Constructive Alignment in Higher Education: Matching Objectives, Teaching and Assessment

Sub-project: Constructive Alignment for Integrative Study Units

Final Progress Report (June 2005)

1. **Background**

   Two years ago in September 2003 a new and innovative approach in the final year of the Department's BEng(Hons)/MEng degree in Industrial and Systems Engineering (ISE) and BSc(Hons) in Enterprise Engineering and E-business (EEEB) was introduced. The curriculum of the ISE programme, consisted of two 9 credit integrative study units, a 9 credit individual final year project, and three 3 credit elective subjects. For the EEEB programme, there is one 9 credit activity, a 9 credit individual final year project, and six taught subjects, three compulsory and three elective subjects. The two nine credit activities are "Integrative Studies on Enterprise Systems and Management (ESM)" and "Integrative Studies on Product and Process Design (ISPPD)". The weighting of the final year of study is 50% of the three years of study, 20% is given for Year 1 and 30% given for Year 2. The total number of credits for the BEng(Hons) degree was 105. Bearing in mind the heavy weighting of final year study activities, the 9 credits integrative study units in themselves account for 26% of the WGPA for the ISE programme and 13% for the EEEB programme. It was therefore essential that their assessment is constructively aligned with their objectives and study pattern since they will have a significant impact students' degree classification. This sub-project was set up to examine the extent, and ensure that there was such alignment, and to make recommendations to improve this as well as the overall delivery of the units.

2. **Objective of the Integrative Studies on Enterprise Systems and Management Unit (ESM)**

   To gain experience and practice at developing and managing an enterprise system that will support a business strategy. This is considered an essential task for ISE graduates to gain experience of in the information era, albeit, in a simulated environment. The enterprise system as it is developed and used must be able to change as the business environment evolves. This activity will provide an opportunity to students to learn the essential concepts, methods, tools and techniques in the Department's state-of-the-art Microsoft Enterprise Systems Centre. In so doing, students will be involved in building an application prototype that integrates the concepts and principles involved in the designing, planning and controlling of such as an extended enterprise system.

3. **Objective of the Integrative Studies on Product and Process Design Unit (ISPPD)**

   To integrate the different aspects in the area of product and process design through an integrated problem-based learning approach. The learning activities will be conducted in the Department's Digital Factory laboratory, which provides a self learning interactive, flexible and graphic-based digital simulation environment for students to model, develop, experiment, analyse and optimise product design and manufacturing processes that also includes including layout planning both at workplace and overall levels.

4. **Objectives this sub-project**

   Since the ESM and ISPPD activities will be continuously assessed, it will be necessary to monitor the progress of their teaching and learning activities (TLA's) as they occur to:

1. ensure that TLA's are aligned with both their respective objectives;

2. ensure that the various assessment methods are also aligned with the TLA's since assessment will occur specific stages through the academic year.

3. To evaluate the effectiveness of the aligned curriculum of these activities on students learning.

In addition, it is anticipated that these activities in their entirety (Objectives, TLA's, and Assessment) will form the basis of a new model for engineering education which, it is believed currently does not exist. As a consequence, a bye product of this subproject will be to publish the findings in suitable educational research journals.

5. The Work that was Done

5.1 Evaluation Instruments

(i) Questionnaire Surveys

These consisted of both Pre- and Post- SPQ (Study process Questionnaire) + MSLQ (Motivational Strategies for Learning questionnaire) tests.

The questionnaire consisted of 38 questions in which the first 20 were from the SPQ and the remaining 18 were from the MSLQ.

(ii) Student Focus Group Interviews

Two one-hour interviews were arranged separately in February and June 2004 respectively for each of the units separately, i.e. ESM and ISPPD. The interviews were structured around seven questions for the first interview and seven different questions for the second interviews.

(iii) Staff Focus Group Interviews and Individual Staff Interviews

Similarly, two one-hour interviews were also arranged separately in February and June 2004 respectively. The former was carried out as a focus group interview whilst the latter was an individual interview. The interviews were structured around nine questions for the first interview and nine different questions for the second interviews.

5.2 Data Processing

(i) Qualitative data from the Questionnaire Survey using SPQ+MSLQ Pre- and Post-test Results

Different statistical procedures using the SPSS software were used to analyse the data collected in the SPQ+MSLQ Pre and Posttest. The statistical tests were Student's t-tests for learning motivation and learning approaches, and Analysis of Variance (ANOVA) for comparing motivational components in the post-test.

(ii) Student Focus Group Interview

The interviews were tape-recorded and the data collected, transcribed and translated from Cantonese to English for analysis and reporting purposes.

(iii) Focus Group interview and Individual Staff Interviews

   The interviews were also tape recorded in the same way as the for the Student Focus Group Interviews

6.   Results

Because of the vast amount of data that has been collected and analysed during this sub-project, the following results are only general. More detail can be found in the two reports that have been complied by the Project Assistant containing all the results for the two classes of students that undertook the ESM and ISPPD units. These reports combined, contain around 130 pages of data and results.

The learning outcomes expected from students were four, namely academic learning, generic skills learning, higher-order learning, and interest-based learning. Students were not aware of them at the commencement of the unit but became more aware of them as the unit progressed. Both teachers and students perceived this as a result of the teaching/learning activities being aligned with the curriculum objectives. In general, the assessment enhanced students' achievement of generic and higher-order learning. However, qualitative data also showed a backwash effect occurred, and when tests were given to them, they often became memory oriented, a misalignment with the real intention of the unit, which could be rectified by a redesign of the tests themselves. Nevertheless, the statistics also showed that students were adopting a deep learning approach through active participation, self-learning, project work, and presentations.

It was also found that there was some lack of communication of assessment criteria and standards and a lack of feedback on their work contributed some ambiguity of the value of tasks performed during the unit.

Students were expected to take responsibility of their learning. However, data showed that psychologically, many were often not ready for this because it was the first time that they were subjected to this form of unit and took some time to adjust to it, through problems in self-learning, manifesting itself in a lack of self-initiative and motivation.

Naturally, they sought support from teachers but this support was not always forthcoming as the role of teachers changed to an advisory one. Students appeared not to understand this and comments were given that support was not adequate and that there were a lack instructions and guidelines given to them. Students' unwillingness to take responsibility of their own learning was reflected by the low scoring in control beliefs.

There was also a problem of heavy workload, it was recognised by teachers that too much was being asked of students, and as is often the case with developing new teaching approaches, teachers, with the very best of intentions tend to over-load rather than underload students with work.

7.   Summary of Recommendations

1. To have the self-learning modules scheduled in earlier years of the programme so as to alleviate some of the workload and to allow for more time for students to adjust to the particular style of delivery of these units.

   Action: This has now been revised, both the ESM and ISPPD units have been separated into two; ESM I and ESM II, and ISPPD I and ISPPSD II. ESM I and ISPPD I (both 3 credits each) will now be taught during Semester 2 of Year 2, and ESM II and ISPPD II (both of 6 credits each) will be covered during Year 3 (the final year). This will overcome

the workload issue and allow more time for the students dijest the contents of these two units.

2. To involve more teachers

   Action: The Department is involving more staff in the delivery of these units subject to Department's Total workload System.

3. More communication between teachers to ensure consistency of learning outcomes and scheduling of workload given to students.

   Action: The teachers involved in these units are examining these issues so that standards of learning outcomes are more consistent and the workload on students can be more evenly distributed

4. To have optional tutorials for students to attend.

   Action: This is being examined and will likely be adopted as a consequence of No 1 above.

5. Review components of the assessment system so as to ensure a greater degree of constructive alignment and to remove forms of assessment that just involve memory recall since it is likely to have a negative backwash effect on students.

   Action: This is being examined and will likely be adopted where appropriate as a consequence of No 1 above.

6. Further briefings, particularly at the commencement of the units to ensure students fully understand the objectives of the units, their particular style of delivery, how they will be assessed and what is expected of them.

   Action: This is now being done.

7. Provide more detailed feedback on assessment components of the units.

   Action: This has been brought to the attention of the teaching staff concerned.

8. Reduce the student workload of the units

   Action: Measures have now been taken to reduce this during the final year, both as a consequence of No 1 above, but also to introduce some of the self-learning modules to students during the summer between Year 2 and the final year of studies so that students can commence them early.

8. **Final Comments**

The two units have been found to be very successful. Constructive Alignment has been achieved, particularly with the implementation of the recommendations described above. Being a new type of approach, there were understandably some initial initial problems, that have been identified and the following recommendations above have helped to alleviate these. Moreover, when the units were initially introduced two years ago, the concept of Constructive Alignment was not clearly understood, although many teachers were aware of the importance attached to aligning objectives, TLA's and assessment together, they did not associate this with the concept of constructive alignment. The consequence of this was that the initial developments of the units did not take this into account to an extent that would have been preferred, causing some of the problems that occurred. However, since that time teachers much more familiar

with the importance of Constructive Alignment, particularly since the university has made it a mandatory requirement for its academic programmes, particularly full-time programmes.

As a final note, such is the success of these units, the Department will continue to adopt this type of approach and in fact some of the components, notably the Business Game in ESM is now being used by departments of other tertiary institutions in Hong Kong.