A STEM approach to help pupils with Autism Spectrum Disorder about emotional expression

Project Introduction

Community Partner - Cheung Wah Child Care Centre

- Target Group: Children aged from two to six years old with physical and/or mental disability, learning disabilities, autism and behavioral problems.

- Characteristics of pupils: sensitive to light and sound, love the flow of water, weak in expressing themselves, etc.


Goals and expected outcomes

- To teach pupils how to distinguish between happiness and unhappiness.
- To teach pupils to understand cause-effect relation.
- To train pupils the hand eye coordination and equilibrium ability.
- To provide opportunities for pupils to cooperate with each other.

Meet the need of the community partner

- Train their **motor skills** → through "catch goldfish" and Match UP activities
- Teach them about **causality** (cognitive development)


Train their motor skills👍

Design Rationale

Cater for students 's learning need and interest

- **Having difficulties in emotional expression** is one of the major characteristics of autism. Hence, teaching students about how to recognize people's basic emotion through observing their facial expression and foster student's recognition development (understand the causality between some social scenes and the occurrence of emotion, like happy and unhappy) are the two major teaching objectives in our project. Besides, the design rationale of activity 1 (撈金魚活動) is aimed to **cater for their sensitivity and interest on the flow of water**.

Students enjoyed joining this activity ☺

Teach students how to recognize people's emotion through observing facial expression👍

The application of technology

In Game 2, teacher will first go to the website we designed and start a game session. The teacher will show some scenarios to students, and ask them whether people in the scenarios should be happy or not. Two students need to pick one doll (with NFC tag) and move it to the "answer chair" (Chair with a mobile phone on it). Answer will be captured by the mobile phone on the phone and response to the server, reaction will be broadcast to the website.

Client Side:

- Two dolls (with NFC tags). There are two dolls, one represents Happy and the other one represents unhappy.
- Website. The function of the website is to show the scenarios to student and give response to the student through images and sounds when the server receive the answers from the mobile app. First teacher need to go to the website and login. Then the teacher need to create a session and a session code will be received.
- Mobile App. The main function of the mobile app is to capture the answer through the NFC reader and communicate with the server through web services. First the teacher use the mobile app to login, the app will request server to generate a JSON Web Token (JWT) for further authentication. Then the teacher need to enter the session code to the app so that the app will know which session it is responding to. Then it is ready for the game. In the game, while the doll with NFC tag put on the NFC reader of the phone, the answer will be captured and send to the server though web service.

Server Side:

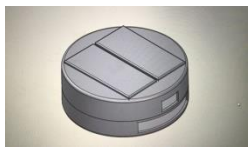
- Server building in NodeJS. The main functions of the server are to receive the answers from the mobile apps and broadcast the result to all the active website clients. The server will communicate with mobile apps through web services and communicate with website clients through web socket.
- Besides the login function, all other functions require token for authentication.
- The server can pair the mobile apps to different sessions through the session code.
- Handshake between client and server to setup a connection for web socket, immediate reaction will be broadcast to client once server receive the answer.

Necklace

The necklace is designed to show different emotions to the students. There are buttons on the necklace, and student can press them to light up the happy face or unhappy face.

Materials:

LilyPad 328 Main Board , LilyPad Button, LilyPad LED, Necklace Parts from 3D printing



Limitation and Difficulties

Activity 1 – Fish Catching:

✧ Limited human resources to take care of students catching fishes

➔ Students were so excited that they leant forward and pressed on the pool → they might fall into the pool or water might spilled out

➔ Not enough professionals to take care of four children playing at the same time

✧ "Fishing with fishing rod" was too difficult to most pupils

➔ In some cases, we needed to grab a toy fish in hand to facilitate successful "fishing"

➔ Such actions involve high level of hand-eye coordination plus muscle control, which was too challenging to most participants

Activity 2 – Matching Up:

✧ Difficulty in holding the rods well and delivering the toy cooperatively

➔ Some children cannot hold both rods throughout the game

➔ Picking up toy with rods and keeping it between the rods was demanding

✧ Easily distracted by the surroundings

➔ Focused on unimportant stuff → did not know what to do next or did not act according to instructions

Individual Reflections

✧ **Carrie (EDU-General Studies)**

This experience gave me the below insight about education.

✓ <u>Understand more characteristics of autism</u>

For example, most of them are visual learners. I have learnt how to use the pictures, schedule strategies and the light sensor effectively in order to enhance their learning motivation and efficiency. Also, I discover that they are fond of the flow of water and very sensitive to multisensory. Therefore, it lets me know how to cater for diversity and design the suitable teaching activities.

✓ <u>Adopt E-learning in classrooms</u>

Before joining this program, I didn't possess enough confidence in integrating new technologies into my teaching. However, this scheme provides us with priceless opportunities to cooperate with students from other professional aspects like engineering. The utilization of NFC tag, 3D printing and Arduino in our group's teaching package is really widen my horizon and experienced the merit of applying E-learning .

✧ **Christy (EDU-Maths)**

✓ Originally, I wondered how preschool students can be benefited from STEM, with the fact that they can hardly develop a scientific mind. Now, I know STEM in education does not only do with teaching content, but can also help students' expression and learning (as communicator and learning tool)

✓ STEM tools can furthermore relieve the demand of workers especially in special education sector, since they can more or less lead pupils' attention to the lesson, or act as a self-entertainment tool when teachers and TA are busy with other students

✧ **Tommy (CU-statistics)**

✓ In this scheme, I have learnt a lot of things. Applying STEM in kindergarten is a challenging task because the application cannot be so complicated. For example, it is impossible to teach pupils to make a robot. Therefore, we just applied NFC technology and 3D printing into our project.

In this project, I was in charge of holding a game called 'doll clipping'. I told a story about Disney with different scenes, each of them needed pupils to determine whether it made people happy. One of the encountered problems is the pupils did not distinguish between 'happiness' and 'unhappiness'. For instance, when the scene was 'If you get sick, what is your feeling?', some pupils answered 'happy'. At that moment, I had to explain why this scene should be 'unhappiness'.

Fortunately, they have understood the reason why it was 'unhappiness'. Another problems was they had a difficulty to clip the doll. Most of the time, they needed our teachers to assist in. If the centre want to play this game again, I will suggest them to play easier level like catching the doll.

To conclude, I understood teaching the pupils in a short time cannot have a good result. We have to invite the centre to keep playing the games, the pupils will understand 'happiness' and 'unhappiness' well and improve their eye-hand coordination.

✧ **Douglas (Poly U-Engineering)**

✓ It is the first time I have join such an joint u activity related with STEM. As a late comer I really appreciate my groupmates are very helpful an d frienly. They have me covered and always back me up whenever difficulties and challenges. I was extremely busy in the past months but they really helped me a lot and I would like to say a truly thank you from heart. The programme also give me a chance to show my strength and ability. In the cooperation with different stakeholders, I have realised it is not enough to make something good, you have to make sure everything will happen at the exact timing in the right order with right people to make everything work. I have learnt a lot this time a surely it will be beneficial to my personal development. I would also like to give return whenever possible.

✧ **Jason (CU-Engineering)**

✓ This is my first time to participate in a STEM project. I think this is quite challenging because normally I work with a team of programmers or alone when I need to do development. But this time I need to work with students who come from different schools with

different academic backgrounds.

I have improved my communication and presentation skill through the project. At first, I was afraid to present my ideas. Then I was encouraged by my group mates and I tried to give a lot of presentations. I appreciate that my ideas were adopted and we respect each other in the group. Therefore we communicate a lot and we did build a positive relationship.

In addition, the project gain me the passion in using technology for volunteering works. I enjoy the development with a meaningful goal and mission. I also enjoy watching the participants smile while I was serving them. I have learned that technology is not only used to solve some critical problems for monetary benefits, more important is we should use technology to create positive change to the society.

Conclusion and Recommendations

Demo 1 (21/5):

- ✓ goal 1: Use a STEM approach to create a lesson→ achieved
- ✓ To teach children between happiness and unhappiness → achieved, students are able to distinguish and reflect their happiness
- ✓ To teach pupils to understand cause-effect relation. → achieved, students shows understanding in the cause and effect relation
- ✓ To train pupils the hand eye coordination and equilibrium ability. → further observation and application needed to show full results
- ✓ To provide opportunities for pupils to cooperate with each other. →achieved
- ✓ To improve pupils concentration. → partially achieved with improvements needed to hide the games during lecture time

Recommendations:

Game 1: fishing game

- ➢ 2 people/group (1 child 1 carer): make sure the child is in safe condition
- ➢ Using graber instead of hook: make it easier for students to get fishes as its shows that students are difficult to hook a fish

Game 2: matching up

- ➢ Adding some support between the sticks: some students have difficulties in cooperating with others. It is also a bit too difficult for students with limited attention and muscle ability
- ➢ Adding direction signs on the ground: give clear instructions to guide participants to the target.
- ➢ Brighter screen for NFC reciever: arise the attention/ focus of participants

More photos on 21/5