

Biotechnology Education Programme (2018/1148) 計劃成果分享



Po Leung Kuk Tong Nai Kan Junior Secondary College

Kwan Siu Ming Eddie

Introduction

Objective

- Promoting biotechnology education to our students and those in the secondary and primary schools in our district.
- Developing our school-based junior secondary biotechnology education, arousing students' interest in learning the biotechnology topics: agriculture, environment, fuels and chemical, food and drink, gene cloning and medicine.
- Fostering a positive moral and ethics through studying the impact of biotechnology to society.

Why we have this idea?

To achieve with the innovation and technology development, the HKSAR government began promoting STEM education in 2015. STEM education aims to equip students for the rapid economic, scientific and technology development. Through Science, Technology and Mathematics Education as the Key Learning Areas, it enhances the training of teachers and students to their potential in innovation.

Realizing the importance of STEM Education and its values to students, our school has set out 3 pillars of STEM development, which are biotechnology, AI and robotic control, and smart home, smart city. Various programmes are organized to stimulate students' learning of STEM subjects. To step up our efforts, a biotechnology laboratory was set up in our school in 2019 to help the promotion of innovation technology. Equipped with professional apparatus for the study of biotechnology, this laboratory does not serve only our students, but also the wider public.

Quality Education Fund

Since May 2020, our school is funded by the Quality Education Fund in conducting a QEF Project on Biotechnology Education Programme (生物科技教育計劃) (QEF Project No.: 2018/1148)

Project period: 05/2020-08/2022

Key Project information

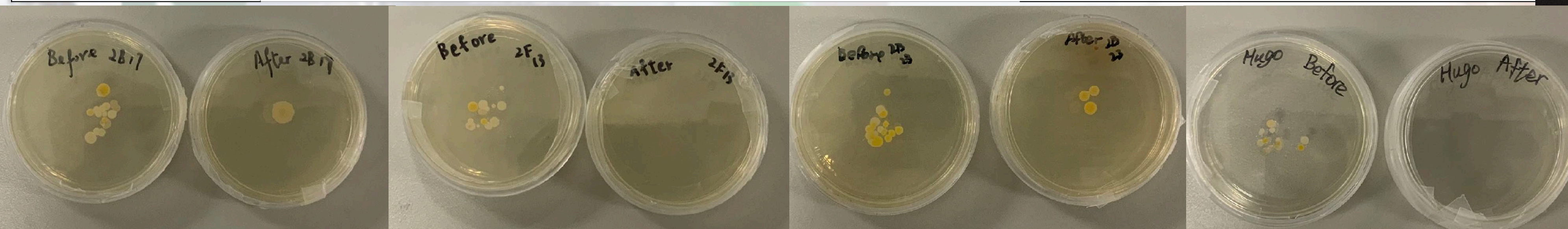
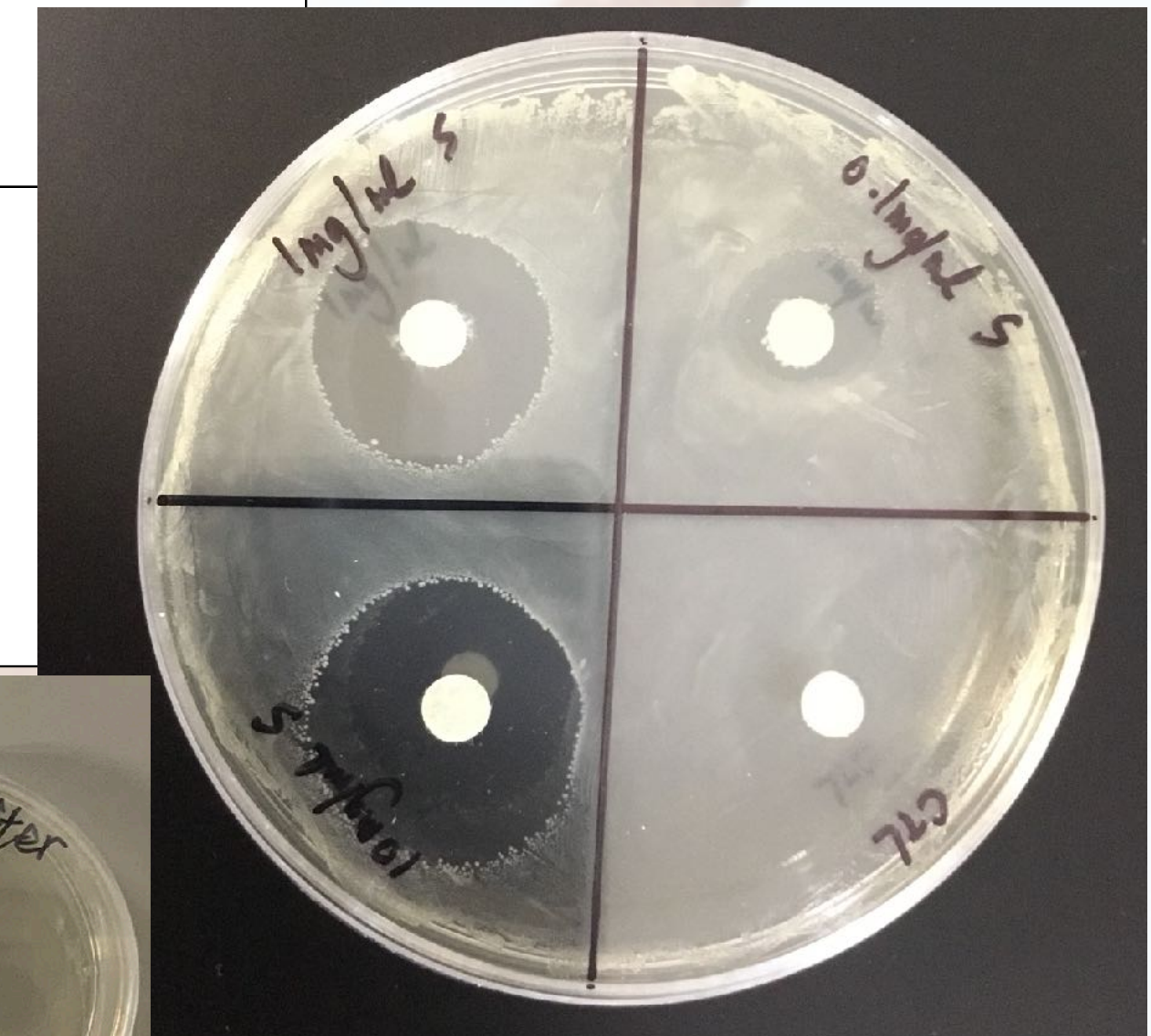
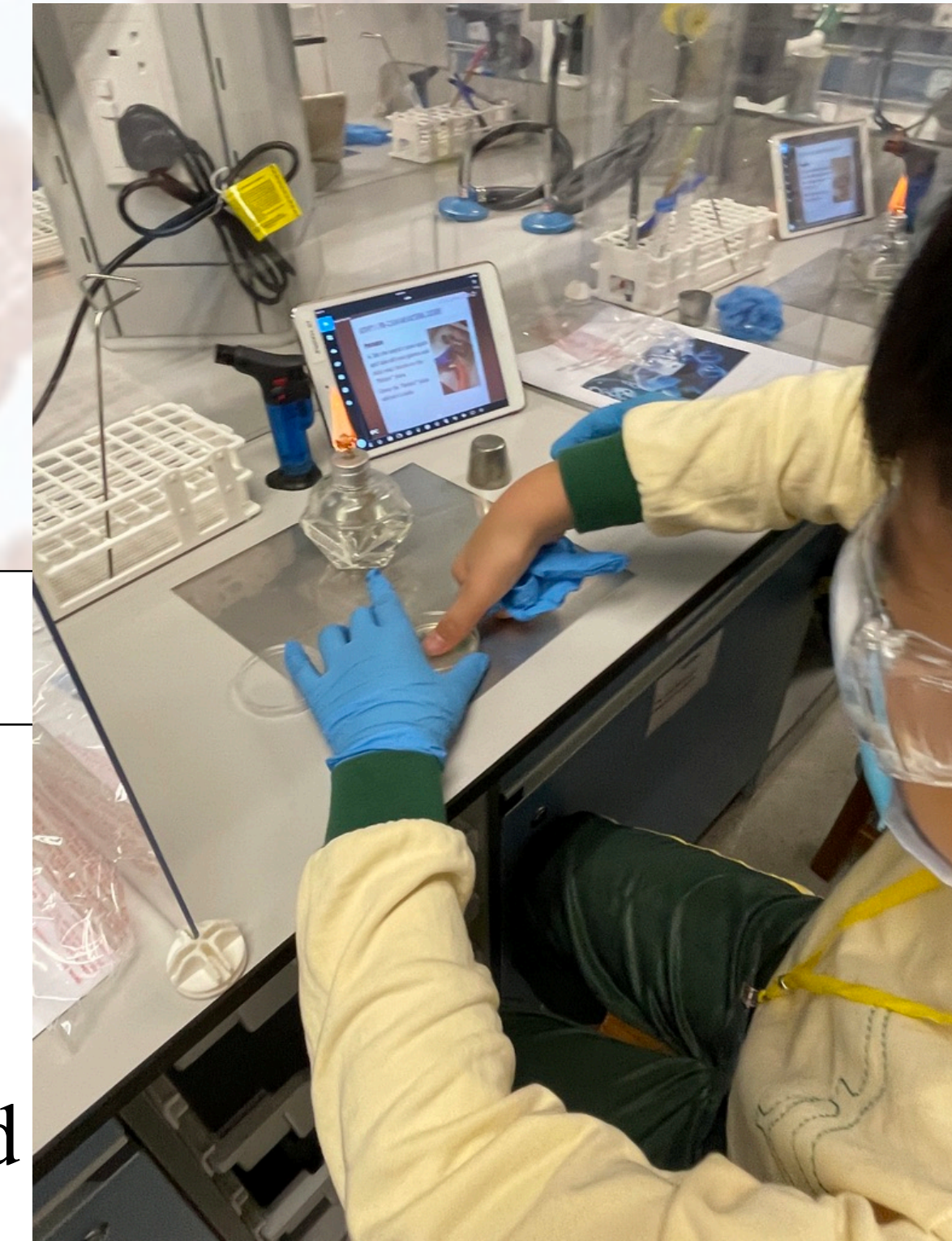
1. Develop our biotechnology curriculum
2. Extended learning activity - Gifted students research team
3. Provide educational service and workshops for other primary secondary schools



Key Project information

1. Biotechnology curriculum

Secondary 1	Bacterial culture & Antibiotics	
Learning and teaching targets	<p>1. Bacterial culture</p> <p>A. Skills and techniques of bacterial culture</p> <p>B. Factors affecting bacterial growth</p>	<p>1. Antibiotics</p> <p>A. Plasmid in Prokaryotic cells</p> <p>B. Application of antibiotics and possible consequences</p>
Teaching activities	<p>Exp1_Growing bacteria</p> <p>Exp2_How the concentration of antibiotics affecting bacterial growth</p>	



Key Project information

1. Biotechnology curriculum

Secondary 2	DNA Extraction & DNA fingerprint	
Learning and teaching targets	1.DNA extraction A.Skills and techniques of DNA extraction	1.DNA fingerprint A.Skills and techniques of DNA fingerprint B.Theory of restriction fragment length polymorphism (RFLP) C.Steps of DNA fingerprint and the theory behind Application of DNA fingerprint
Teaching activities	Exp3_DNA extraction Exp4_DNA fingerprint	



Flipped classroom



Po Leung Kuk Tong Nai Kan Junior Secondary College

Steps

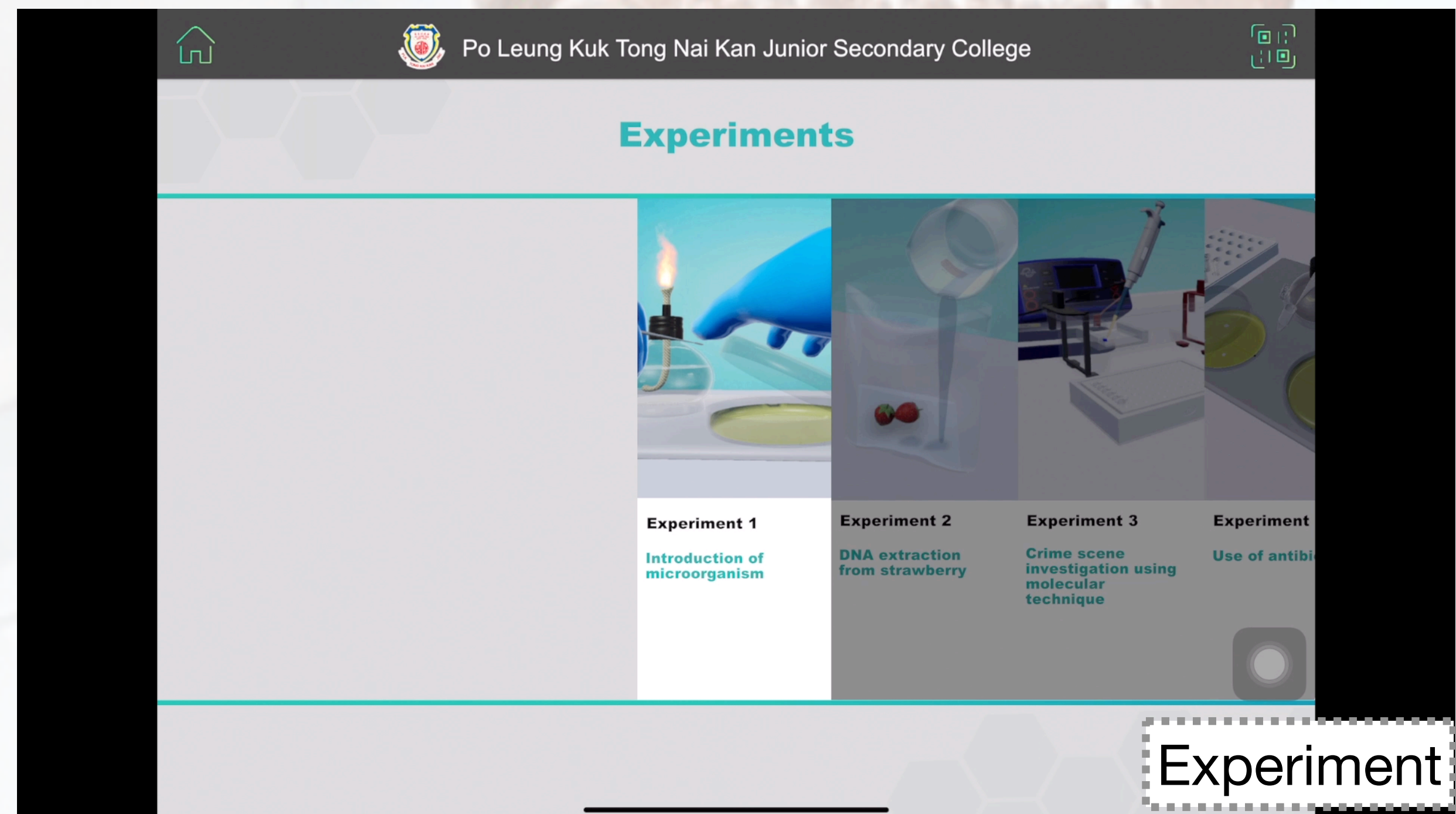
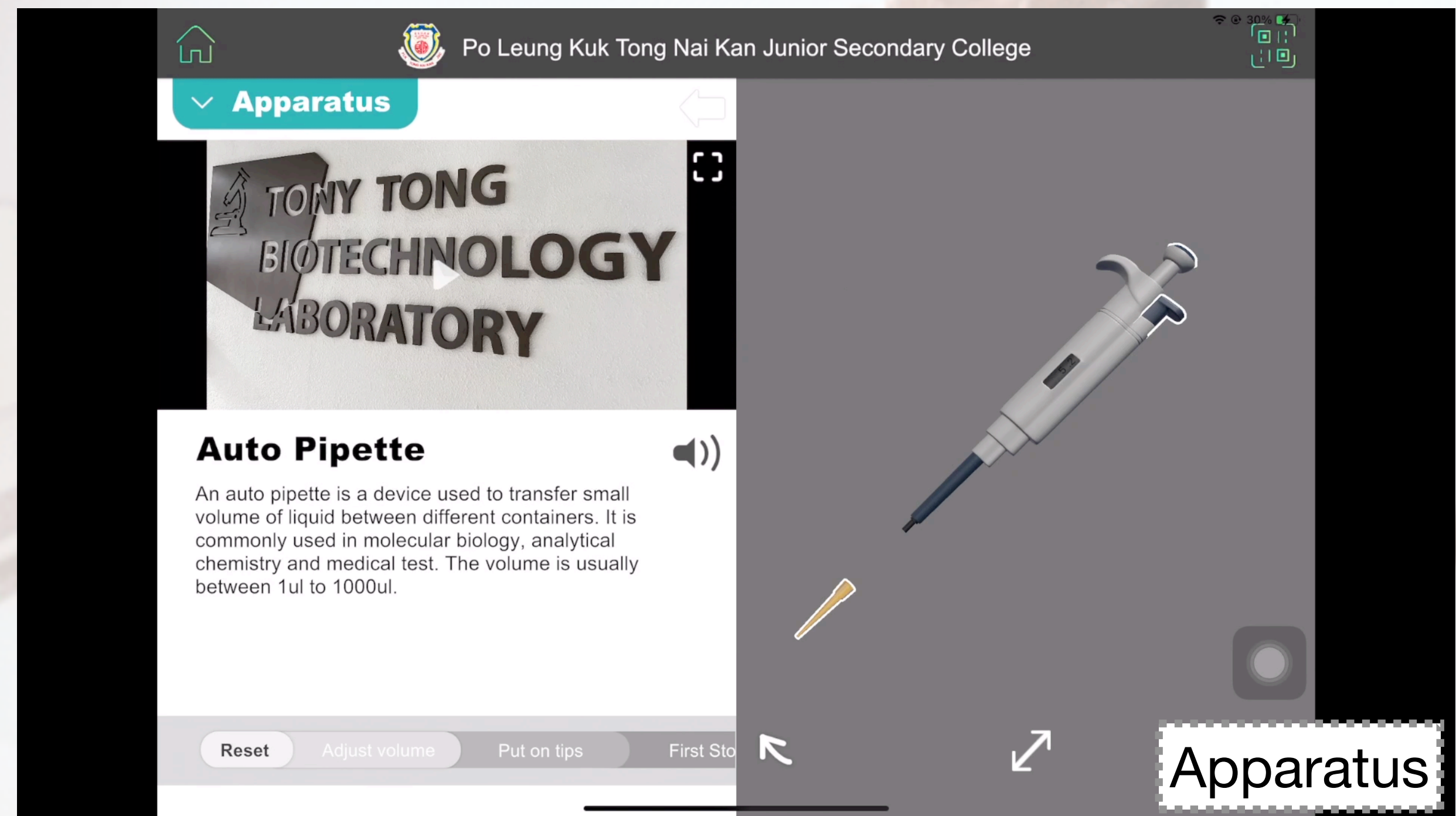
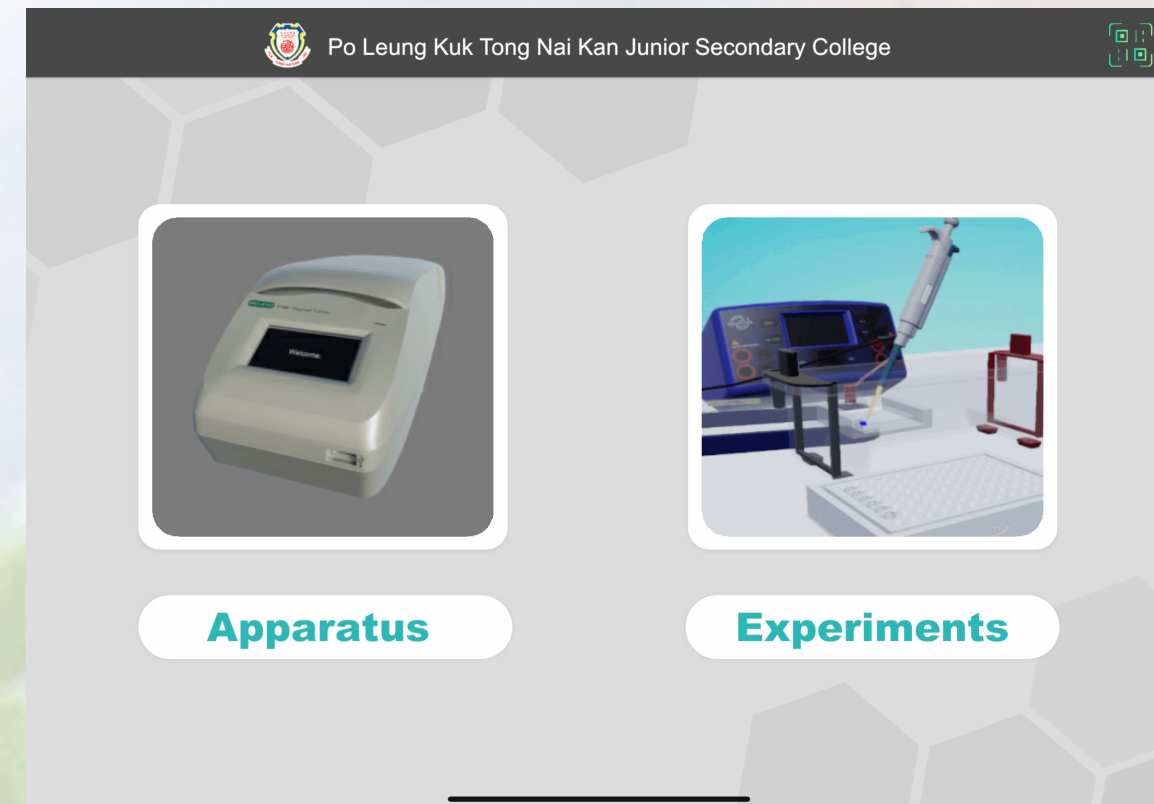
Step 1: Preparation of Standard Curve
2) Add water

The complex block shows a digital interface for a laboratory procedure. At the top, there is a home icon and the school name: "Po Leung Kuk Tong Nai Kan Junior Secondary College". Below this is a blue header with a left arrow and the word "Steps". The main area features an illustration of laboratory equipment: a white BIO-RAD spectrophotometer, a blue Milli-Q Water bottle, a blue rack with test tubes, and a pipette. At the bottom, there is a grey footer with a left arrow and the text "Step 1: Preparation of Standard Curve" and "2) Add water".

Augmented Reality (AR) App



X.TNKJSC

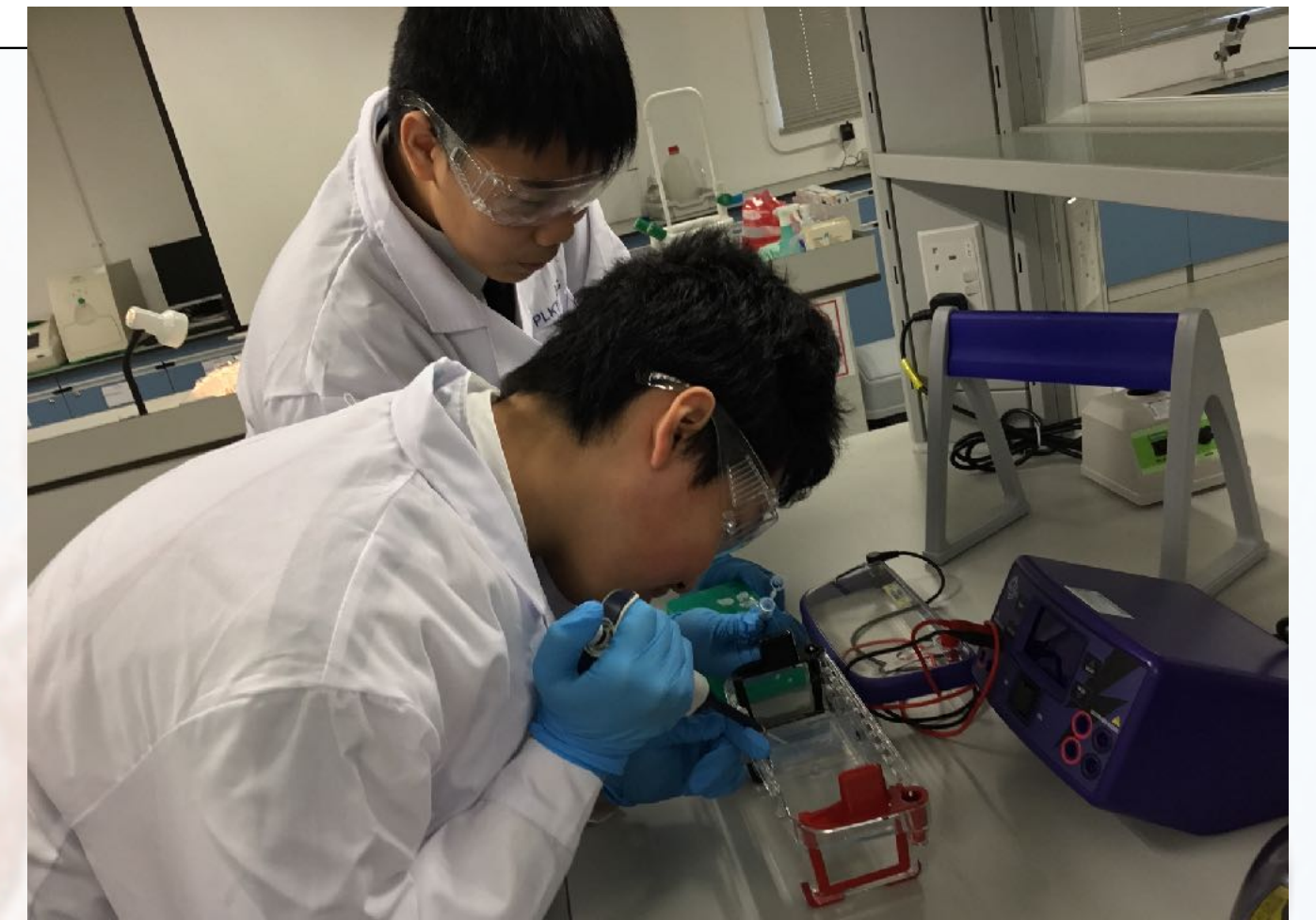
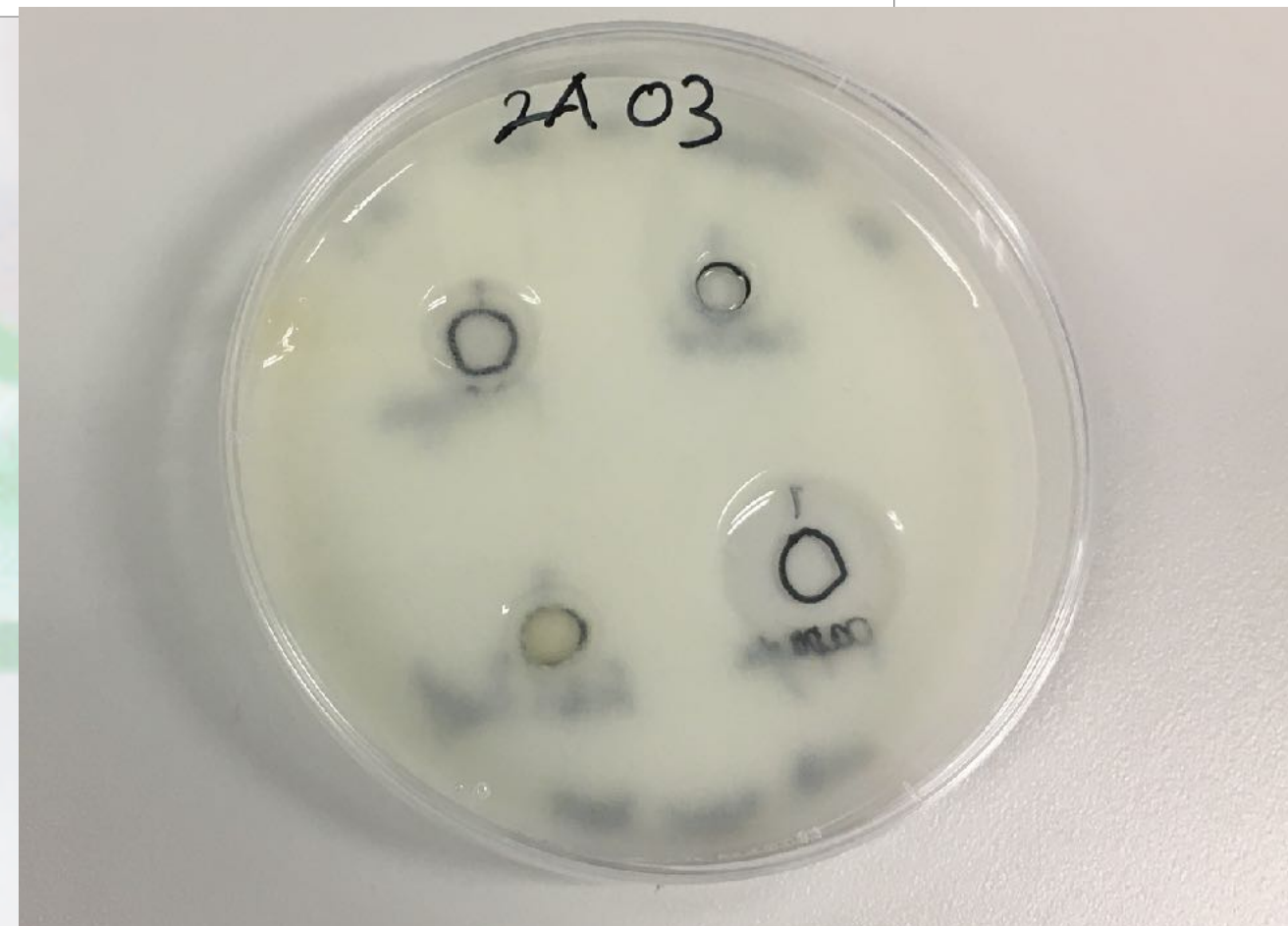
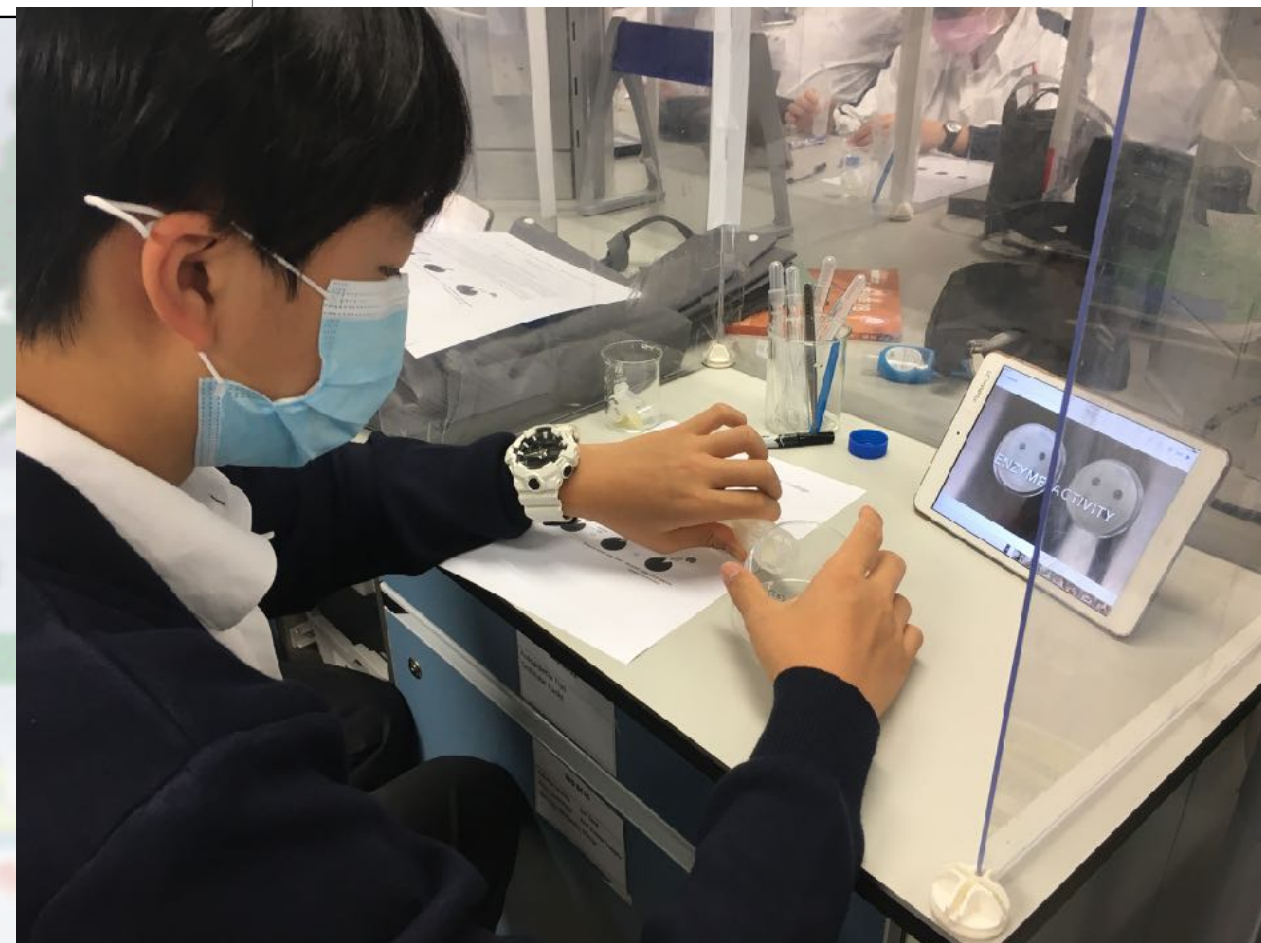


Augmented Reality (AR) learning kits will be designed and produced to facilitate the learning and teaching of the biotechnology lessons, gifted education school research team research and workshops for secondary and primary school students before, during and after they learn the biotechnology experiments and skills in the lessons. Through the AR learning kits, 3D models of demonstration of the uses of the apparatus and the experiments processes will be displayed interactively. Students can flip the lesson before lesson or learn during the lesson or even after many times so as to be familiar with the related skills and analyse more about the results deeply with discussion easily with classmates

Key Project information

1. Biotechnology curriculum

Secondary 3	Genetically Modified Organisms & Biological Catalyzers in daily life and Biotechnology	
Learning and teaching targets	1.Genetically Modified Organisms A.What is genetically modified organisms B.Skills and techniques of GM food screening C.Technology and application of recombinant DNA	1.Biological catalysers in daily life and biotechnology A.What is enzyme? B.Application of enzyme in daily life and biotechnology Production of pharmaceutical products
Teaching activities	Exp5_Screening of GM food	Exp6_Catalytic reaction of enzyme



Teaching Schedule

2019-2020

S1 Biotech lab: Introduction to Microorganisms - Thumb culture, Spread plate & Streak plate (In group)

[4 Nov 2019 - 15 Nov 2019]

2020-2021

S1&2 Biotech lab: Introduction to DNA - DNA extraction from Strawberry (Individual)

[30 Oct 2020 - 19 Nov 2020]

S1-3 Biotech lab: Introduction to Enzyme - Catalytic reaction of enzyme in Fruit juice on gelatine (Individual)

S1-2 [19 April 2020 - 6 May 2020]

S3 [10 May 2020 - 25 May 2020]

2021-2022

S1 Biotech lab: Introduction to Microorganisms - Thumb culture & Spread plate (Individual)

[5 Nov 2021 - 23 Nov 2021]

S2 Biotech lab: Introduction to Microorganisms - Thumb culture, Spread plate & Streak plate (Individual)

[4 Nov 2021 - 3 Dec 2021]

S3 Introduction to GMO - GMO Investigation (In group)

[2 Dec 2021 - 21 Dec 2021]

Biotech Curriculum

S1 Biotech Lesson:

1st Term: Introduction to Microorganisms - Thumb culture & Spread plate

2nd Term: Introduction to Antibiotics - Effectiveness of Antibiotics

S2 Biotech Lesson:

1st Term: Introduction to DNA - DNA extraction from Strawberry

2nd Term: DNA Fingerprinting – Crime Scene Investigation

S3 Biotech Lesson:

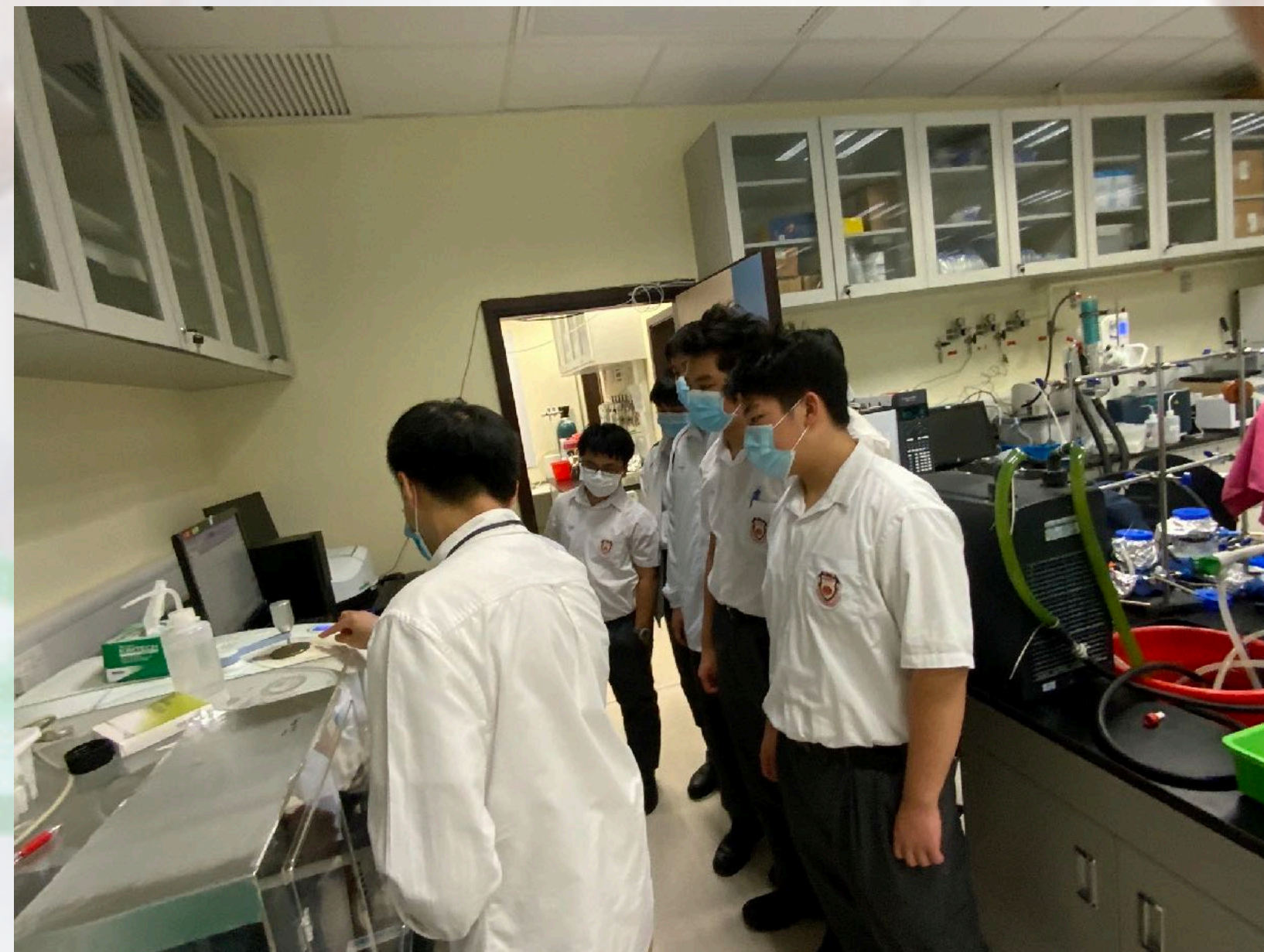
1st Term: Introduction to GMO - GMO Investigation

2nd Term: Introduction to Enzyme - Catalytic reaction of enzyme in Fruit juice on gelatine

Key Project information

2. Extended learning activities (Gifted students research team)

- Apply the knowledge and apply in real-life problems



54th Joint School Science Exhibition



F1 二〇二〇年十一月十三日 星期五

星島教育 SING TAO EDUCATION SING TAO DAILY

教育專欄 STEM視窗 深圳奇跡與總設計師 F2 教材版

有助處理 疫下廢物

唐乃勤學生研究發現 超級麵包蟲降解塑膠

新冠肺炎疫情下，廢棄口罩、外賣發泡膠盒等塑膠廢物急增，嚴重破壞自然環境。保良局唐乃勤初中書院五名初中三年級學生，在大學學者的指導下，花一年時間進行研究，發現隨處可見的超級麵包蟲 (Superworm)，能以發泡膠、保鮮紙及口罩中層為食物，且能經消化系統排便，經教育大學協助分析下，證實超級麵包蟲可把塑膠降解；團隊亦與城市大學合作，探究麵包蟲可降解塑膠的原因。

記者袁謙謙

他坦言研究經歷兩次失敗，最先是文獻提及的屎殼蟲，因很快便會化蛹，不再排食，屢試無功。六月與鄭嘉儀老師合作，在七月第三波疫情爆發時，團隊決定改以麵包蟲為研究對象，但麵包蟲不食塑膠，且容易發臭，研究一度被迫中斷。目前取得的數據顯示，已獲轉化為糞便的屎殼蟲，其菌、細菌等與麵包蟲降解塑膠的關係，後者負責化學分析，計畫未來將研究結果寫成論文，以及進一步研究其可食之塑膠種類、地食塑膠對其生理的影響等。

5初中生揭大麥蟲 更有效降解塑膠

【本報訊】早年已有研究發現，一種名為「黃粉蟲」的甲蟲幼蟲能透過進食塑膠將其降解。保良局唐乃勤初中書院的5名初中生，自去年起就此進行追蹤研究，成功發現一種名為「大麥蟲」的甲蟲幼蟲，能更有效將塑膠降解，有關研究已由城大和教大的研究團隊接手，繼續深入研究。

城大教大團隊接手 續深入研究

保良局唐乃勤初中書院的生物科技實驗室自去年啟用後，隨即展開多項科學研究，其中一個名為「蟲型世界」的研究項目，是由5名現讀中三的學生負責。基於早年發現甲蟲幼蟲能透過進食塑膠將其降解的研究，作進一步追蹤研究。

他們的最新研究結果發現，除了早年已發現的「黃粉蟲」能降解塑膠外，原來另一品種的「大麥蟲」亦能達同樣效果。

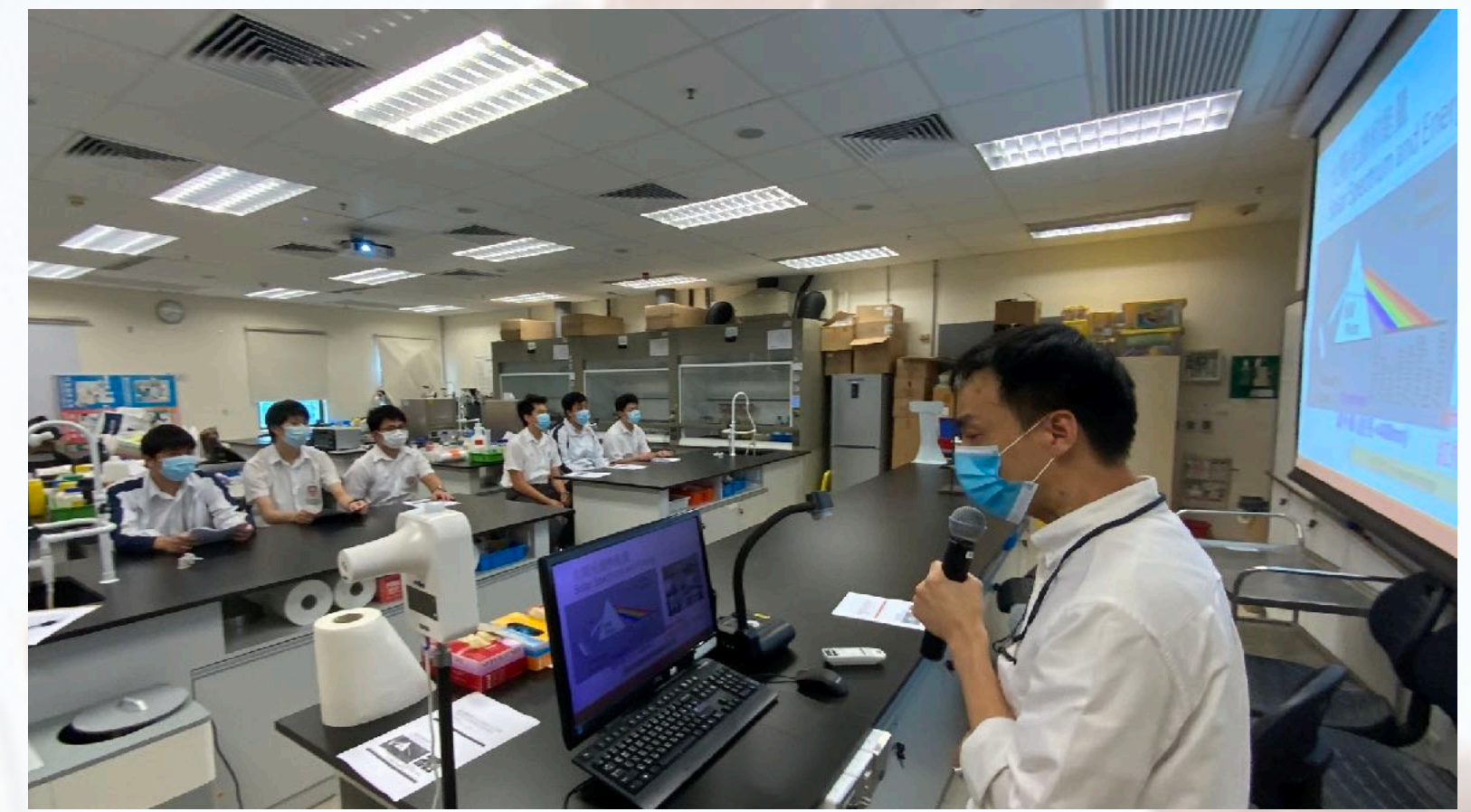
而兩者最大的分別，是「黃粉蟲」平均數日便會結蛹並化甲蟲；相反，只要控制好養育環境，「大麥蟲」一年都不會結蛹，能降解更多塑膠。他們的研究成果更獲教大和城大認可，分別為他們完成餘下的化學分析和分子分析工序，希望能了解哪種微生物是降解塑膠的「功臣」。

發起此研究項目的中三學生馮永濤指，自己最初提出研究項目時，數日內便有4位志同道合的同學加入團隊，5人由編譯外國論文開始，到定立研究方向，定期觀察大麥蟲，到最後的數據分析都通力合作。另一名中三學生林子杰亦稱，能真心完成項目，除很有樂趣，亦獲得巨大的成就感。

5位同學的「師傅」是從事生物化學研究10多年，曾擔任城大生物及化學系講師的陳嘉儀，她指現時香港科研界人才短缺，很欣賞5位同學對科研的熱情，未來會輔導5位同學作更深入的研究。

保良局唐乃勤初中書院的5名初中生，成功發現一種名為「大麥蟲」的甲蟲幼蟲，能更有效降解塑膠。(曾麗輝攝)





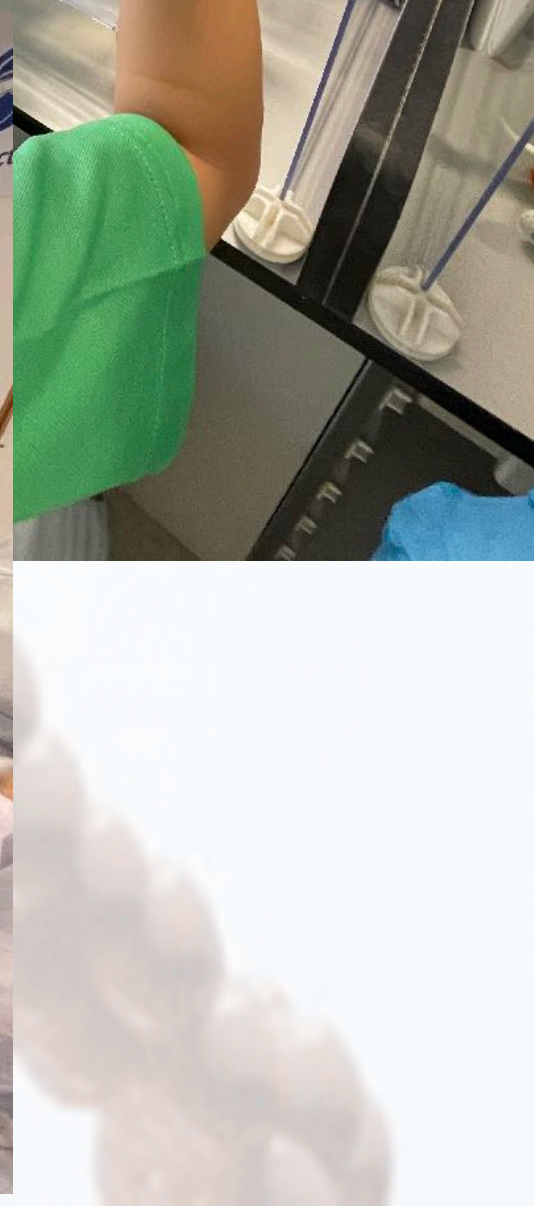
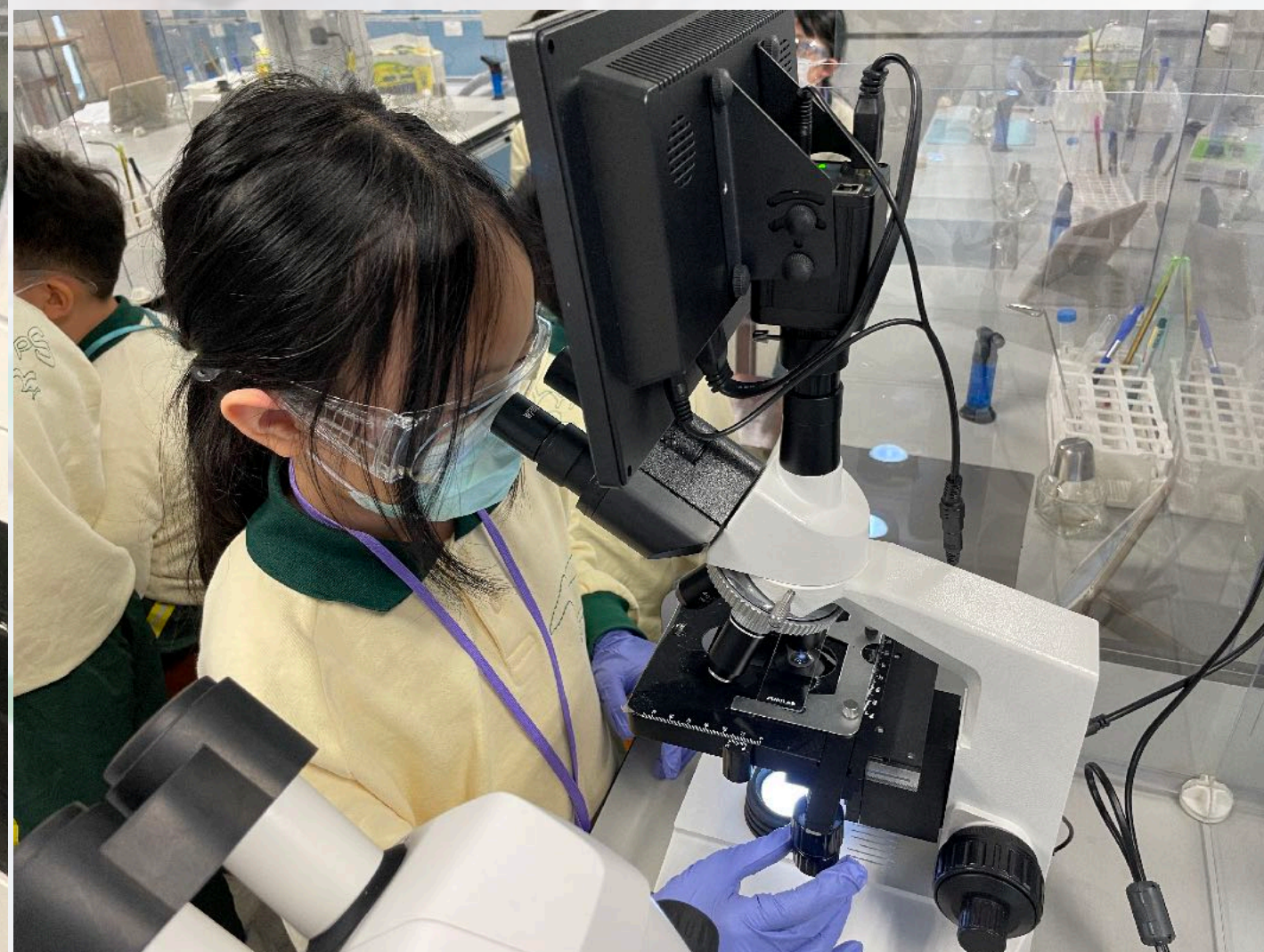
Horseshoe crab rearing programme



Key project information

3. Provide educational service and workshops for other primary secondary schools

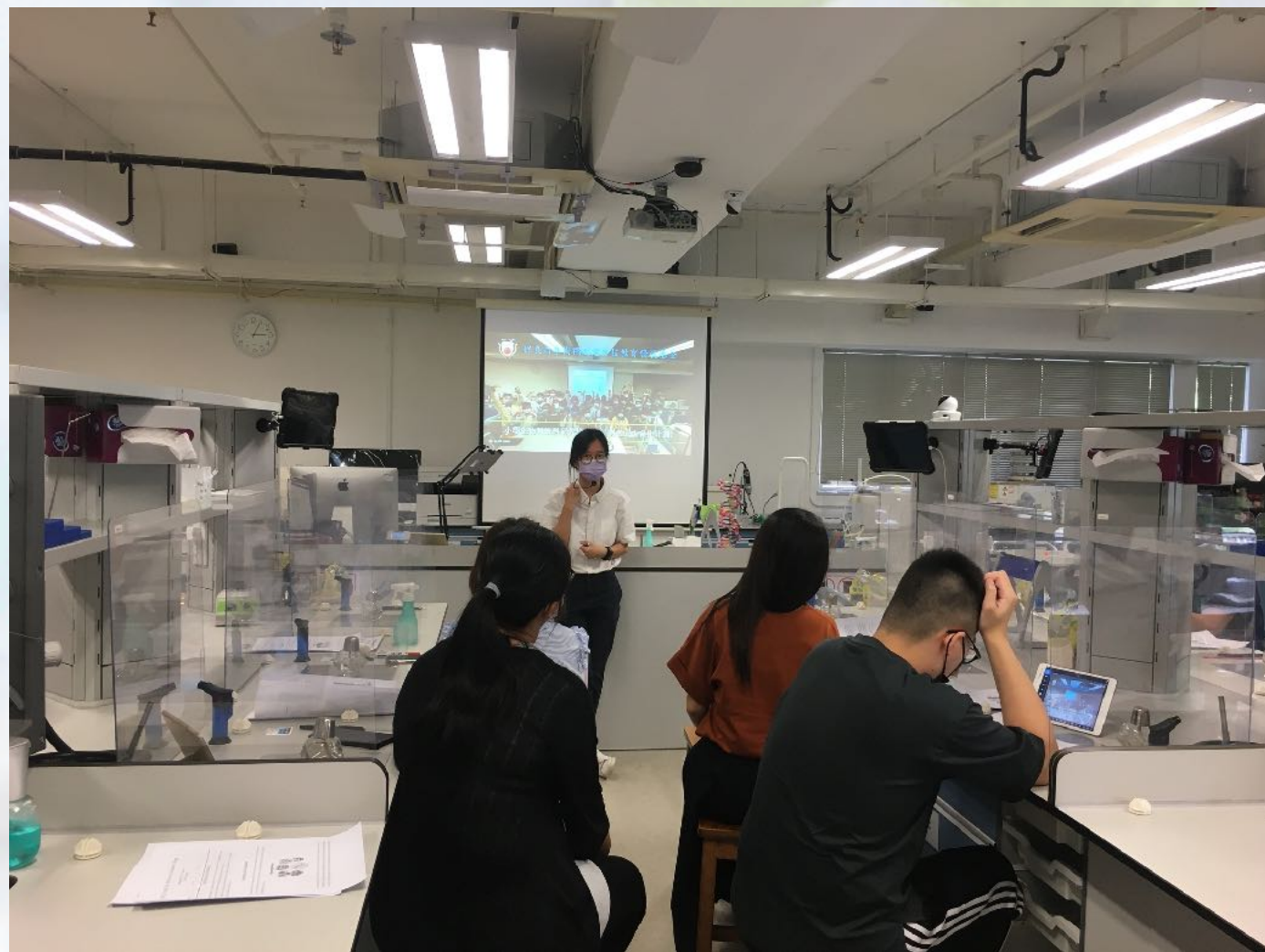
- 3-day Biotechnology Tasting Programme
 - to primary school students
 - Benefit to both our students and the primary school students
 - Learn the presentation skill, cooperation skill and leadership



Key project information

3. Provide educational service and workshops for other primary secondary schools

- Offered a bio-tech training programme to PLK Riverain Primary School
 - Thirteen teachers joined the first programme in 23rd September 2021.
 - Five student helpers participated in this activity



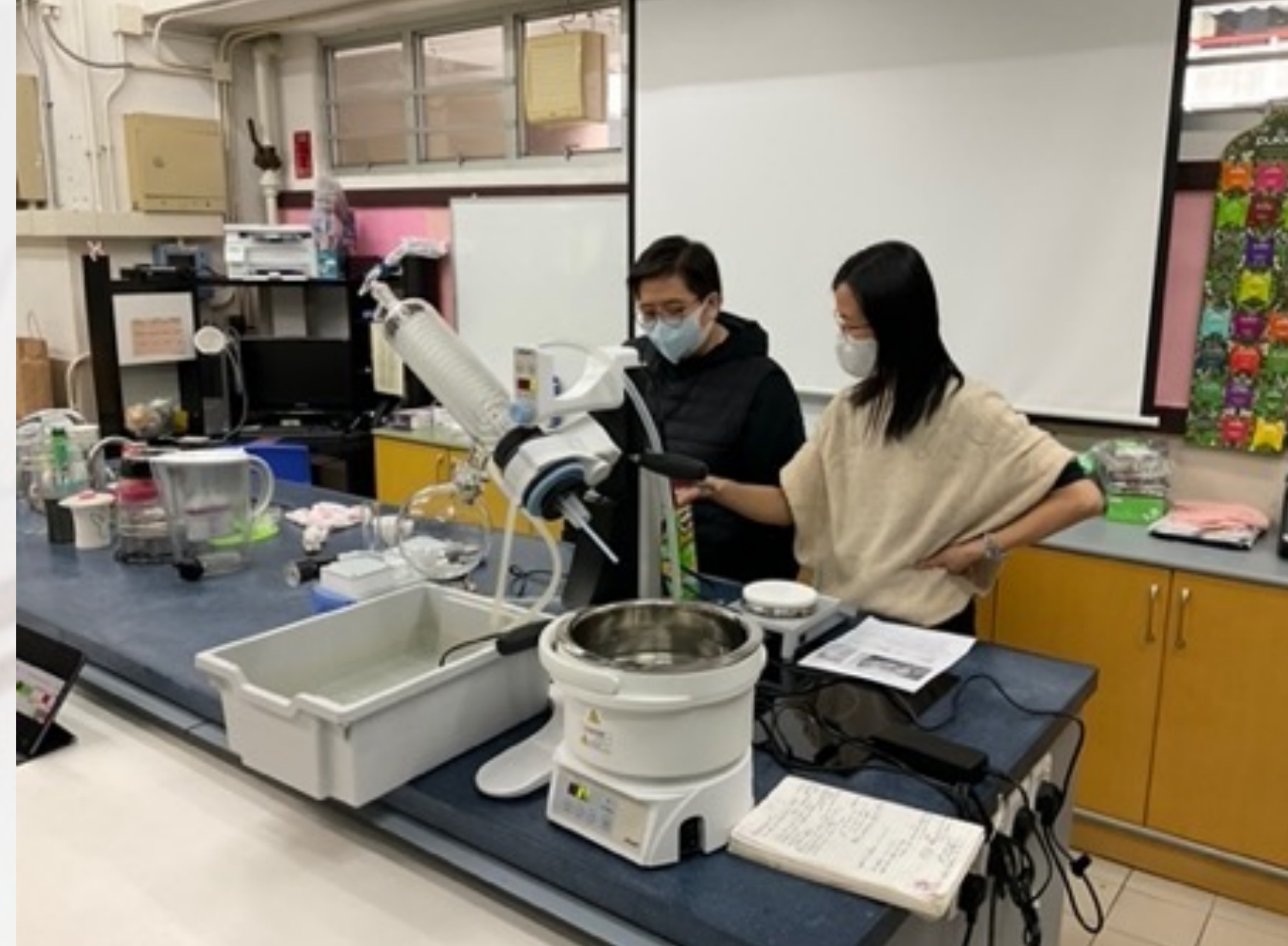




Subject Crossover

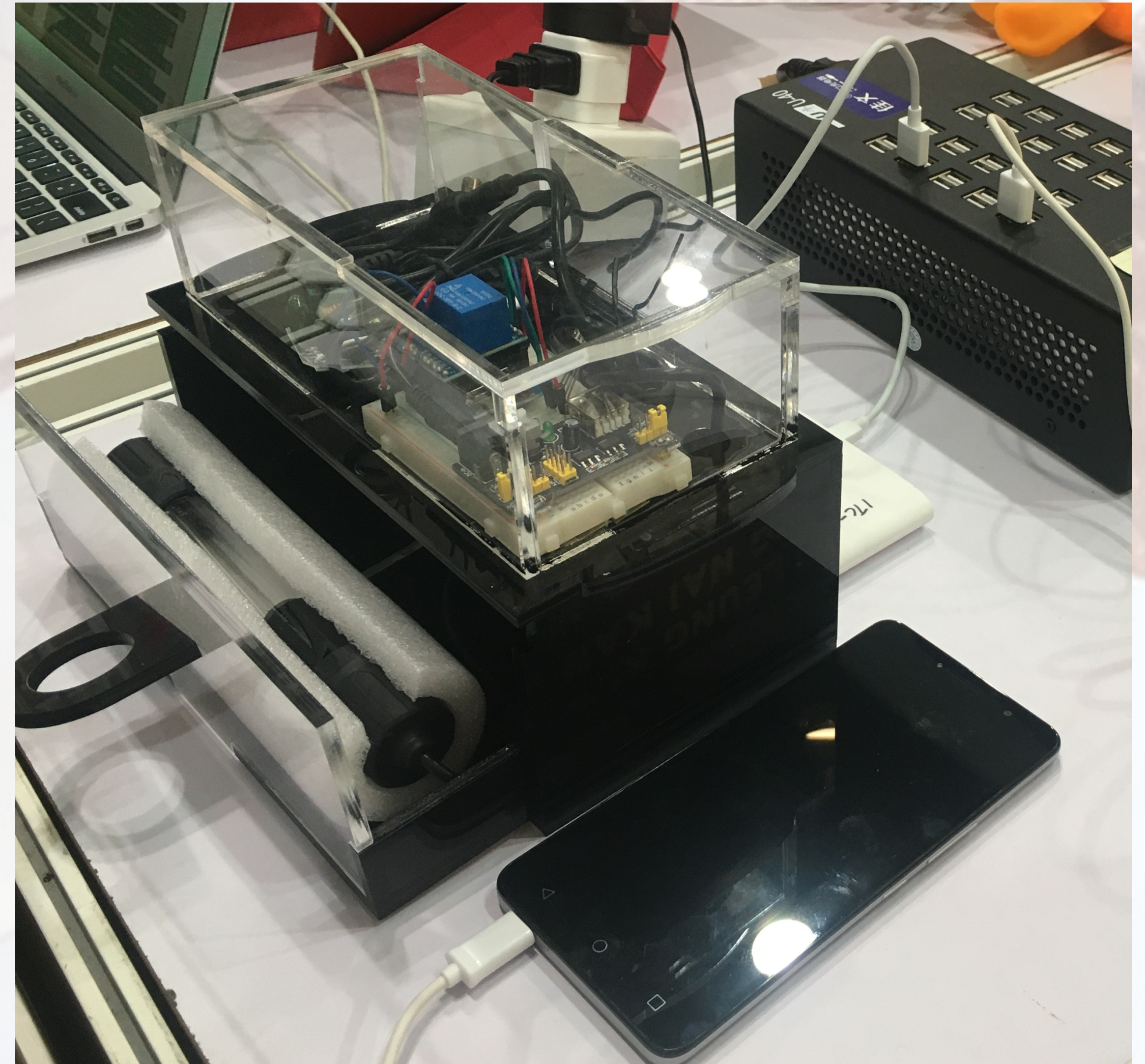
Living Technology, ITS and D&T

Living Technology



D&T and ITC

UV-C sterilisation box





Thank you