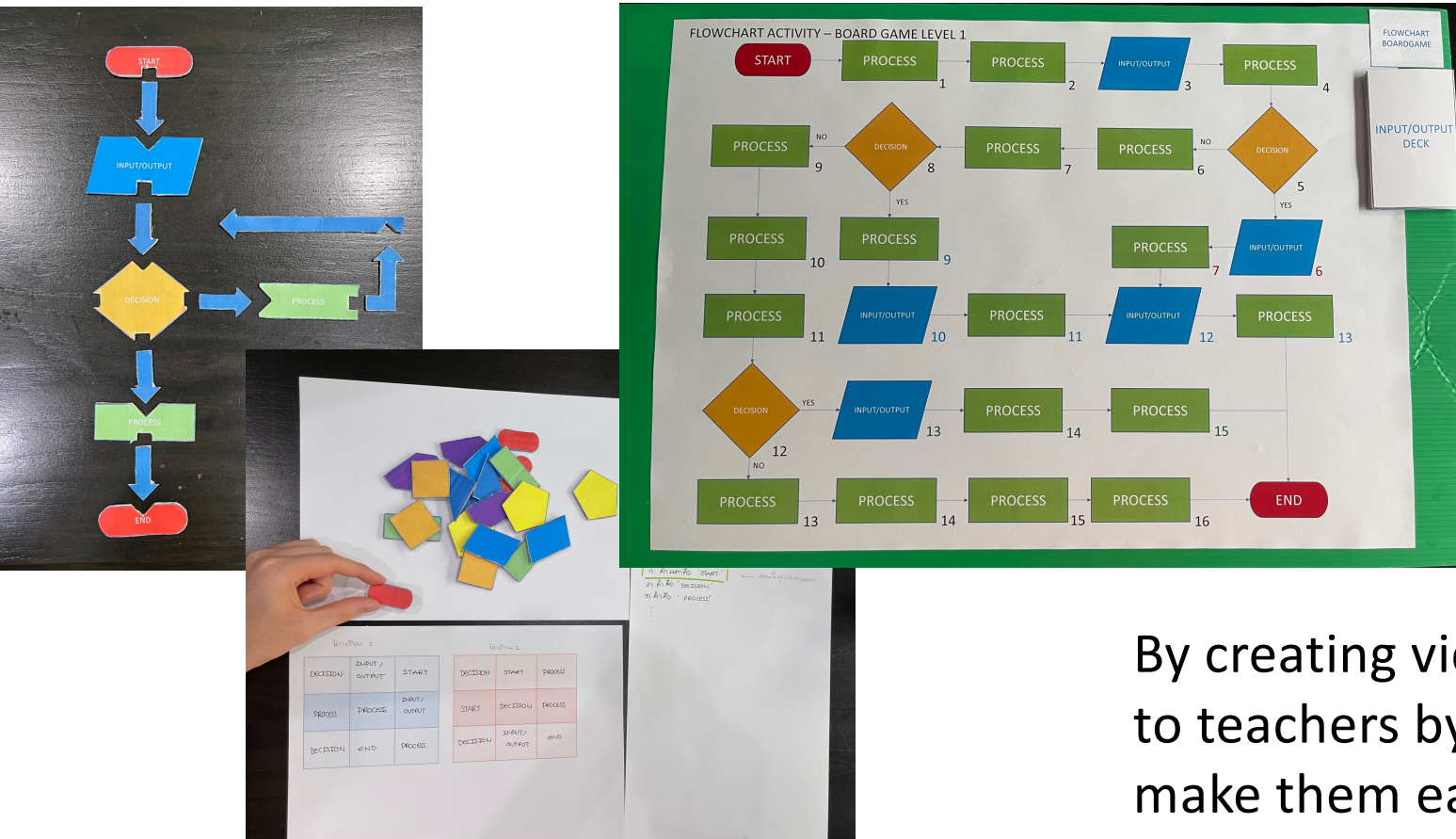


Templates for activities in the FLOWCHART section (JIGSAW AND MATCH THE SYMBOL) will be provided to teachers. This will make it easier for teachers as they can trace around the template and then cut the shape out on cardboard.



ACTION

CREATING VIDEOS



By creating videos for each activity, this would allow them to be accessible to teachers by introducing how each activity can be made and used. To make them easy to follow, my videos follow a simple sequence:

I create storyboard plans for each of my videos to allow production to run smoothly and according to plan.



BOARDGAME LEVEL2

<p>FLOWCHART BOARD GAME LEVEL 2</p>		<p>CARDS</p>	<p>Video cut template</p>	<p>START</p>	<p>FLOWCHART SYMBOLS</p>	<p>Video draws card</p>	<p>Video draws card</p>
<p>Aims:</p>	<p>MATERIALS</p>	<p>Preparation</p>	<p>COUNTERS DICE</p>	<p>KEY: START: START LINE PROCESS: PLAY</p>	<p>Colour coded points</p>	<p>BLACK NUMBER SEQUENCE</p>	<p>DECISION</p>
	<p>CARDS DICE</p> <p>www.bynond.com</p>	<p>Preparation</p>	<p>COUNTERS DICE</p>	<p>Video</p>	<p>Video</p>	<p>BLUE NUMBER SEQUENCE</p>	<p>RED NUMBER SEQUENCE</p>
<p>GLUE SCISSORS</p> <p>HOW TO MAKE</p>	<p>Gs</p> <p>www.bynond.com</p>	<p>Preparation</p>	<p>HOW TO PLAY</p>	<p>Video</p>	<p>Video</p>	<p>GREEN NUMBER SEQUENCE</p>	<p>Video</p>
				<p>Video</p>	<p>Video</p>	<p>UNPLUGGED ROBOTICS BY NONO</p>	<p>DECISION</p>
				<p>freeze frame</p>	<p>Video draws card</p>	<p>UNPLUGGED ROBOTICS BY NONO</p> <p>www.bynond.com</p>	<p>DECISION</p>

- Activity Name
 - Aims
 - Materials
- How to make
- Preparation
- How to play

SHARING INFORMATION

CREATING MANUALS

To allow teachers to obtain a clearer image of how the activities work, I created manuals for each activity. Each manual includes key information for its designated activity such as materials required and sample questions.

วิทยาการคำนวณและหุ่นยนต์ - กิจกรรมโฟลว์ชาร์ท

ณนดี โนดทรัพย์

คู่มือกิจกรรมโฟลว์ชาร์ทกิจกรรม

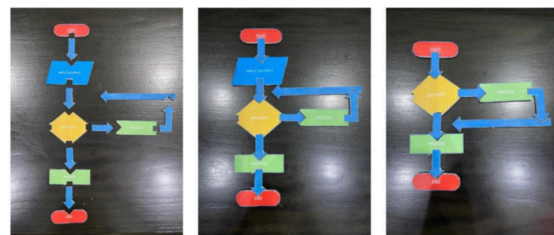
อุปกรณ์ที่ต้องใช้

- กระดาษสำหรับพิมพ์รูปสัญลักษณ์ซึ่งเป็นกิจกรรม
- ไฟล์รูปแบบสัญลักษณ์สำหรับเป็นต้นแบบในการตัดสัญลักษณ์ซึ่งเป็นกิจกรรมที่ใช้ในการเล่น (ไฟล์ Flow Chart - รูปแบบกิจกรรม.jpg)
- กระดาษสี (เช่นกล่องกระดาษ A4)
- กรรไกร
- กาว

คุณครูที่พิมพ์แบบสัญลักษณ์ให้นักเรียนตัดตามรูปสัญลักษณ์ และ แปะลงบนกระดาษสี แล้วตัดออกมาอีกครั้ง รูปต่างๆ จะประกอบด้วยสัญลักษณ์ที่ใช้ในโฟลว์ชาร์ท และ ลูกศร

ความยากระดับที่ 1:

ให้นักเรียนลองต่อจิ๊กซอว์แบบอิสระ ตามรูปแบบที่ตนเองคิด โดยจะต้องเริ่มด้วยเครื่องหมาย Start และ จบ ที่เครื่องหมาย End ในระหว่างทาง นักเรียนมีอิสระในการวางสัญลักษณ์ขึ้นๆ แต่จำเป็นต้องเชื่อมต่อกับสัญลักษณ์ด้วยลูกศรเสมอ ดังตัวอย่างด้านล่าง

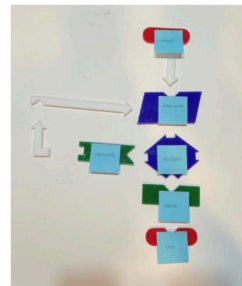


ความยากระดับที่ 2:

- ให้นักเรียนลองฝึกถึงขั้นค่อนข้างยาก ไม่ชีวิตประจำวัน เช่น การเดินทางกลับบ้านจากโรงเรียน มีทางเลือกในการใช้เส้นทางใดบ้าง และ ลองคิดออกมาเป็นขั้นตอนในลักษณะของโฟลว์ชาร์ท และสามารถเขียนกิจกรรมต่างๆ เหล่านี้บน Post-it เพื่อติดบนสัญลักษณ์

วิทยาการคำนวณและหุ่นยนต์ - กิจกรรมโฟลว์ชาร์ท

ณนดี โนดทรัพย์



- คุณครูกำหนดปัญหาให้นักเรียนทดลองใช้กิจกรรมโฟลว์ชาร์ทในการวางลำดับขั้นตอนของการแก้ปัญหา โดยคุณครูเขียนขั้นตอนเป็นคำสั้นๆ บนจิ๊กซอว์ซึ่งมีทั้งขั้นตอนที่ถูกต้อง และ ขั้นตอนที่ไม่ดี เพื่อให้ให้นักเรียนเรียงลำดับให้โฟลว์ชาร์ทที่ถูกต้อง ทั้งนี้ให้นักเรียนได้ใช้ทักษะและความรู้ของการคิดเชิงตรรกะ

- หลังจากที่นักเรียนสามารถเรียงลำดับโฟลว์ชาร์ทที่คุณครูเป็นผู้กำหนดปัญหาและเขียนขั้นตอนให้แล้ว นักเรียนสามารถลองทำโฟลว์ชาร์ทของตนเองได้

CREATING A WEBSITE

By using WordPress, I created my own website to compile all the information for my activities into one place. This includes videos, manuals and any templates.

Match the Symbol Level 1

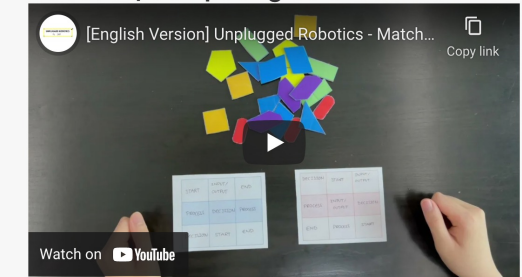
This activity is an introduction to flowchart symbols through learning by playing. It aims to help teach robotics and programming to beginners in the subject, especially to younger audiences.

The templates for this activity can be downloaded by pressing the button below. The files are the flowchart symbols (including unrelated symbols) and example questions.

The video on my YouTube Channel (Unplugged Robotics by Nond) will go through the steps of making and playing the activity.

FLOWCHART TEMPLATE

Match the Symbol Level 1: Robotics/Computing Science



Match the Symbol Level 2: Robotics/Computing Science

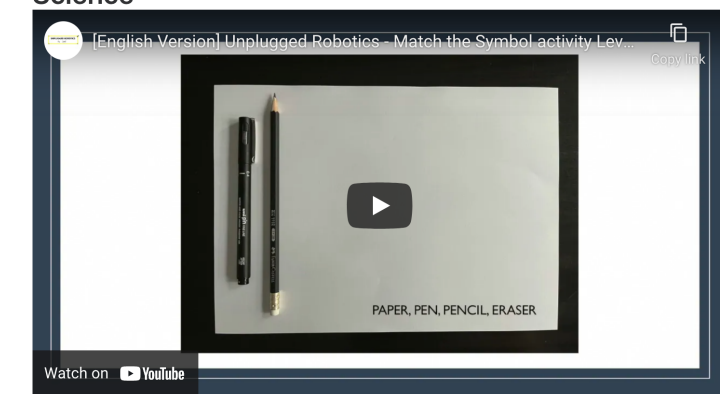
Match the Symbol Level 2

This activity is the 'second level' of Match the Symbol. This activity is similar to Match the Symbol Level 1, but is more challenging for the players as this activity will build on the knowledge that was used in level 1. It aims to introduce flowchart symbols and its application in a flowchart sequence and 'learning by playing', especially to younger audiences.

The sample questions for this activity can be downloaded by pressing the button below.

The video on my YouTube Channel (Unplugged Robotics by Nond) will go through the steps of making and playing the activity.

SAMPLE QUESTIONS



ACTIVITY DEVELOPMENT

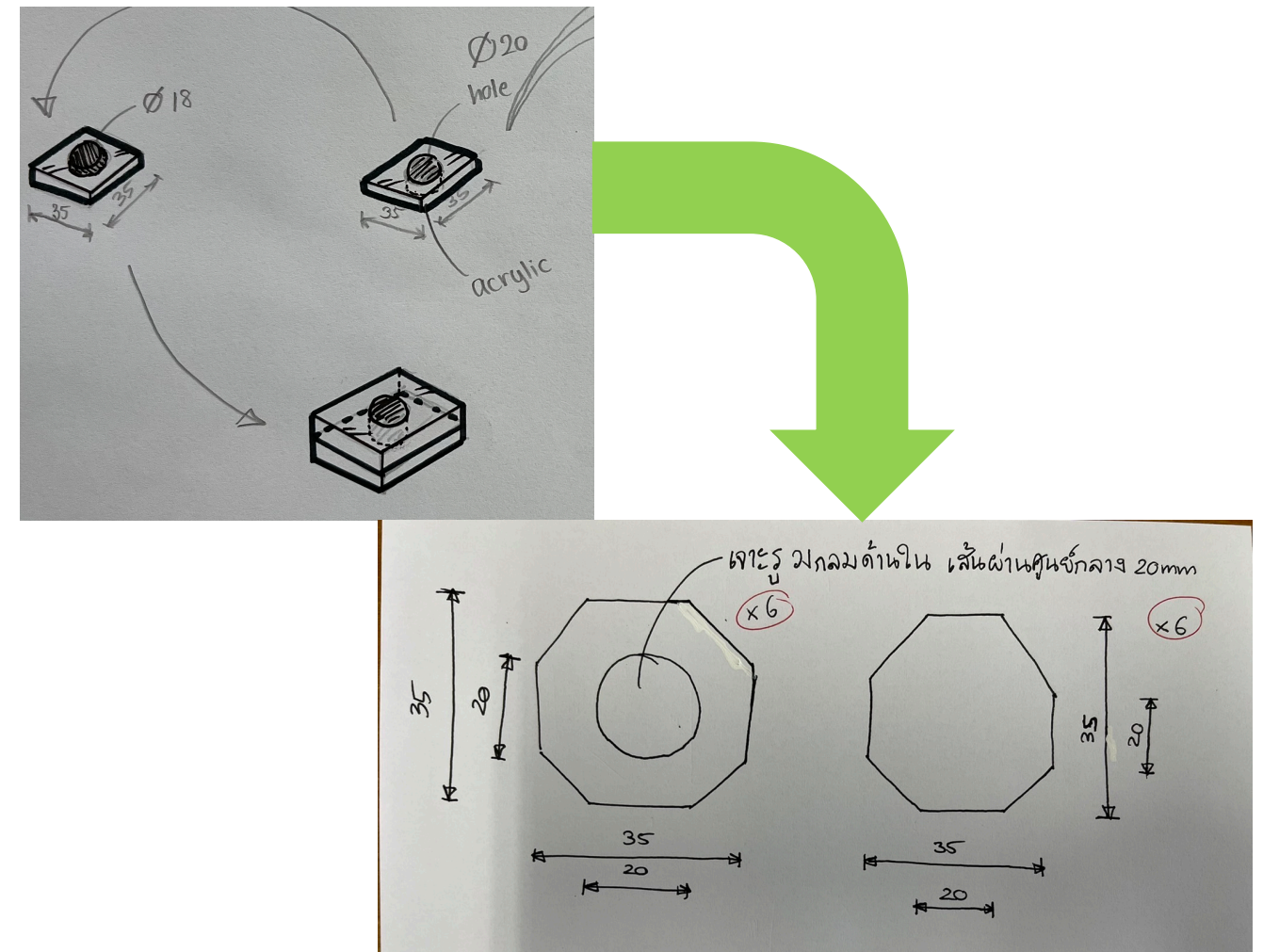
FLOWCHART JIGSAW

Upon reviewing this activity with my supervisor, we found that some of the flowchart symbols had lost their distinct shapes as a result of the jigsaw mechanism. So, we designed an alternative version of the jigsaw to remove this problem. Both versions were tested in a classroom environment to find out which version was more useful.



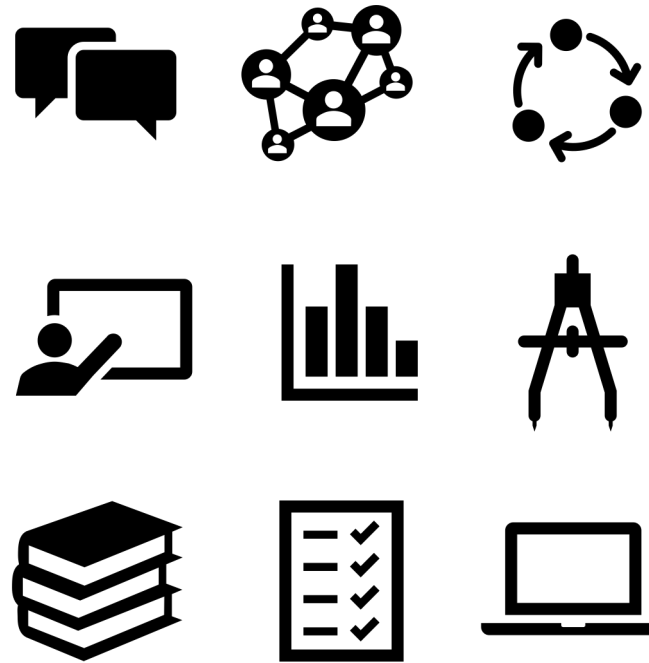
MAGNET MAZE

After a re-tested this activity, I found that the magnet movement could be sometimes unreliable as it would get stuck between two close obstacles. To offset this problem, I re-designed the magnet into an octagon shape.



TESTING PLAN

• Following the re-opening of schools, I was able to test my activities. To obtain feedback, I created a google form for teachers to fill in to allow me to implement any improvements and understand how my activities worked in a classroom environment. For the ease of testing, I created acrylic forms of the activities by using CAD.



Unplugged Robotics Activity Testing Feedback Form

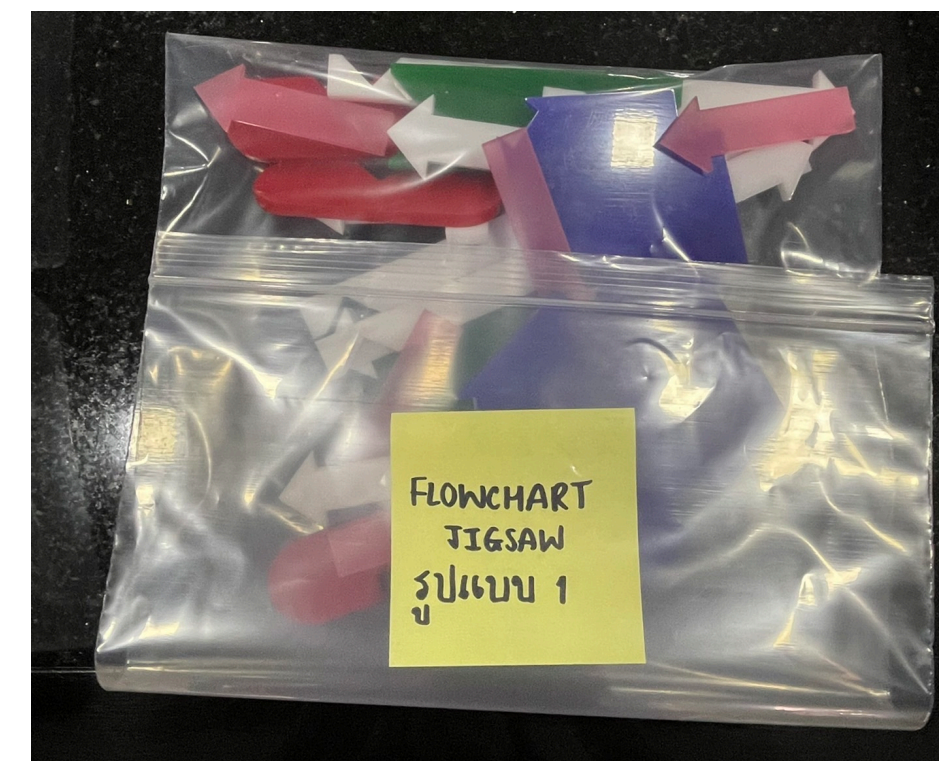
แบบฟอร์มสอบถามความคิดเห็นกิจกรรม unplugged robotics

What year group were the activities used with? กิจกรรมเหล่านี้ได้ไปใช้กับนักเรียนในชั้นใด *

- Year 2 (UK) / ป1
- Year 3 (UK) / ป2
- Year 4 (UK) / ป3
- Year 5 (UK) / ป4
- Other...

To what extent were the activities useful? กิจกรรมเหล่านี้มีประโยชน์ในระดับใด *

- Not Useful / ไม่มีประโยชน์ 1 2 3 4 5 Very Useful / มีประโยชน์อย่างมาก
-

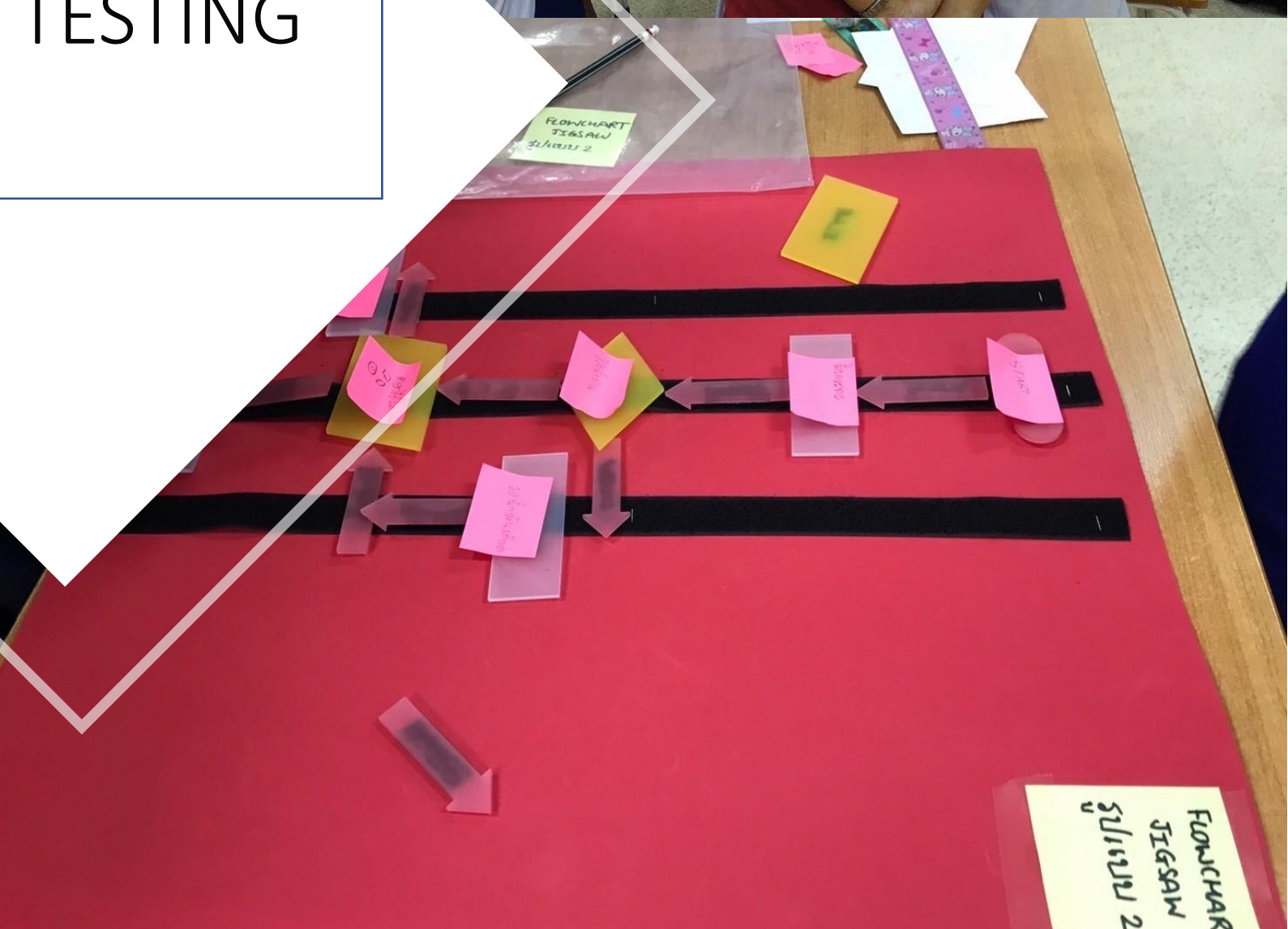
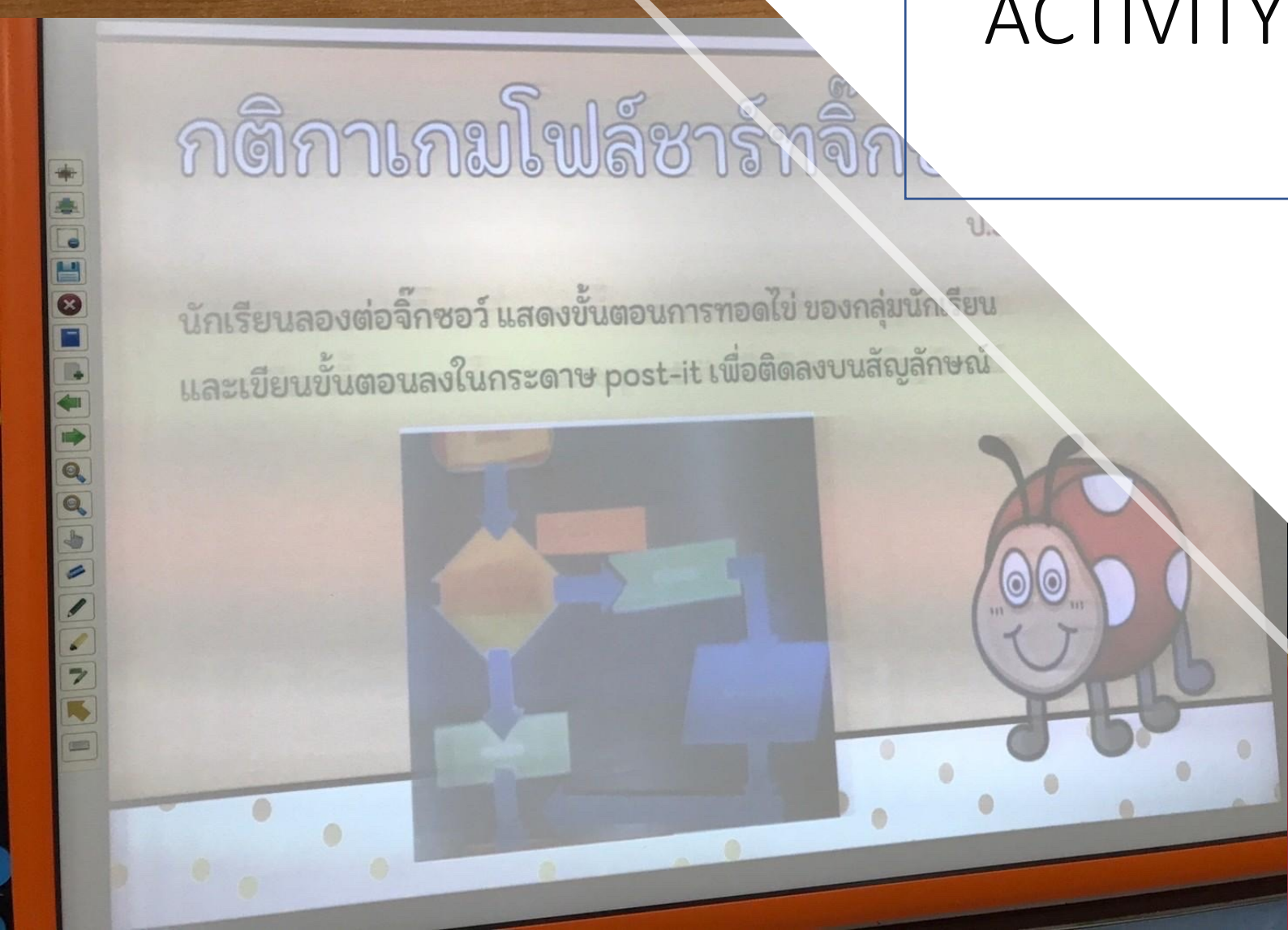




TESTING



ACTIVITY TESTING



FEEDBACK

Unplugged Robotics Activity Testing Feedback Form

แบบฟอร์มสอบถามความคิดเห็นกิจกรรม unplugged robotics

What year group were the activities used with? กิจกรรมเหล่านี้ได้ไปใช้กับนักเรียนในชั้นใด *

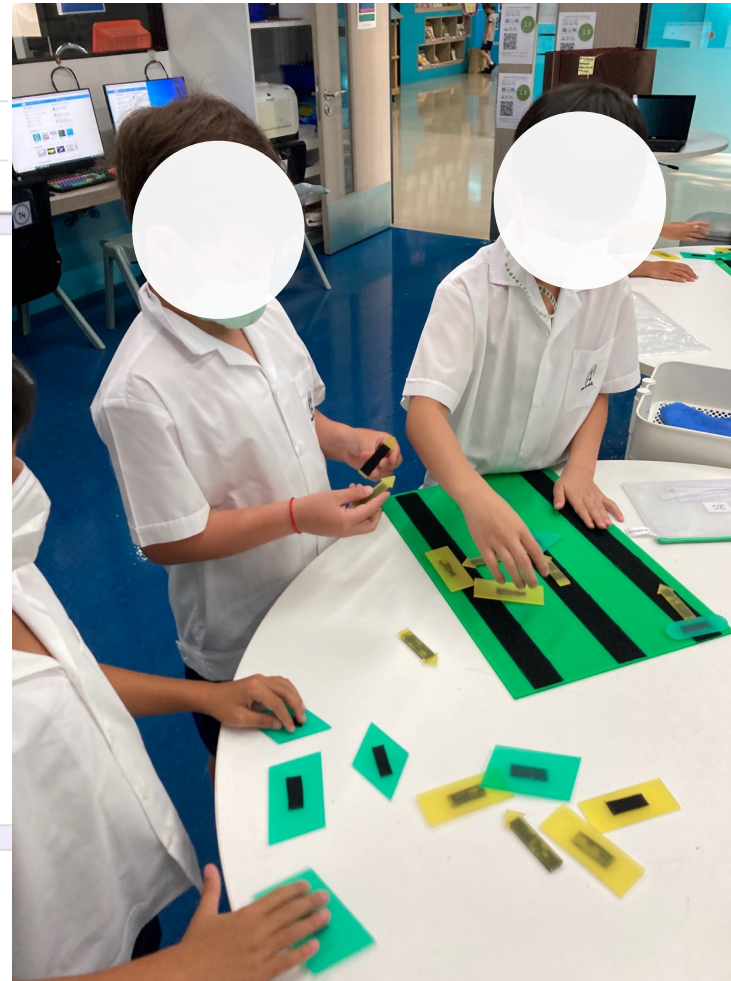
- Year 2 (UK) / ป1
- Year 3 (UK) / ป2
- Year 4 (UK) / ป3
- Year 5 (UK) / ป4
- Other...

To what extent were the activities useful? กิจกรรมเหล่านี้มีประโยชน์ในระดับใด *

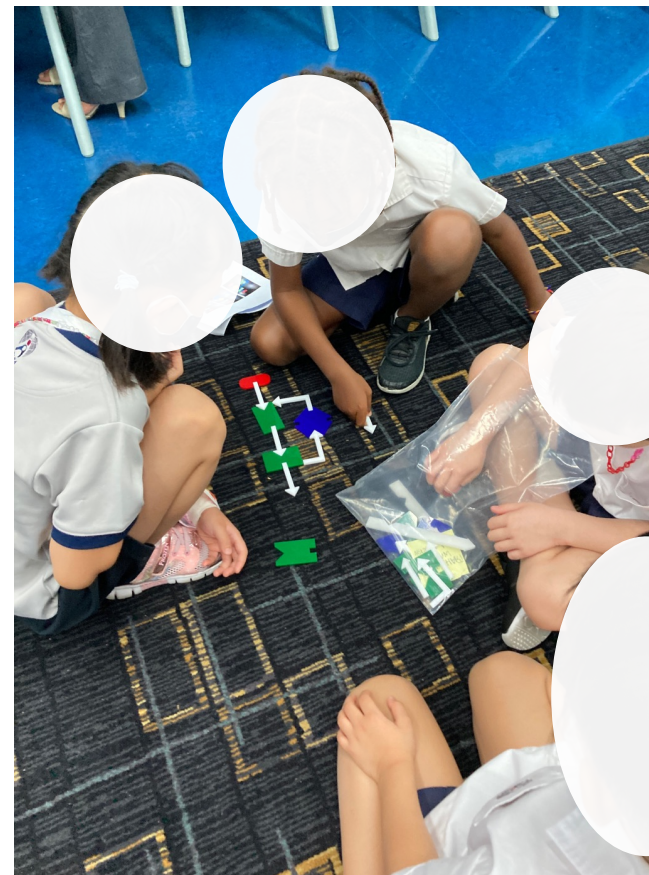
1 2 3 4 5

Not Useful / ไม่มีประโยชน์

Very Useful / มีประโยชน์อย่างมาก



Overall, there was a positive response to my activities. In this initial testing process, the activities that were tested were the Match the Symbol, Flowchart Jigsaw, and Board game. The activity that was most useful was the flowchart jigsaw. In general, the activities allowed teachers to test students' understandings of flowcharts and the situation being modelled along with good discussions regarding flowcharts.



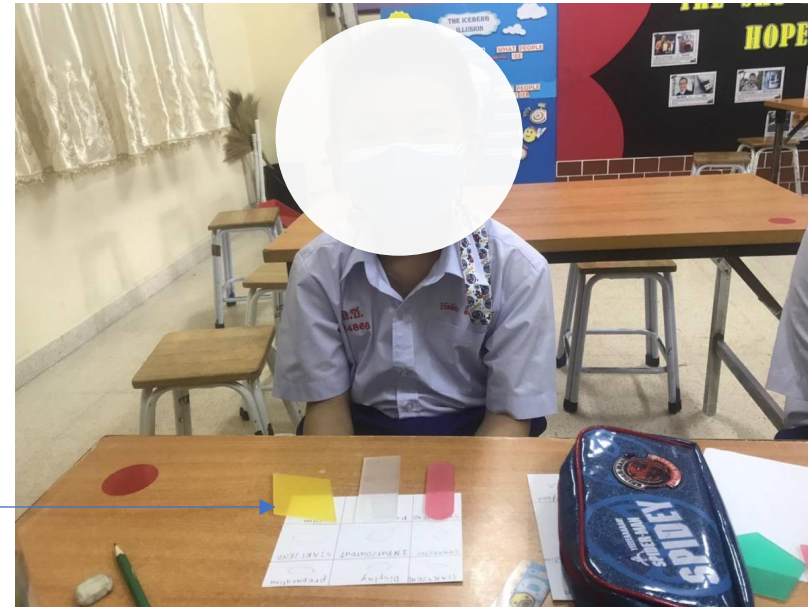
ACTIVITY REVIEW

MATCH THE SYMBOL LEVEL 1

+ The activity allows students to remember and visualise the different symbols.

Suggested Improvements:

- The 3x3 table needs to be bigger to allow for the symbols to be placed.

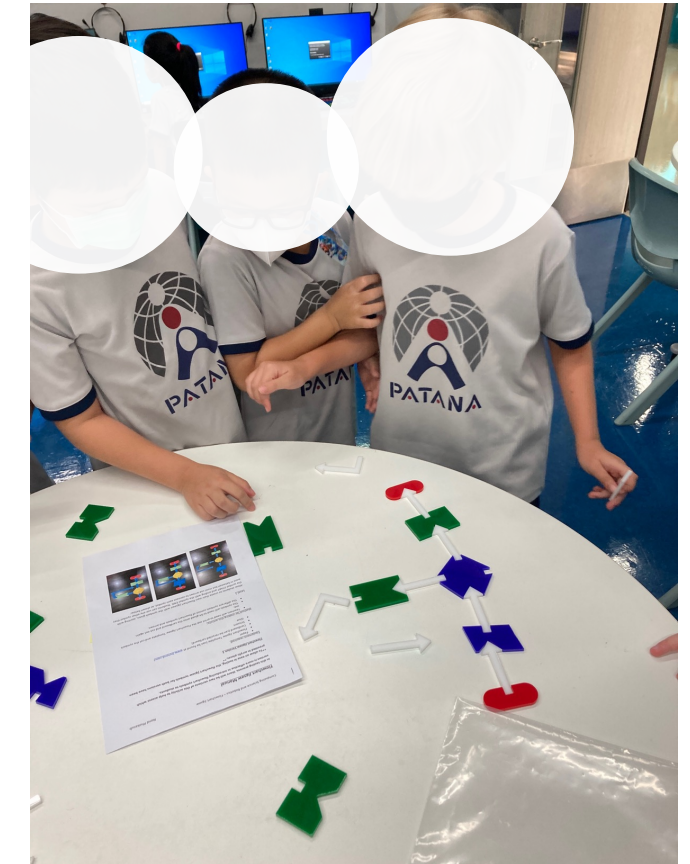


MATCH THE SYMBOL LEVEL 2

+ Easy to use and fun for students

Suggested Improvements:

- Students cannot cross out more than 2 boxes per symbol
- Challenge students with a 4x4 or 5x5 table



FLOWCHART BOARD GAME

+ Easy to use and fun for students

Suggested Improvements:

- Questions for the Question deck could be asked by the students themselves to prevent them waiting for the teacher to ask the question.



ACTIVITY REVIEW

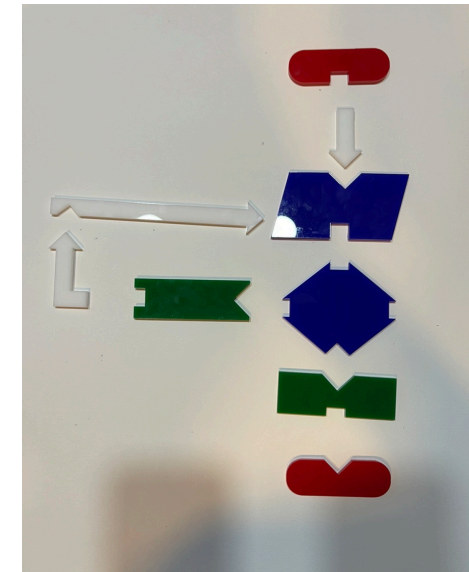
FLOWCHART JIGSAW VERSION 1

- + Students have freedom in creating the flowchart.
- + Fun to join pieces together
- + There is no limitation to the end shape of the flowchart.
- + Discussion between students before placing each symbol is very effective.

+ Working as a group allows the generation of detailed ideas.

Suggested Improvements:

- Students could have a limited time to design the flowchart.
- Each group could present their flowchart jigsaw to the class.
- More pieces could be added to each set to allow for different terminals and a wider range of flowcharts.



In terms of practicality, version 1 was more effective on a flat surface (e.g. a table) whilst version 2 was more effective on a carpet.

FLOWCHART JIGSAW VERSION 2

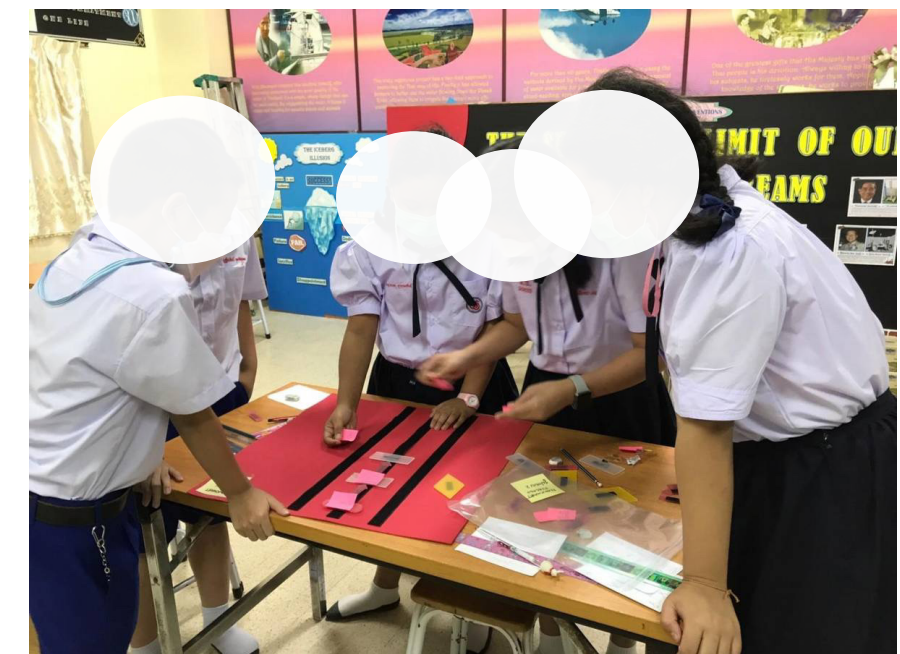
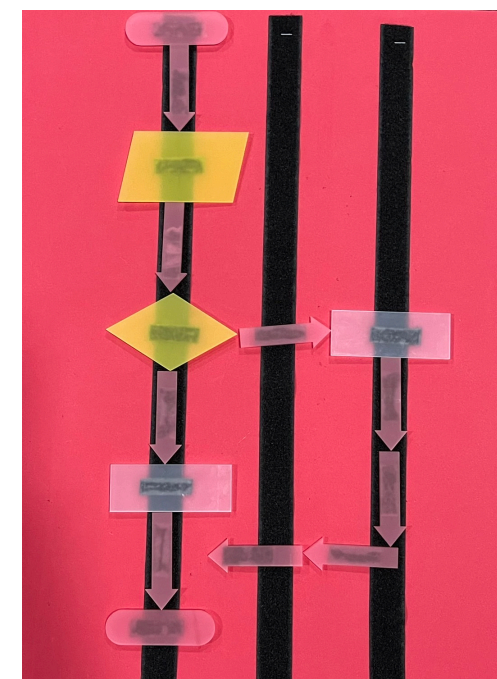
- + Students are able to understand the function of the activity.
- + Discussion between students before placing each symbol is very effective.

+ Working as a group allows the generation of detailed ideas.

- The activity is limited to three vertical lines.
- The Velcro straps make the symbols difficult to remove.

Suggested Improvements:

- Use activities in everyday life to allow debate within the group of which symbol to use.





IMPROVEMENTS

FLOWCHART ACTIVITY IMPROVEMENTS

The main improvements for these activities were the method of usage rather than the design. To implement the improvements, I edited my manuals for each of the activities.

Computing Science and Robotics – Flowchart Jigsaw Nond Phokasub
Flowchart Jigsaw Manual

In this testing process, there will be two versions of this activity to help assess which version is more effective in introducing flowchart symbols to students.

****To allow an ease in testing, the flowchart jigsaw symbols for both versions have been provided in acrylic pieces.****

Flowchart Jigsaw Version 1

Equipment required:

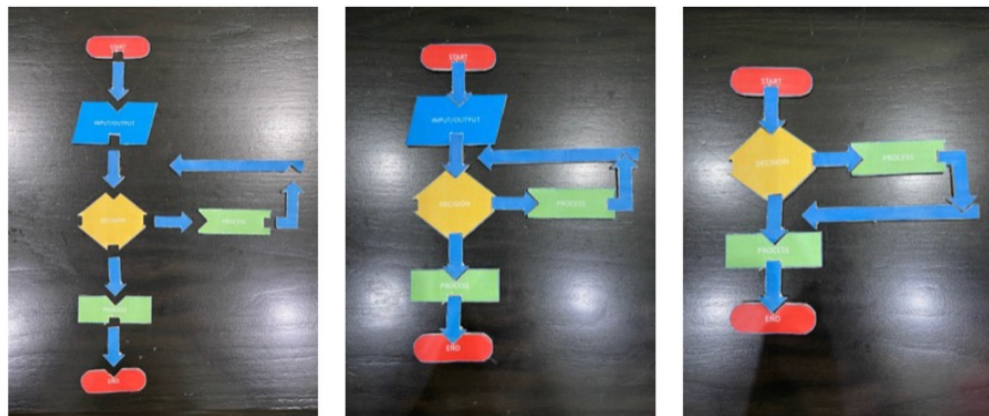
- Paper
- Flowchart Jigsaw Template (can be found at www.bynond.com)
- Cardboard (can be recycled cardboard)
- Scissors
- Glue

Method for making this activity:

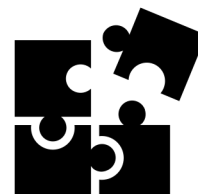
- Teachers will need to print out the Flowchart Jigsaw Template and cut the symbols out.
- The symbols will need to be glued onto the cardboard and cut out again.
- The different symbols consist of flowchart symbols and arrows.

Level 1

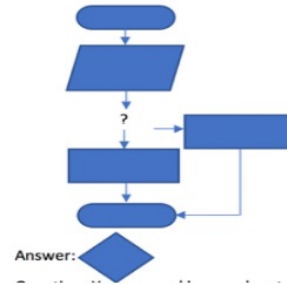
Allow students to create their own flowchart jigsaws with the symbols given, starting with the symbol START and ending with the symbol END. Students can use any other symbol they want in between but must use arrows to connect each symbol, as shown below:



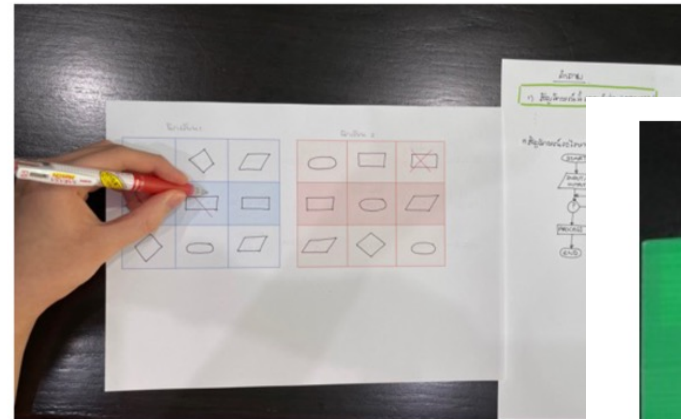
 Improving the overall presentation

 Adding more pieces

- Teachers will need to ask questions which have answers as the different flowchart symbols. For example:
 - What symbol is used to start a flowchart? (Difficulty: Easy)
 - What symbol is missing from the following flowchart? (Difficulty: Hard)




- If the student answers the question correctly, they can cross the symbol out from their table (only one symbol can be crossed out per question even though their table may have the symbol written twice).
- The student who is able to cross out three symbols in a row first is the winner.



- The difficulty level of this activity could be increased 3 by 3 table to a 4 by 4 or 5 by 5 table.

 Improving the explanations

 Improving the communication

 Implementing improvements from feedback given



- Examples of instructions on the Input/output cards include:
 - FORWARD 5
 - BACKWARD 2
 - GO TO 7
- An explanation of this can be found in my video: <https://www.youtube.com/watch?v=0PtZfu5OAPI>
- The student who reaches the END symbol first is the winner.

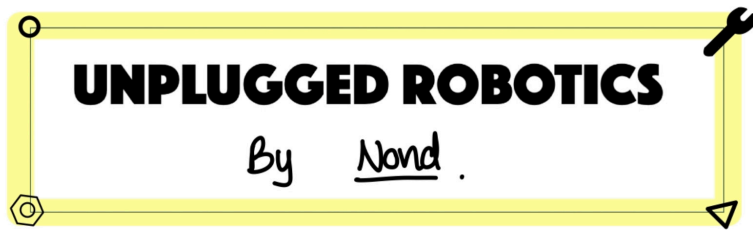


DISTRIBUTION

DISTRIBUTION



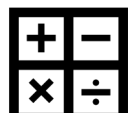

FLOWCHART ACTIVITIES

These activities will be distributed through my website and videos by providing information of how to make and use the activities.



www.bynond.com



-  Flowchart Jigsaw
-  Flowchart Board Game
-  Flowchart Match the Symbol
-  Kit List and Instructions

MAGNET MAZE

This activity will be distributed through my website, which will contain a manual of how to make and use this activity.

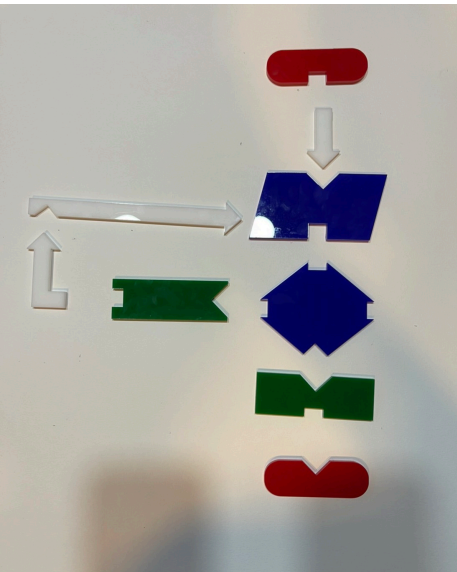


www.bynond.com

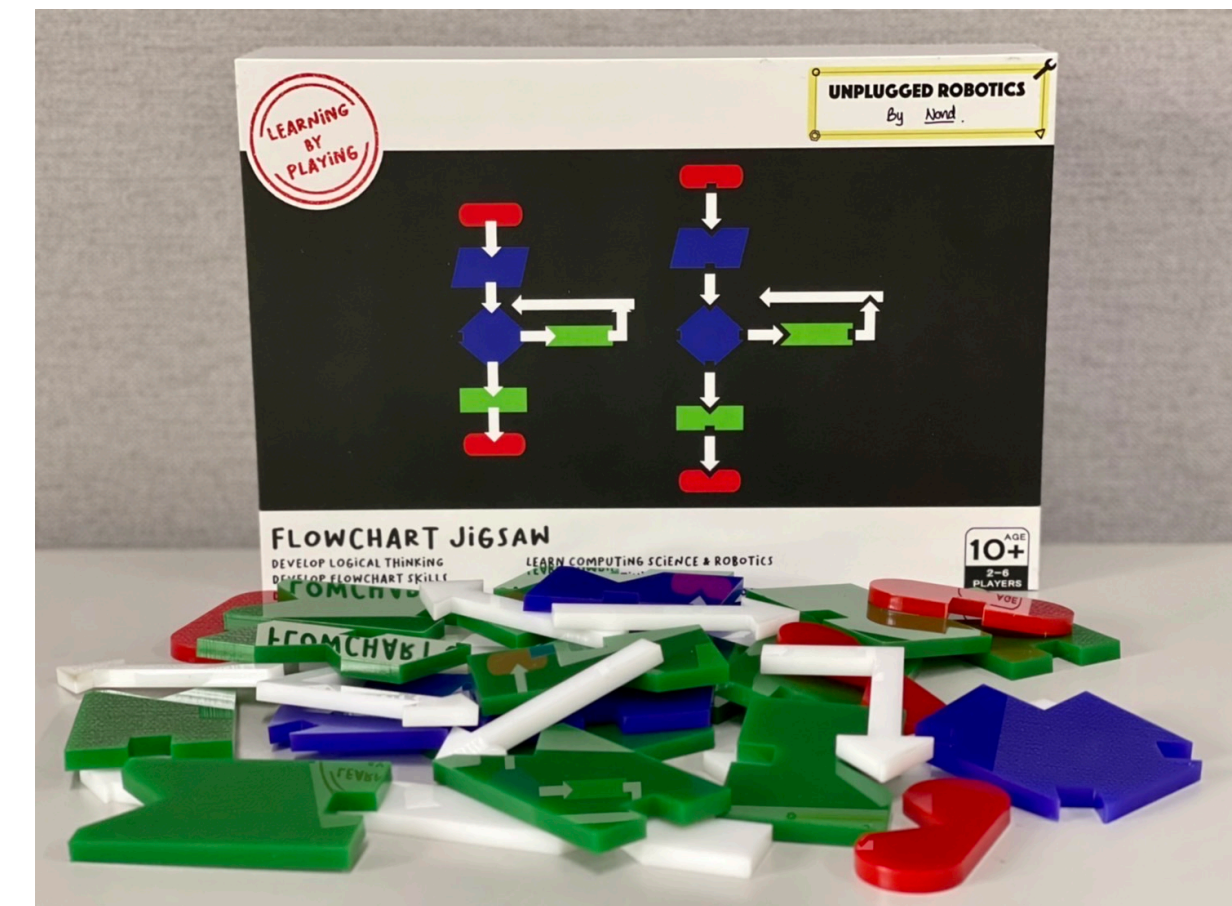
DISTRIBUTION

For the most successful activities that can be improved in terms of practicality, I will be manufacturing the activities to allow them to be bought. This includes the Flowchart Board Game and the Flowchart Jigsaw.

FLOWCHART JIGSAW



FLOWCHART BOARD GAME



PROJECT EXPANSION PLAN

By developing a business plan, I will be able to manage the retail side of this project more carefully and successfully.



WHO



The main target users will be Computer Science Teachers and parents.

WHAT



Unplugged Robotics by Nond will be a non profit shop that sells unplugged robotics activities including Flowchart Board Game and Jigsaw. All proceeds will be used for further production of activities to be used in more schools in need.

HOW

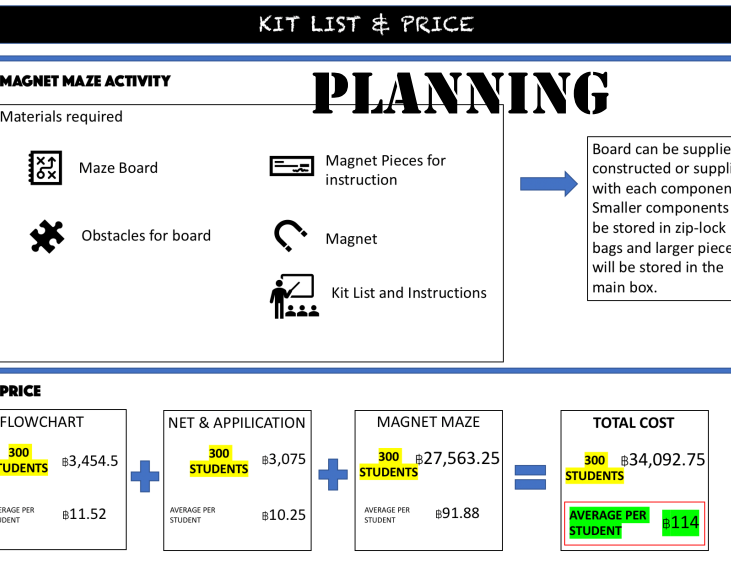
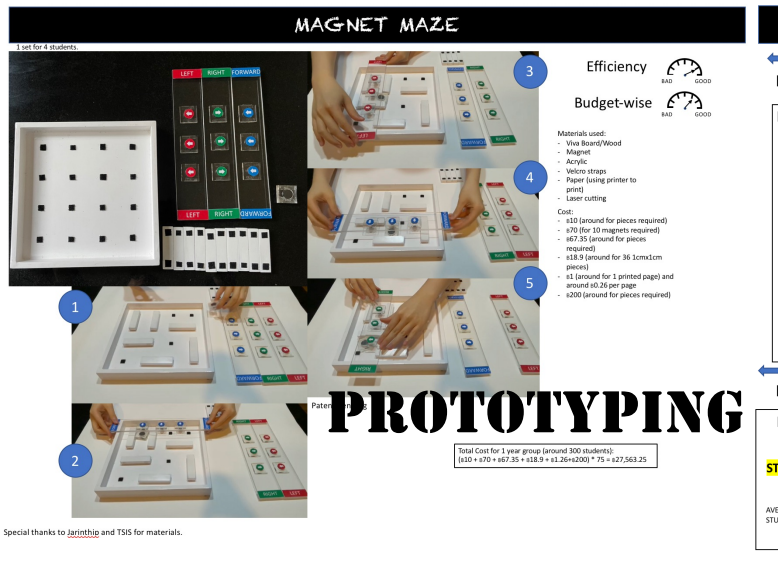
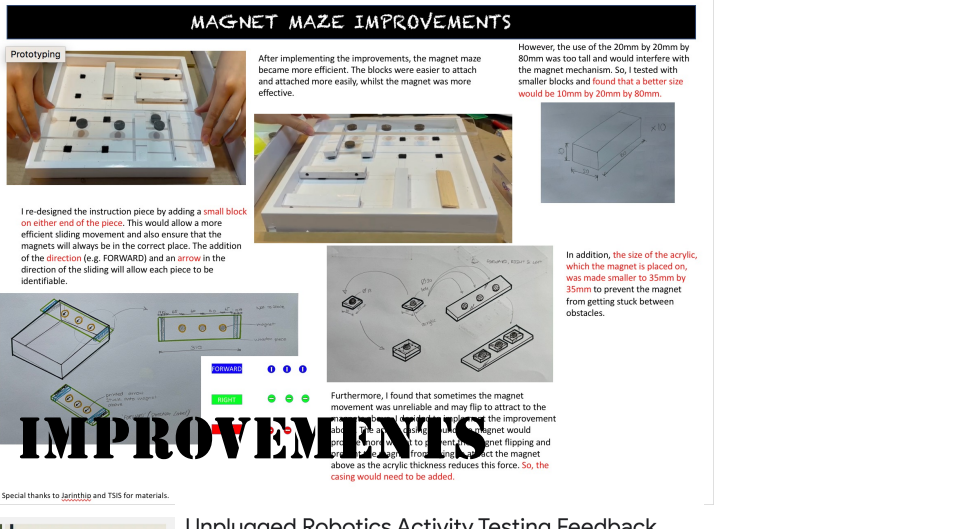
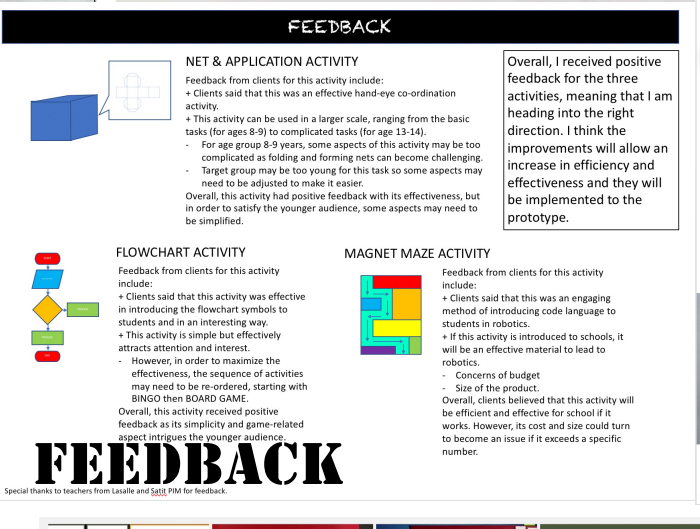
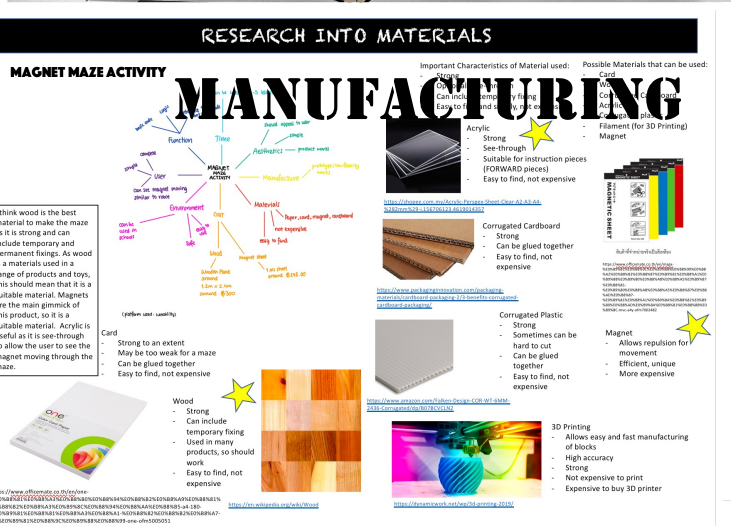
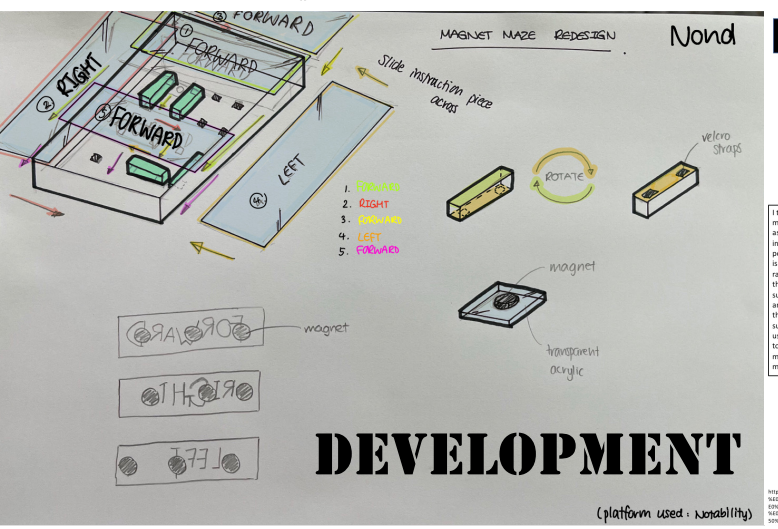
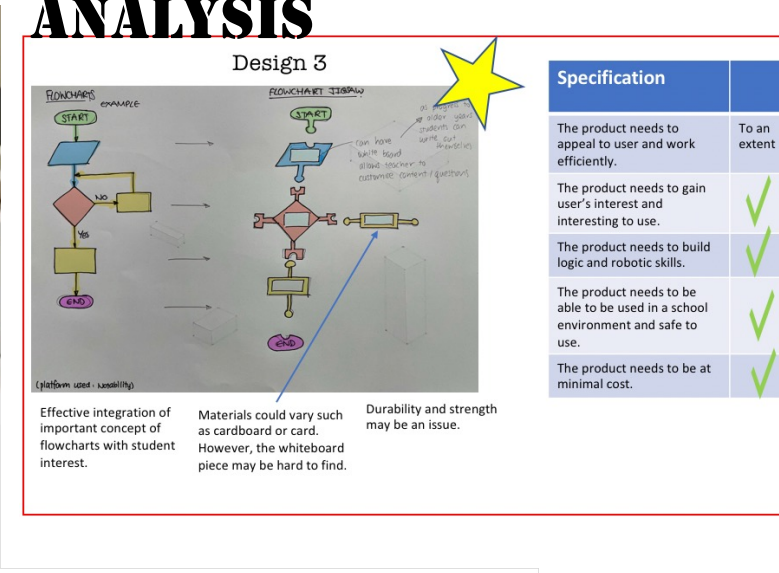
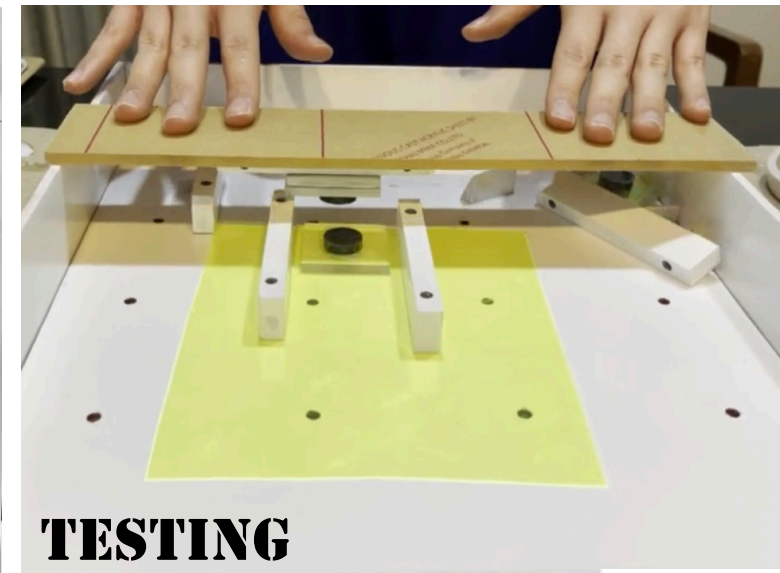
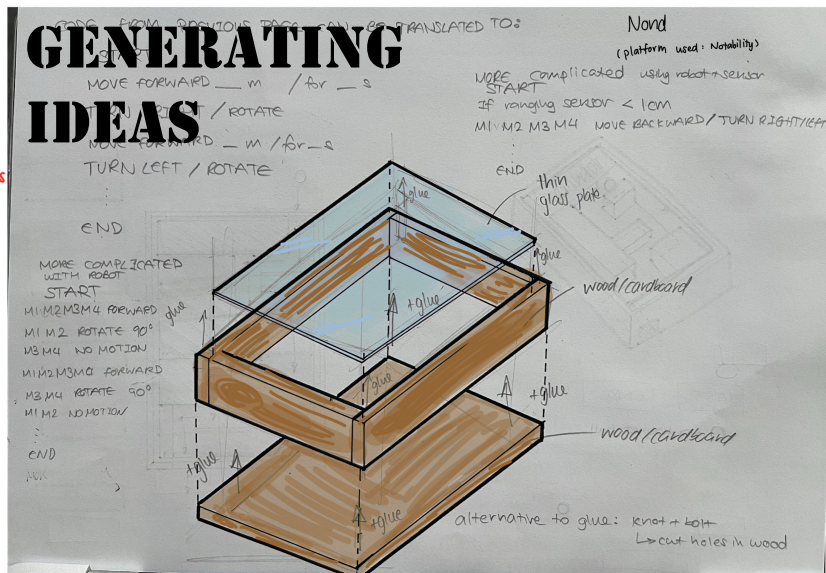


I will promote this shop through social media (e.g. Instagram) and my website. Activities will be sold through the Line official account @bynond.



PROJECT OVERVIEW

PROJECT OVERVIEW



DISTRIBUTION

Match the Symbol Level 1: Robotics/Computing Science

Match the Symbol Level 1: Robotics/Computing Science

Match the Symbol Level 1: Robotics/Computing Science

Unplugged Robotics Activity Testing Feedback Form

What year group were the activities used with? กิจกรรมเหล่านี้ได้ใช้กับนักเรียนในชั้นใด

Year 2 (UK) / ปี 2

Year 3 (UK) / ปี 3

Year 4 (UK) / ปี 4

Year 5 (UK) / ปี 5

Other...

To what extent were the activities useful? กิจกรรมเหล่านี้มีประโยชน์ในระดับใด

Not Useful / ไม่มีประโยชน์ Very Useful / มีประโยชน์อย่างมาก

In this project, I was able to learn many vital skills and achieve many different things that I had not expected. I had the opportunity to create various design ideas, which turned from a simple thought bubble into a working piece of equipment used in schools. I took on a whole process from designing all the way to testing the ideas. Whether it was collaborating with different people and professionals, creating a website, filming my own videos and planning my designs and actions, this project had it all. The amount of things that I learnt from this project could not all be written into words as there would be no word that could describe the importance of each of the skills gained. If you have read up until here, I am truly grateful for your time and I hope that my journey has helped you learn something new. The key skill that I believe was the most valuable to me in this project is the ability to plan and manage uncertainty. As soon as you create a plan, you are likely to be viewing it from an ideal world perspective and that is what I felt during this project. At school, I learnt about estimating the velocity of projectile motion in Physics, in which calculations would be completed by ignoring air resistance. However, when you conduct an experiment, you find that your initial prediction derived by calculations does not match that in the experiment. The truth is, just like projectile motion, what you expect when you are planning and what you actually experience may be completely different. This may be from an exclusion of some factors and many more. For example, when I designed the Magnet Maze activity, I was pretty certain that it was going to work; in reality, nothing is perfect and it took me many iterations until it worked as I wanted. Therefore, the act of managing uncertainties is very important and we should prepare for any uncertainty that may come when we execute our plan.