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Bridging the Gap Between Technology and Information Systems: encapsulating the design and delivery of the unit Hardware Integration at degree level

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ABSTRACT

This concise paper describes the introduction of a technology unit into the BAppIS degree programme at UCOL trading as Manawatu Polytechnic. The reasons for its introduction are provided. The unit is described in terms of its content, assessment method and performance criteria. The unit is evaluated from the perspective of unit content, student outcomes, performance criteria and student feedback evaluations. The concise paper fully details an implementation plan for the introduction of the unit into other degree programmes complete with the technology and software requirements. Finally, proposed improvements to the unit will be discussed.

1. INTRODUCTION

The introduction of new technology based subjects was required on the Bachelor of Applied Information Systems degree at the Manawatu Polytechnic, now trading as Universal College of Learning (UCOL). The demand for more technology-based subjects was primarily influenced for the demand by the information systems industry and the students themselves, as well as requirements of the Institute of Electrical and Electronics Engineers (IEEE) and the British Computer Society (BCS).

2. HARDWARE INTEGRATION

The unit was designed from the theoretical base of many other units being taught at a variety of international education institutes. This satisfies some of the requirements for chartered information systems professional, as determined by the chartered engineer institute of the BCS and the Engineering Council.

3. THEORETICAL COMPONENTS

A strong basis of logic and theoretical understanding must be achieved before any practical skills can be imparted: theory of control, logic, transduction, signal conditioning and mathematics. The ratio of theory to practical content is an important factor when designing degree units; this will be described in section 5.

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4. PRACTICAL COMPONENTS

A robot was purchased to bring the theoretical elements into experiential context. The robot is recipient of information via a simplex communications channel from a PC. The robot also has different sensors. The simplex channel is used to download robot programmes to control the robot's actuation elements and use the sensors as a feedback mechanism for these elements. The robot is a self-contained unit it does not need the PC once the correct program has been downloaded. Many theoretical elements of hardware integration can be experienced by the students: multiple feedback control, transduction, actuation, error-self-correcting sequences, simplex communications, robot construction and protection.

The students construct a thermocouple device from scratch, as well as analogue to digital, digital to analogue, operations amplification and power amplification. This operation shows the students the difficulty of constructing instrumentation from scratch. The students experience the construction of digital electronic circuits: moving Boolean algebra from a theoretic to applied context. The diagnostics of the self-constructed circuit provide the student with experiences of logical and systematic problem solving.

5. DELIVERY

As is mentioned above, it is important to understand the ratio of practical-to-theoretical element for units on degree programmes. The unit Hardware Integration is no different. The ratio chosen for the programme is 2/3 theory and 1/3 practical. The first nine weeks of the unit is predominantly theoretical. The second nine weeks of the unit is practical. Several practical sessions revisit the theoretical components associated with the practical sessions. Two sessions (one hour and two hours) were used to deliver the theoretical components of the unit. A three-hour session was used to deliver the practical components in the second half of the semester.

6. PERFORMANCE CRITERIA

Element 1 - Demonstrate an understanding of different problems associated with hardware integration.

Performance Criteria

- Internal and external communications problems explained correctly, associated with internal devices and external devices
- Problems associated with off-the-shelf integration explained correctly
- Problems associated with in-house hardware integration explained correctly

Element 2 - Demonstrate an understanding of computer hardware.

Performance Criteria

- Analysis and description of hardware are described correctly
- Criteria for hardware integration are described correctly
- The purpose and operation of hardware units described correctly
- Typical applications, interconnections, and interdependencies are explained correctly
- Problem diagnostics described correctly

Element 3 - Explain common configurations found in a variety of application areas.

Performance Criteria

- Hardware configurations suitable for the development of integrated devices in several applications are described correctly. Consideration given to cost, size, memory requirements, interdependencies, complexities, off-the-shelf solutions and in-house solutions

Element 4 - Assemble and configure integrated hardware solution.

Performance Criteria

- A personal computer is configured with off-the-shelf hardware components and in-house components.
- Diagnostics and configuration of integrated solution (off-the-shelf hardware) to be tested to pre-defined instructions and to meet stated requirements
- Diagnostics of in-house devices to be provided, instructions to be defined and requirements to be determined

7. ASSESSMENT METHODS

Students were given the choice to use flexible assessment, see McCurdy (2000): their choice was limited. The students chose four memorandum type reports of five hundred words regarding any theoretical element of hardware integration for their theoretical assessment. Finally, all students chose an end-of-semester interview as opposed to an end-of-semester examination: the interview covered all performance criteria.

8. IMPLEMENTATION PLAN

The unit requires a lecturer knowledgeable in the areas of instrumentation & control, hardware and measurement methods. Additionally, the unit requires assessment that is highly integrated into the learning process. The unit was delivered theoretically and then experientially (with theoretical overtones). Although this is not the only way to deliver the unit, this was quite successful.

9. UNIT EVALUATION

The students suggested that this was their preferred delivery on conclusion of the unit. The students gained a great deal of interest in the unit and theory once the practical sessions began. In fact, many students were keen enough to stay an extra hour after class: the lecturer was also keen. The robot was enough to excite the most unmotivated student. Generally, the students would prefer additional practical sessions. However, they did suggest that without the theoretical underpinnings their overall understanding would suffer.

10. CONCLUSIONS

This paper discussed several aspects of the unit Hardware Integration:

1. What it is
2. Theoretical components
3. Practical components
4. Delivery methods
5. Performance criteria
6. Assessment methods
7. Implementation plan
8. Unit evaluation.

7. REFERENCES

British Computer Society (2000), [on line] accessed (5/2000), available URL: **http://www.bcs.org**

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