

Cross-course collaboration between software and hardware modules

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1. Background

Students often focus on specific knowledge or skills in individual modules but neglect the relations between them. We should encourage students to acquire a broad range of knowledge or skills across their entire degree programme study. Staff often focus on their own responsibilities at module level. We should motivate the staff to collaborate and overlook at the whole programme level.

In our BSc(Eng) Internet of Things Engineering degree programme, Software Engineering is a core module that provides an introduction to modern software development techniques and Microprocessors for Embedded System is a core module that examines the structure, programming and applications of microprocessor and microcontroller devices. This project is to design and implement a cross-course collaboration between these two modules to provide a coherent learning experience for students and a collaboration opportunity for staff.

2. Aims

- Help students understand the relation between the modules and the complete curriculum
- Provide opportunities for students to engage in active learning
- Provide students timely and continuous feedback
- Prepare students for the future career
- Help teaching staff know what their colleagues are doing in their modules
- Provide opportunities for staff collaboration and sharing good practice

3. Activities

We designed a collaborated coursework between the two modules and experimented it in a large class of 180 students. The students worked in small groups (6 students/group) with their own hardware kits. They spent two months to complete a project which included a software development using Agile process and a hardware design. They had to make the software and hardware work together. The assessments were divided into 3 stages: early stage, mid stage and final stage. At each stage, the groups did a live demonstration and received immediate feedback. At the end of the project, the groups submitted their reports and code online. The groups also received a written feedback of their submissions.

Activities include:

- Design collaborated coursework
- Build hardware kits
- Teaching assistants training
- Hands-on workshop
- Joint group demonstration and feedback



Fig 1. The hardware kits and hands-on workshop

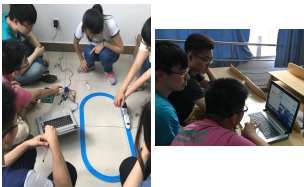


Fig 2. Group demonstration 2016: A tourist train journey management system



Fig 3. Group demonstration 2017: A self-service ticketing kiosk for cinemas



Fig 4. Group demonstration 2018: A smart energy management and monitoring system

4. Outcomes

- 30 sets of reusable hardware kits
- Sustainable coursework collaboration framework
- Marking and feedback scheme
- Automated marking and feedback forms
- Archive of outstanding students' projects
- Project webpages to allow access of software and instructions, including videos

5. Evaluations

All students participated to an anonymous online survey. The results show that the collaboration between the software and hardware modules is highly praised by the students. The 3-stage feedbacks greatly helped the students on completing the project.



Fig 5. Student survey

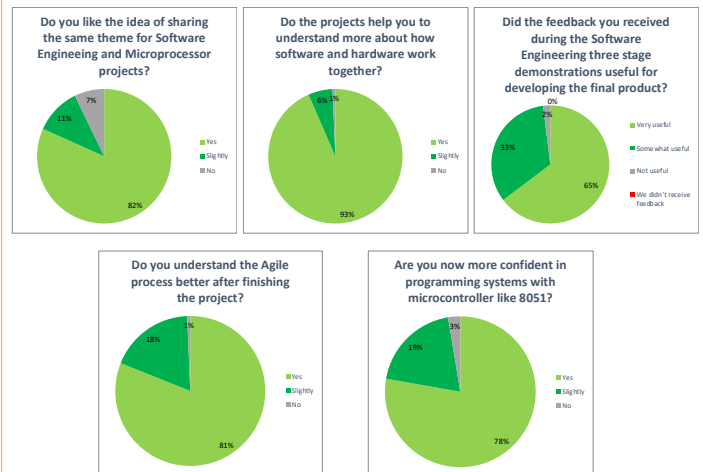


Fig 6. Survey results

Some students commented: "This is very good!", "We do Agile pair programming, it improved the relationship between group members".

Our teaching assistants observed: "The students were much more engaged in the labs and the group work because the hardware kits were more accessible."

Other staff attended the demonstrations commented: "It went very smoothly. Some projects were very impressive." "This is a brilliant idea, students received immediate feedback of their work throughout the development stages."

Our colleagues from other departments thought it is "the most inspirational for their own work" at our Teaching and Learning Conference.

6. Challenges

- Manage the large number of students
- Maintain the hardware kits for reuse
- Give effective training to teaching assistants
- Timely and quality feedback to students

7. Further work

- Extend the scope of the collaboration
- Expand the collaboration to more modules
- Share reusable hardware kits and developed software