QMUL-BUPT Joint Education Institute (JEI)
School of Electronic Engineering and Computer Science (EECS)
Queen Mary University of London (QMUL)

Educators and Learners co-creating practice exam questions: inviting students to the assessment drawing room in transnational education

Dr Matthew Tang, Dr Mona Jaber and Dr Ana Cabral
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matthew.tang@qmul.ac.uk

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"Can you give us more exercises?"

- We have been teaching microprocessor system designs to two classes (80 and 180 students each) in our Joint programmes with Beijing University of Post and Telecommunications (BUPT)
- While there is a rich library of past exam papers (10+ years), my students are likely to rely on recitation of materials and past questions rather than taking the past exam papers as useful learning resources.
- We still receive frequent requests for more exercises …

Co-Creation Roadmap

10 steps for planning and implementing co-creation projects

- This project is developed based on the QMUL Co-Creation roadmap.

Reference: https://www.qmul.ac.uk/queenmaryacademy/students/co-creation/

Have you considered co-creation?

- Co-creation encourages students and staff members to move away from curriculum as delivery to curriculum as the joint making of meaning.
- Both staff and students have a voice and a stake.
- Working with students, being open to ideas and views, enables shared understanding, goals and responsibilities that teaching and learning is a joint endeavour.

Why? Our goals are:

Development assessment and feedback dialogue

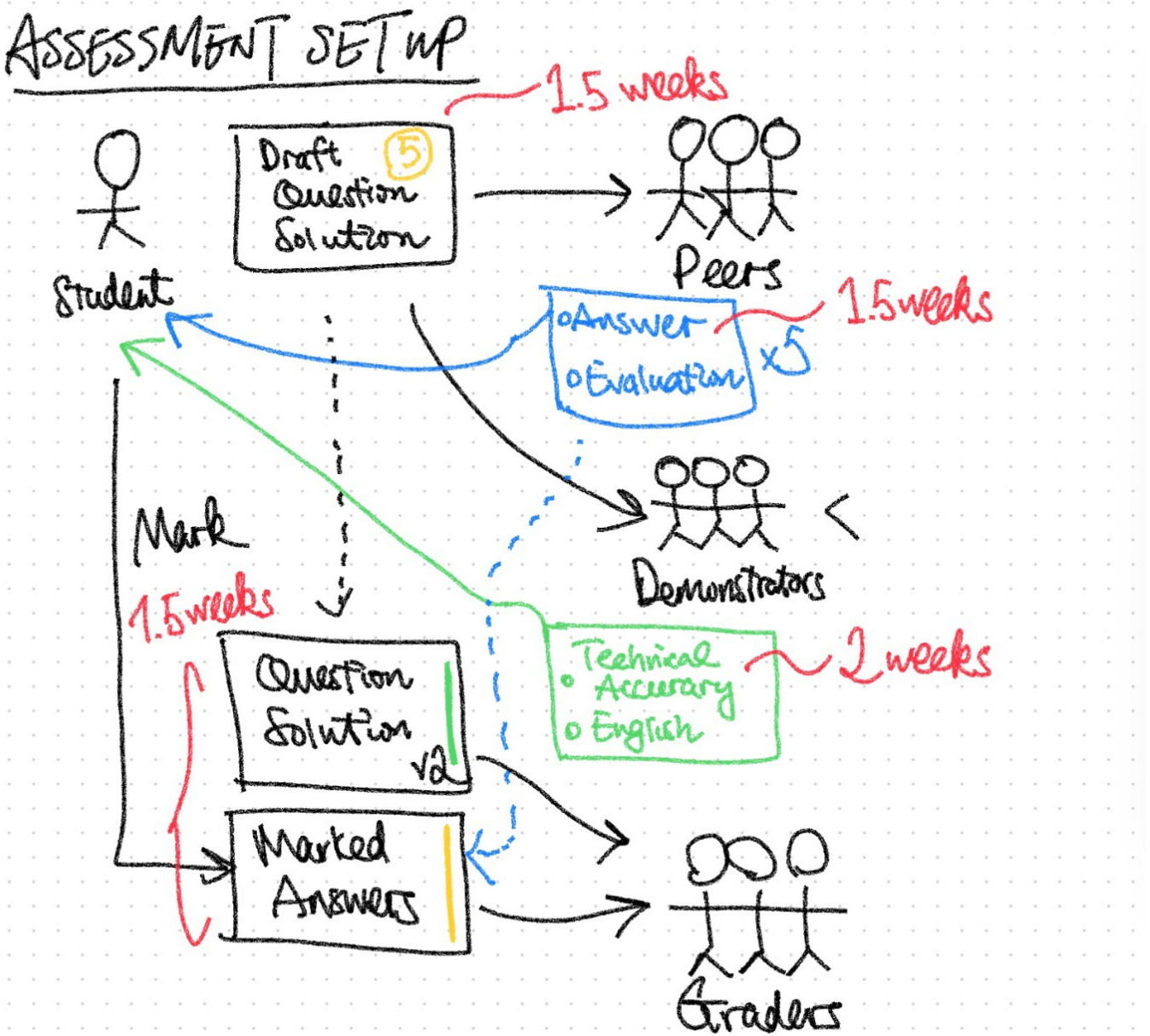
Create an assessment and feedback environment that fosters trust

Encourage our students' to be active learners

What? - Objectives

1. enhance students' understanding on the lecture material to a level that they can draft exercises on, and then try to answer questions drafted by their fellow classmates;
2. promote the development of assessment literacy by the students by getting to know the assessment rubrics and requirements;
3. promote opportunities for active learning and critical thinking (individually and co-creation in groups);
4. develop the students' sense of belonging by working in groups and in close collaboration with the educators (including TAs).
5. develop the students' engagement by contributing to the teaching and learning process;
6. create a question bank that can be a valuable resource to the current and perspective students.

How & Who: our setup



Where & When: Workshop 1

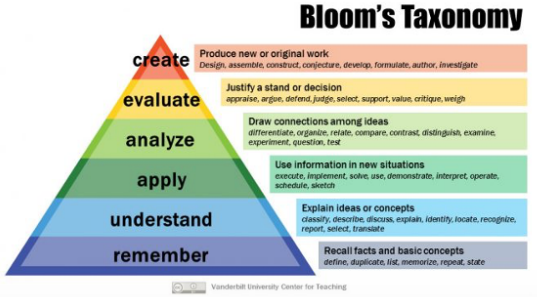
- Discuss the criteria of a good exam question
  - Examples from past paper
- Groups try to set a question based on a given learning outcome, using the evaluation form.

EXAM QUESTION EVALUATION FORM

Group Members:

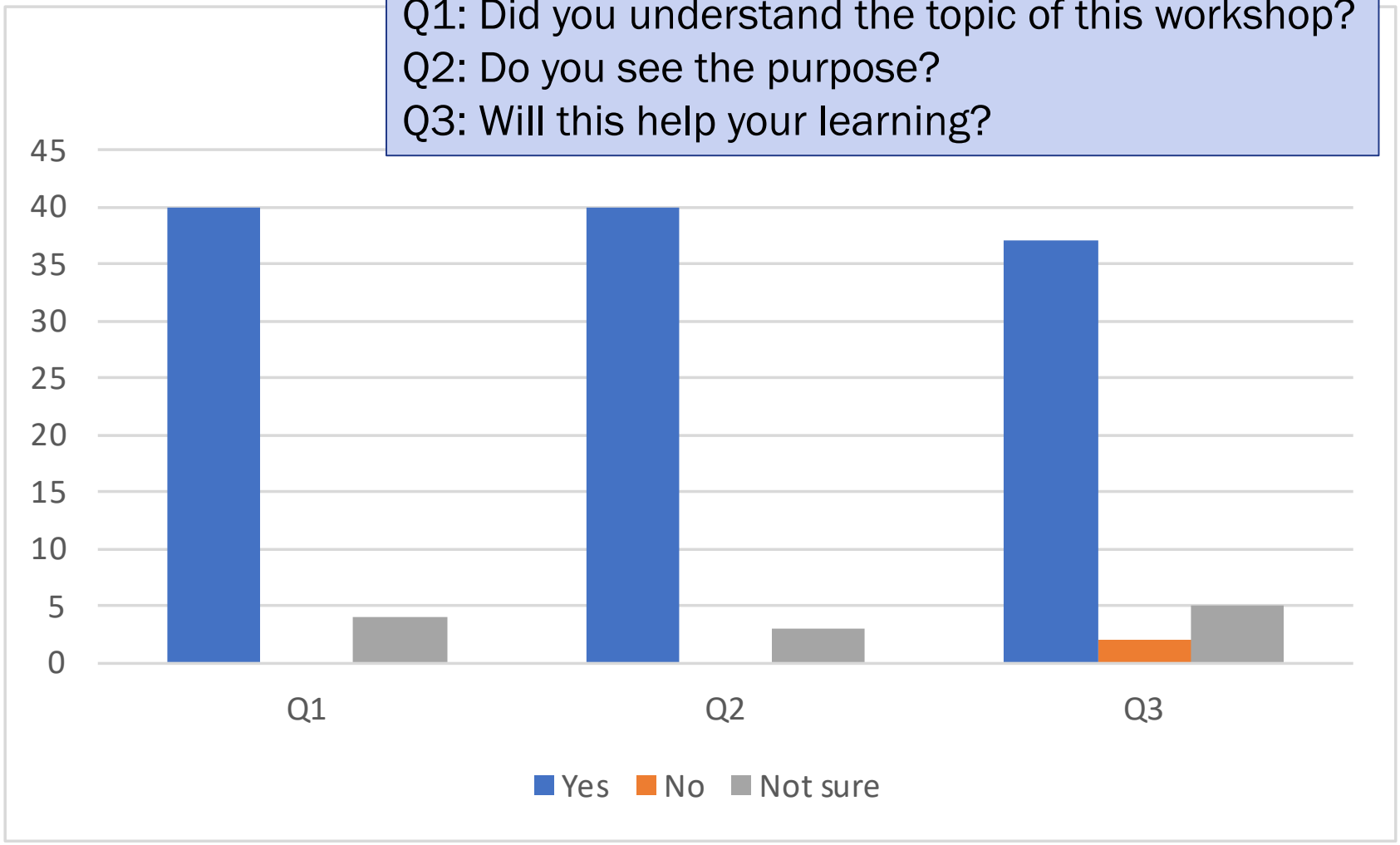
Question Text

Criteria	Weak/Low				Excellent/High
	1	2	3	4	5
Level of cognitive demand (Bloom's Taxonomy)	☐	☐	☐	☐	☐
Clear mapping to identified learning outcomes	☐	☐	☐	☐	☐
Level of difficulty (Easy - Challenging)	☐	☐	☐	☐	☐
Standard of grammar and expression	☐	☐	☐	☐	☐
Level of unambiguity	☐	☐	☐	☐	☐



Evaluation: Workshop 1

Q1: Did you understand the topic of this workshop?
Q2: Do you see the purpose?
Q3: Will this help your learning?



Where & When: Assessment 1

- Each student has to draft a 5-mark exam question based on a randomly assigned learning outcome.
- Peer assessments using the evaluation form
- Demonstrators provide formative feedback on English writing and accuracy.
- Students then revise and finalise the question and suggested solutions.

Where & When: Workshop 2

- Focus: the academic marking practice and procedure
- Ideas on how to develop outstanding marking scheme and rubric
- Examples rubric & samples of answers

Marking Rubric (skeleton answer)

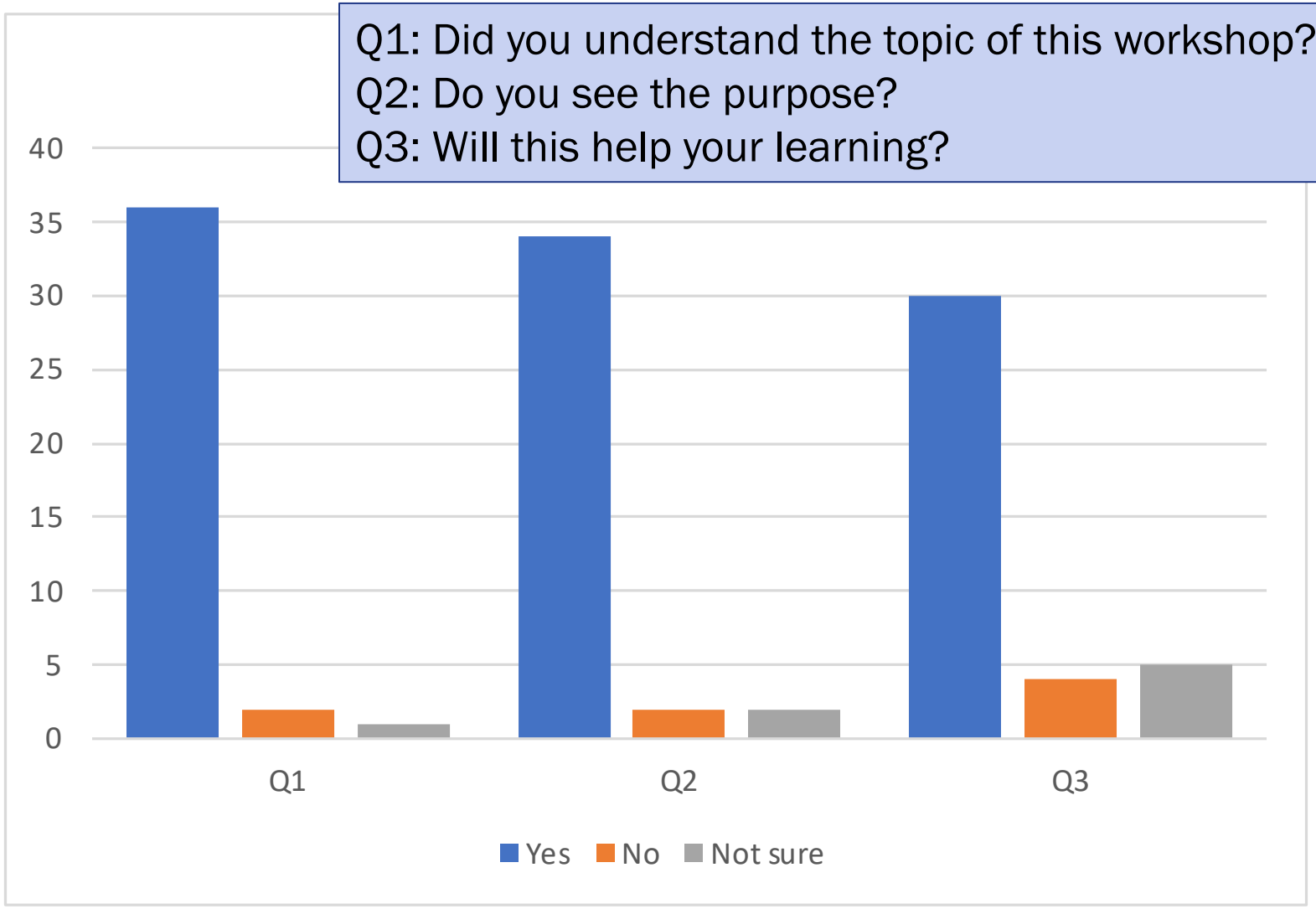
```
1  void gpio_set(Pin pin , int value ){
2  uint32_t pin_index = GET_PIN_INDEX(pin);
3
4  uint32_t mask = 1 << pin_index;
5  uint32_t tmp = port_struct ->data_reg & ~mask;
6  tmp |= value << pin_index;
7  GET_PORT(pin)->data_reg = tmp;
8  }
```

data_reg= 0b01010101**;** gpio_set(P2_5, 1)

(1 mark) 4: Create a mask for the bit we want to set (**0b00100000**)
(1 marks) 5: Invert the mask (0b11011111) to select all the other bits in the port data register, and save the status of the other bits (**tmp = 0b01010101**)
(1 mark) 6: Move the new value of the bit into position, and (logic) OR it with the new register value (**tmp = 0b01110101**)
(1 mark) 7: Write the new data register value out to the port (**DATA_REG = 0b01110101**)
(1 mark) P2_5 is configured as **output**

Evaluation: Workshop 2

Q1: Did you understand the topic of this workshop?
Q2: Do you see the purpose?
Q3: Will this help your learning?



Where & When: Assessment 2

- Questions from past exam paper were extracted and assigned to students. They have to provide a detailed marking scheme.
- Our teaching assistants ”mark” the sample answers (good, average, poor; prepared by lecturers) based on the students’ marking scheme.
- Quality of the marking scheme is judged by the level of details as well as the applied consistency with the sample answers.

A1: Sample 1

Question Text

This question concerns the definition and benefits of instruction set.

a) In your own words, briefly describe what instruction set is. (2 marks)

b) Thumb-2 is the most widely used instruction set in modern Cortex-M microcontrollers, what type of instruction sets does Thumb-2 consist of and what benefits does it have? (3 marks)

Suggested Solution

a)

An instruction set is a collection of instructions (1 mark) that a processor can execute (1 mark).

b)

Thumb-2 consists of 32-bit Thumb instruction and the original 16-bit Thumb-1 instruction sets. (1 mark)

Thumb-2's benefit: reduce code size (1 mark) while keeping a high performance (1 mark).

A1: Sample 2

Question Text

Give an example of an embedded system and analyze the characteristics of the embedded system including operation, input and output hardware, design features, energy consumption and so on.

Suggested Solution

hair dryer

Real-time operation: The hair dryer needs to respond to user operations in real time, such as adjusting air speed, temperature, etc., as well as responding to safety control systems, such as overheating protection, etc.

Low power consumption: In order to avoid overloading the power grid while saving energy, the hair dryer needs to consume as little power as possible.

Specific design: The hair dryer is specifically designed to dry hair, so it should be designed around this purpose, including the selection of the right motor, control chip, sensors, etc., to achieve the best performance and efficiency.

it has inputs/outputs: mode key button, temperature sensors, etc.

It uses timers to control blow-drying time.

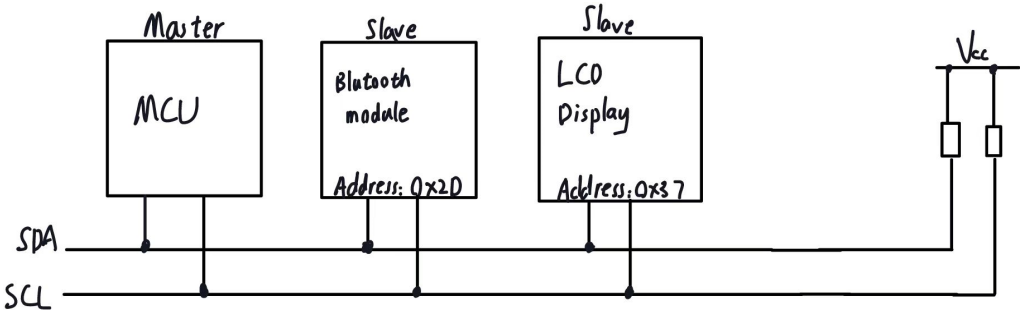
A2: Sample

Question Text

You are given a list of devices to connect with a Cortex-M microcontroller:

Device	I2C address
Bluetooth module	0x2D
LCD Display	0x37
Accelerometer	0x1E

Use a labelled diagram to that illustrates the necessary electrical connections between the microcontroller and ANY TWO of the devices from the above table. [5 marks]



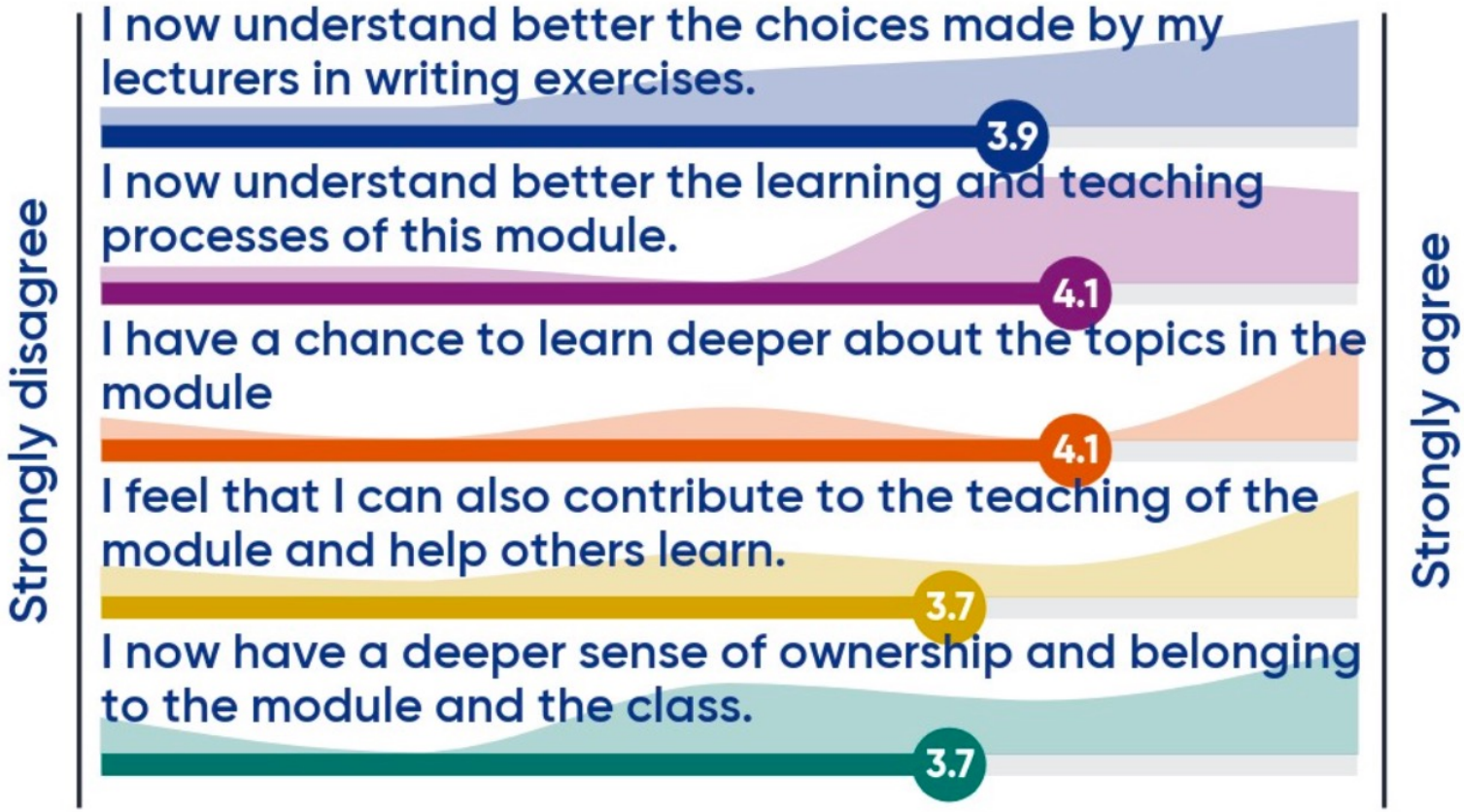
part	score	explanation
Two lines with correct label 'SDA' and 'SCL'	1	All devices are connect to the data line and clock line for transformation

part	score	explanation
MCU is displayed and has the same way to connect to the two lines	1	MSU is the master and responsible for initialising a transfer, generating clock signals... So in an I^2C , there should be a MSU to be the master
Two devices in the table are displayed and the name and address are matched correctly	1	According to the question, labels is asked to have
All devices on I^2C have and only have a line connected to SDA and SCL respectively	1	A line for send/receive data, and the other to access the clock
SDA and SCL lines are connected with a resistor respectively and then connected to a power V_{cc}	1	Let the two lines have a default voltage if they are not controled by devices

Submitted Solution

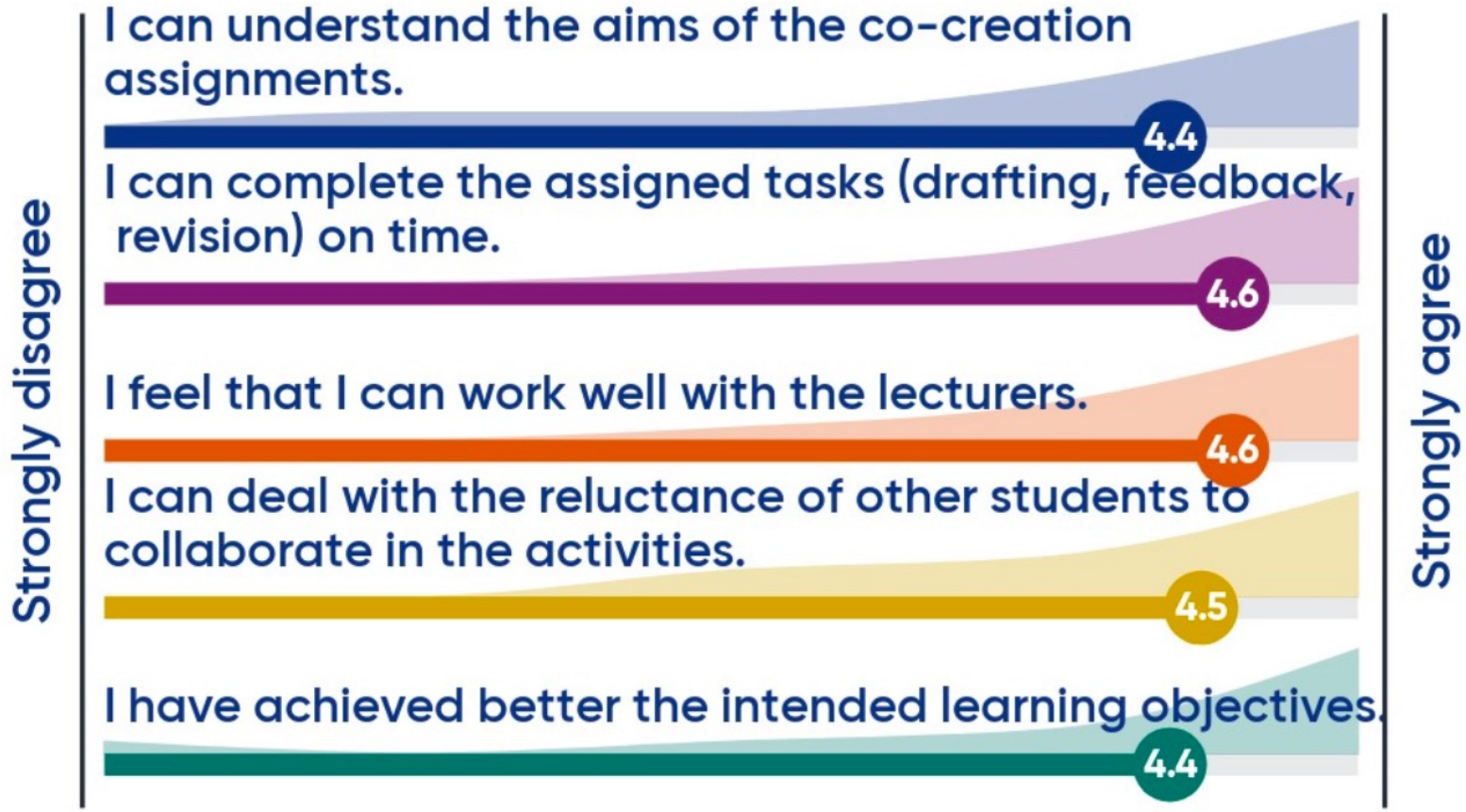
Overall Evaluation: Benefits

We only managed to get 15 responses after the exam.



Overall Evaluation: Challenges

The respondants are happy to take the shared responsibility.



Comments from Students

Student A: *"I hope we can focus more on a certain type or a specific knowledge point, rather than randomly responsible for a part of the content."*

Student B: *"I don't think students can answer these difficult questions after the modules, and not everyone will engage in microprocessor related work and research in the future. No need for difficult questions"*.

Our Reflections

- Students are very positive about the workshops (and likely the co-creation) project, but at the same time, they were overwhelmed by the time and effort required to complete the tasks (i.e. the assessments).
- For next year, we wish to streamline the assessments by merging the question and rubric writing into a single assessment with several formative checkpoints.
- Quality of students' work can be improved, especially in A1. Most adapt an example and make some changes in parameters. Their work is mostly text-based.
  - Will generative AI tools unleash (or harm) the hidden creativity of our students?

Our Reflections (Cont')

- It is a meaningful, engaging experiences which makes us realise the potential in our students and how learning needs to be two-way.
  - We both needs further investment in terms of time, preparation.
- It is challenging to make sure that everyone is aligned with the approach and overcome resistance of other staff and sometimes students to engage and share responsibilities.
- A first step to change our students' mentality about teaching and learning and to try encouraging them to take on the shared responsibility.

Our Work in Progress

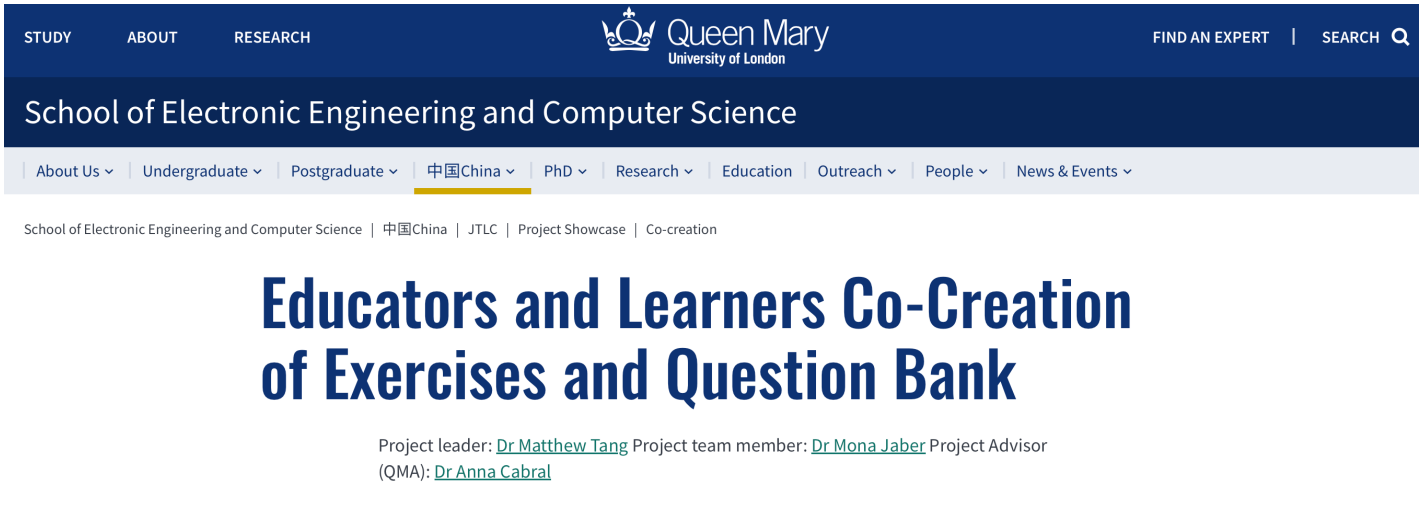
SEED Award

Student Enhanced Engagement and Development Award

Student Focus Group

Developing toolkit

Attending conferences



Follow our updates on

http://eecs.qmul.ac.uk/china/jtlc/project-showcase/co-creation/

THANK YOU!

References

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