

創新資訊工程教育在交大

文／林珮雯

身為全國規模最大、能量最充沛的資訊學院及資訊工程學系，我們肩負著培育未來所需及創造未來的資訊人才。交大資工向來注重精進教學，在資工系曹孝樑教授帶領下，本系獲得教育部 108 學年度新工程教育方法實驗與建構計畫（以下簡稱「新工程教育計畫」），也是全國資訊工程科系中唯一的全面課程地圖與學習架構之調整（A 類）計畫。

資訊工程教育在過去 30 多年來的努力之下培養了實力堅強的電腦與資訊軟硬體的人才，也創造了近 10 多年來電腦與網路的榮景，為資訊環境打下了堅固的基石。展望未來 30 年，電腦與網路的發展與基礎建設或許趨於穩定，但可以想像的到，建立在這堅強的資訊基礎建設之上，將出現更多創新且跨領域的資訊應用與服務，創造更多價值與機會，資訊教育的改革及創新更是刻不容緩。

本系目前正在進行之資訊工程教育創新課程架構之設計與實踐工程，利用三至四年時間，以跨領域，國際化及創新的思維，全面檢討，設計，實踐並持續改善資訊工程教育。本系觀察近

五年國際知名大學在資訊工程教育的調整，國內外學習環境的改變，也分析未來資訊工程人才的需求，是以綜合歸納本系最新課程改革總體目標如下：

1. 激發資訊工程學生主動學習興趣 (Active Learning)。
2. 培養資訊工程學生自學能力 (Self Learning)。
3. 培養資訊工程學生跨域 (Interdisciplinary) 的思維與利用資訊工程技術解決跨領域難題。
4. 建構個人化 (Personalized)，模組化 (Modularized) 的高度彈性課程地圖與學習環境。
5. 訓練學生以問題導向的學習 (Problem-based Learning)，加強解決問題 (Problem Solving)，
6. 實務動手的能力。
7. 培養資訊工程學生面向國際舞台的學習方式與態度。

並基於上述的總體目標，本系亦擬訂相對應的發展策略包括：

1. 降低必修學分，增加選修彈性：有助於激發資

訊工程學生主動學習並增加學習自由度，以激勵自學。

2. 規劃實施資訊工程主題式課群：引導學生以主題式修課與學習，建構個人化，模組化的彈性課程地圖與學習環境。
3. 規劃實施各主題式課群之總整課程：以總整課程貫穿主題式課群各課程概念，並以實作與問題解決能力之培養為重點，協助學生掌握主題式課群課程內容與關聯，訓練學生以問題導向的學習，加強解決問題，工程實務的能力。
4. 規劃實施資訊工程跨領域主題式課群：提供選課彈性，培養資訊工程學生跨域的思維與利用資訊工程技術解決跨領域難題。
5. 增加深碗課程，海外實習，資訊工程基石課程 (Cornerstone) 等創新課程：仿效哈佛大學 CS50 課程，設計資訊工程基石課程，激發學生學習動力，引導學生了解資訊工程整體樣貌。設計海外實習課程，培養資訊工程學生面向國際舞台的學習方式與態度。增強各基礎與專業課程間之連結，強調兩課程之連貫性，提供學生彈性接續選修更深度課程。

目前針對 108 學年度入學的學生，已全面改採新制修業規定，其中除了調整必修學分課程與比例之外，也將原有專業選修課程，以七大主題課群來分類。同時，以主題學程規劃，將相同領域內的課程結合在一起，相較於傳統無特別規劃的修課方式，對於學生來說他們學習目標將更為一致，也因此更能夠專精在某些特別領域，並且更注重自我長期學習以及自學能力。

其次，本系建置了一個課程教育資源共享平台，提供給系內的老師們共享其製作的教學投影片或實驗教材。我們建議同一課程之各授課老師採用 70% 之共同教材，30% 則自由決定。透過平台互動功能，讓同門課的授課老師可互相交流教材設計，如此教學內容一致化，以利後續課程銜接。



本系除了自發性在課程改革上的規劃，我們也積極結合校院各項資源。例如，連結產業人才培訓計畫，帶入產學合作的業界夥伴協助授課與課程設計諮詢。配合高教深耕計畫，以院為核心進行國際化（包含國際交換學生與海外實習課程）與全英語授課之推動。本系教師亦積極參與本校推動之微學分，跨域學程，NCTU-ICT 工坊（亦稱創創工坊），藉由引進與整合更多相關資源，進一步推升本系創新資訊工程教育之動能。



Education Innovation in Computer Science & Engineering at NCTU



Standing as the largest and most competitive College of Computer Science and Department of Computer Science in Taiwan, our college is committed to cultivating influential graduates and future pioneers in the Computer Science field. The Department of Computer Science at National Chiao Tung University (NCTU) has always paid attention to education innovation. Under the leadership of Professor Shiao-Li Tsao of the Department of Computer Science, our department has received the grant of the 2019 New Engineering Education Method Experiment and Construction (NEEMEC program) by the Ministry of Education. The NEEMEC program (A-type project) is the only program which involved department-wide efforts to reorganize and renew the core undergraduate curriculum in the higher education of Computer Science in the country.

Over the past 30 years, Computer Science & Engineering Education has not only cultivated graduates equipped with contemporary knowledge and robust skills in software and hardware design, but also drove the bloom of computers and communication industry in the past 10 years, thereby establishing a solid foundation for the information environment. Looking forward to the next 30 years, we can be conceived that more innovative and interdisciplinary applications and services within information

technology based on the solid infrastructure will emerge to create more value and opportunities, while keeping sustainable development and infrastructure of computers and networks. Therefore, it is even more crucial for program reform and education innovation of Computer Science.

Our department is undergoing the process of design and implementation for Curriculum Innovation Framework of computer science and engineering. With global view and interdisciplinary innovative thinking, we expect to spend 3 to 4 years comprehensively reviewing, designing, implementing, and constantly improving the curriculum of computer science. We observed the adjustments of the programs of computer science and engineering in globally renowned universities over the past five years, and the changes in the learning environment both at home and abroad; meanwhile, we also analyzed the demand for future computer science and engineering talents. Therefore, the overall objectives of the latest curriculum reform of the department are summarized as follows:

1. Inspiring CS Students to engage in active learning.
2. Motivating CS students towards self-learning.
3. Cultivating CS students with interdisciplinary thinking and being able to solve interdisciplinary

problems.

4. Constructing a personalized, modularized, and highly flexible curriculum map as well as corresponding study environment.
5. Training students to establish problem-solving abilities and improve their hands-on skills by engaging with problem-based learning.
6. Preparing CS students' learning styles and attitudes for the global stage.

According to the above objectives, the department formulated corresponding development strategies, including:

1. Reducing required credits and increasing the flexibility of elective courses selection: it can help inspire students to engage in active learning and increase the learning flexibility, thereby encouraging students towards self-learning.
2. Planning and implementing the computer science and engineering subject-based courses: guide students to take subject-based courses, and construct a personalized, modularized, and flexible curriculum map as well as corresponding study environment.
3. Planning and implementing the overall curriculum of all subject-based course groups: Crucial to the overall curriculum is that the curriculum connects the concepts of different subject-based courses, and focuses on the establishment of problem-solving abilities and hands-on skills for students. It may help students engage in problem-oriented learning and strengthen their abilities in problem-solving and engineering applications.
4. Planning and implementing the interdisciplinary subject-based courses in computer science and engineering: with the flexibility in courses selection, students are able to develop interdisciplinary thinking, thereby solving interdisciplinary problems with computer science technologies.
5. Increasing the number of Deep Bowl courses, overseas internships, and innovative courses, such as Cornerstone: referring to Harvard University's CS50 course, the CS cornerstone courses are constructed to inspire students to engage in learning motivation, and guide students to understand computer science and engineering comprehensively. By the overseas internship courses, students' learning styles and attitudes would be prepared for the global stage. Moreover,

we enhance the connection between basic and advanced courses and emphasize the relevance of both courses, so that students are able to select subsequent advanced courses with flexibility.

At present, for the students enrolled in the academic year 108, the regulations have been revised to the new version. In addition to adjusting the number and proportion of required courses, the original professional elective courses are also categorized into seven subject-based course groups. At the same time, the subject-based course planning integrates courses in the same field. Compared with the former way of taking courses without special planning, the learning objective for students would be more consistent, thereby helping students specialize in a particular field, motivating them towards long-term self-learning, and emphasizing self-learning ability.

In addition, the department has built up a teaching resource sharing platform for faculty in the department to exchange the teaching slides or experimental textbooks they made. We recommend that all faculty of the same course may use 70% of the common teaching materials, and freely decide what to use in the rest of materials (30%). Through the platform's interactive function, faculty of the same course may collaborate teaching material design with each other so that the teaching content would be consistent in order to facilitate subsequent courses.

Beside the spontaneous planning of curriculum reform in the department, we also actively integrate various resources at NCTU. For example, we engage in industry talent training programs and invite partners of industry-academic cooperation to assist in teaching and offer consultation on curriculum design. Within the framework of the Higher Education SPROUT Project, internationalization (including international exchange students and overseas internship courses) and the promotion of all English teaching courses would be the core missions of our college. Motivated by the university, faculty of our department also actively participate in micro-credit courses, interdisciplinary programs, and NCTU-ICT workshops. By introducing and integrating more related resources, our department will further push forward innovative capabilities in computer science and engineering education.