Evaluating Student Opinion of Constructivist Learning Activities on Computing Undergraduate Degrees

John Colvin and Alan Phelan, University of Worcester

Abstract

This paper discusses the student-focused learning activities employed by a number of computing lecturers at the University of Worcester to encourage learning amongst 2nd and 3rd year undergraduates. These activities include on-line discussions, variations on group discussion and presentational activities, students undertaking and analysing computer simulations, and the completion of a structured series of programming activities. The paper introduces the background to these learning activities, documents them and then analyses the approach adopted by members of staff. This is followed by a review of the feedback from both students and academic staff. Finally, the paper comments on the awareness of the academics of the term 'Constructive Alignment'.

Introduction

University of Worcester (UW), formerly named University College Worcester, is an expanding Higher Education Institution (HEI) that acquired University Title in 2005. Although UW is the only HEI in Herefordshire and Worcestershire, it recruits successfully in national and international markets as well as the local market and currently has approximately 5,000 FTE students enrolled. Like other HEI's in the United Kingdom, UW is under pressure to recruit a more inclusive and broader based student body, and it is committed to widening participation and lifelong learning. This has resulted in students who previously would not have entered Higher Education now being welcomed. (Colvin, 2003)

Undergraduate computing at UW is offered as part of an institutional Undergraduate Modular Scheme and attracts an annual intake of around 100 students. The disparate educational backgrounds and mode of study of students enrolled on computing modules reflects the institution's commitment to widening participation and to lifelong learning. Admission offers are made on the basis of 160 UCAS points, and many students enter with vocational 'A' level qualifications or via non-traditional routes such as Access courses. Academic staff who were involved in the project have recognised that such students are likely to come from a less academic background than students entering from the familiar educational background of a decade ago.

Computing students (both 'new' and 'traditional') are encouraged to engage in deep rather than surface learning Marton & Saljo, 1976a & Marton & Saljo, 1976b). This is promoted by an emphasis on student-focused learning activities rather than relying solely on a traditional lecture and tutorial approach. The latter approach is usually inappropriate for a broader-based student body (Biggs, 2003). This paper discusses a project to evaluate students' opinions of the learning activities employed by a number of computing lecturers at UW with 2nd and 3rd year undergraduates in the academic year 2004-2005.

Methodology
A range of approaches was taken in order to assess student opinion of these learning activities. Questionnaires were used to obtain both quantitative and qualitative data from students in the week following the period in which a particular learning activity had been offered. Students were observed undertaking the learning activities and also volunteer students were videoed. Finally an informal discussion with one group was subsequently held to clarify the data obtained.

All computing lecturers at UW were offered the option to participate in the project. Nine full-time lecturers volunteered and these were briefed, and asked to supply a written description of their learning activity and asked to identify which learning objective(s) from the module the learning activity was targeted at. Questionnaires were used to obtain data from academic staff regarding the influences that informed the choice of particular learning activities and to elicit their understanding of the term "Constructive Alignment".

Student Centred Learning Activities
The project involved student-centred learning activities in 2nd and 3rd year undergraduate modules during the academic year September 2004 – June 2005.

The learning activities were integrated into three-hour module sessions and generally occurred on a regular basis following a traditional 60-90 minute lecture, over periods of between 3 and 8 weeks. The activities are categorised and described below

- Variations on group discussion and presentational activities were including in Project Management, Professional Ethics and E-Commerce modules. Small groups of students are given a current issue to discuss in sessions and asked to feedback to other students using Powerpoint or acetates at subsequent sessions.
- On-line discussions were employed in HCI and Web Design modules - in one module the activity followed a formal lecture, whereas the other module incorporated the activity into a blended learning strategy.
- Small groups undertook computer simulations in an Operating Systems module. On completion of these group tasks students were individually required to analyse the data collected and reflect on its significance within the scope of the module. At the end of the module students select the analysis and their reflections resulting from two of the practical tasks and these are submitted as an assignment.
- Similar strategies were applied in two programming modules. Students were individually encouraged to complete a structured series of programming activities that included both examples for them to work through and also exercises of increasing difficulty. Additionally, students on one of these modules were given an on-line multiple-choice quiz (MCQ) using WebCT to complete - these students were offered multiple attempts at the quiz and successful completion enabled a student to access subsequent week's materials (handouts and worksheets)
- An Image Manipulation and Interpretation module enabled students to use proprietary software to investigate the structure of maps and analyse the images. At the end of each session students completed open-ended questions, designed to

encourage deeper thinking and reflection. Completed questionnaires were submitted as part of an assignment.

Armitt (2002) advises us that synchronous peer-to-peer on-line activities, employed in HCI and Web Design modules, can play a significant important role in encouraging deep learning. Armitt (2002) also warns that “groups do not spontaneously coalesce to undertake effective in-depth synchronous discussions”. The academic staff involved with these modules acknowledge this warning and so monitored and encouraged in-depth discussion.

The three modules that include discussion and presentational activities require students to work in small groups of three, four or five and so offer the potential of cooperative learning (Ramsden, 1992). The issues discussed (e.g. “Compare and contrast the pressures that the Data Protection Act and the Freedom of Information Act place on companies”) engage students with higher level cognitive skills such as analysis and evaluation.

The structured series of activities included in the two programming modules are intended to encourage different levels of learning. Working through examples and straightforward exercises with solutions similar to given examples may only encourage surface learning (Tait, 1996). However, the more complex exercises require higher levels of problem solving, and problem solving involves deep learning (Tait, 1996). The challenge is to encourage surface learners to move on from the examples and less complex exercises onto the more challenging exercises. This, the authors believe, is possible by a structured approach to the level of complexity of successive exercises coupled with appropriate support mechanisms. The use of MCQ tests as formative assessment, on the other hand, is unlikely to be appropriate in an ‘aligned’ context, as students tend to employ surface learning in a MCQ context (Scouller ,1998).

Not only do the Operating Systems and Image Manipulation & Interpretation modules require students to analyse and reflect, but also some or all of this analysis and reflection forms part of the modules’ assessment. Entwistle (2000) suggests that incorporating such formative activity into an assessment will encourage deep learning. However, our experience suggests that students may be reluctant to fully engage in this type of activity and tend to focus on summative assessment (Gibbs & Habeshaw, 1998; Colvin & Keene, 2004). The integration of summative elements into these learning activities makes it more likely that students will engage in deep learning.

In all of the modules in the project at least 50% of timetabled sessions was scheduled for student-centred learning activities and so the academics have addressed the problem of devoting too much time to teaching content (Fink ,2003). This paints a picture of academic staff who are “student-focused, and learning-oriented” (Entwistle, 2000) and who adopt a “Conceptual Change / Student-Focused approach” (Trigwell et al, 1999).

Student Opinion

Students evaluated the learning activities against a range of criteria:

- Was the learning activity challenging?
- Did the learning activity generate interest?
- Did the learning activity enable the achievement of the learning outcomes?
- Was the learning activity appropriate for the stage of the course?
- Should the learning activity be included frequently?
- Does the learning activity encourage attendance?
- What is the purpose of the activity?

On the whole these opinions were positive and it is interesting to note that feedback was generally uniform across the different activities. Students expressed the following opinions:

- 73% of students expressed an opinion that the activities were challenging and stretched them (see Fig. 1) and 72% of students indicated that they believed the activities were interesting (Fig. 2). This appears to be consistent with Ramsden (1992) who proposes that deep learning is enjoyable, whereas surface learning is dissatisfying, tedious and unrewarding.

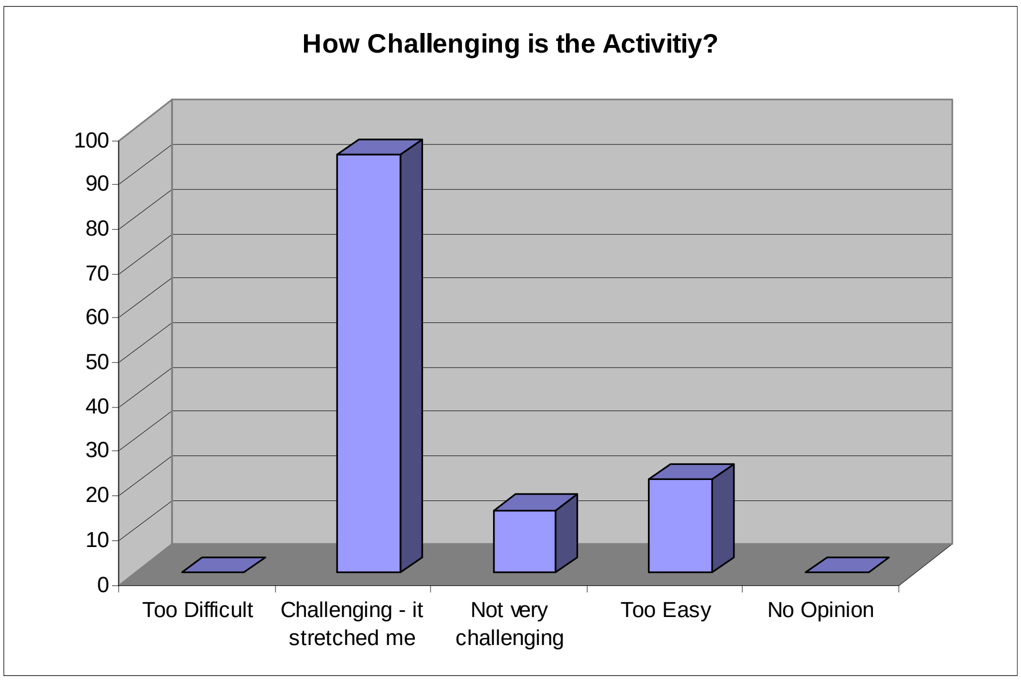


Fig. 1

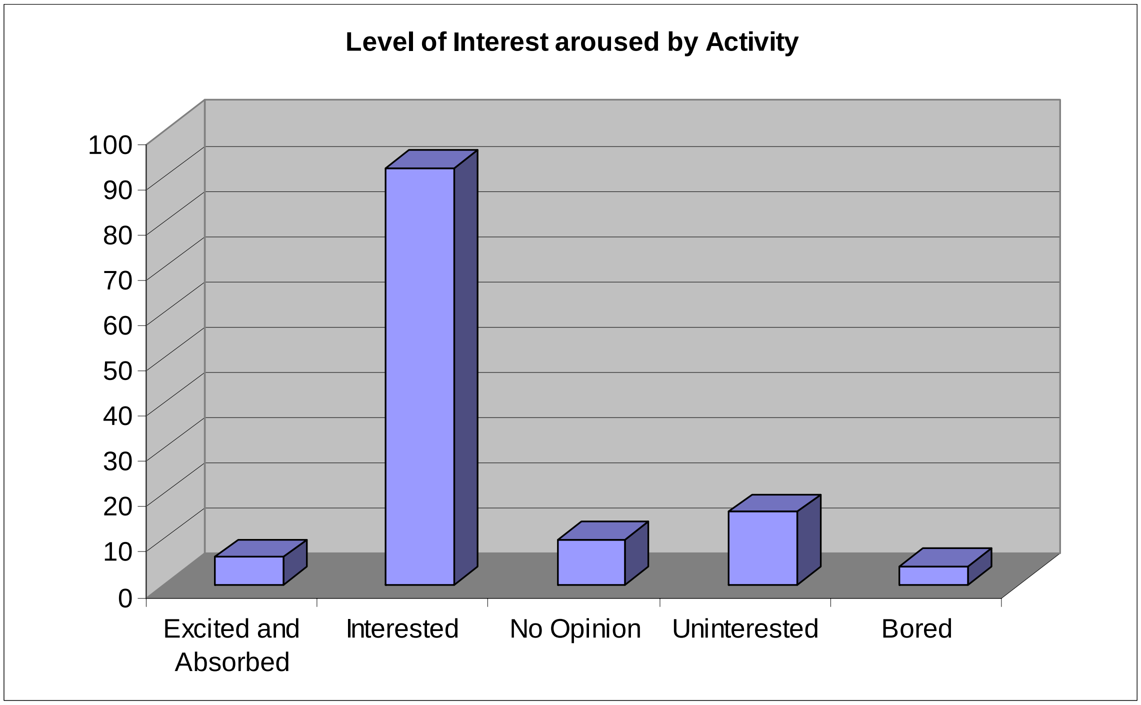


Fig. 2

- Trigwell (1999) confirms that the conceptual change/student-centred approach is more likely to be associated with higher quality learning outcomes. Therefore we might expect students to report that these learning activities supported them in the achievement of the learning outcomes. Fig. 3 shows that 66% of students believed they had achieved all or most of the learning outcomes at the end of the learning activities.

  This achievement rate may appear disappointing, particularly as Cmor (2001) cautions us that students can exaggerate their own abilities. It is worth noting that there will be other opportunities (e.g. self-study, alternative learning activities) for students to achieve the learning outcomes later in the module. It would be very surprising if all students were able to achieve all the learning outcomes on an undergraduate module. Further research is required in order to correlate students' perception of achievement against actual individual achievement.

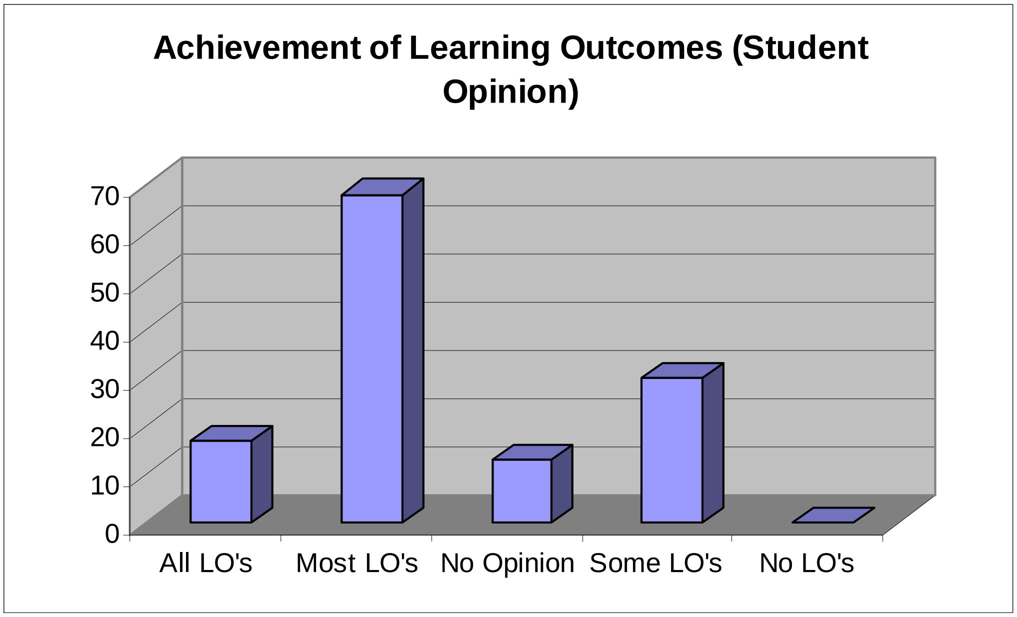


Fig. 3

- 87% of students expressed the view (see Fig. 4) that the activities were either appropriate or very appropriate for the stage of the course. The activities require the use of higher-level cognitive skills and it is encouraging to note that students acknowledge the appropriateness of the activities. These data are consistent with data from a subsequent survey (see Table 1) that was carried out with a smaller sample of these students designed to elicit students' opinion of the purpose for including the learning activities. Only 3% of students were of the opinion that the activities were inappropriate. Further research is suggested in order to determine whether such students are surface learners.

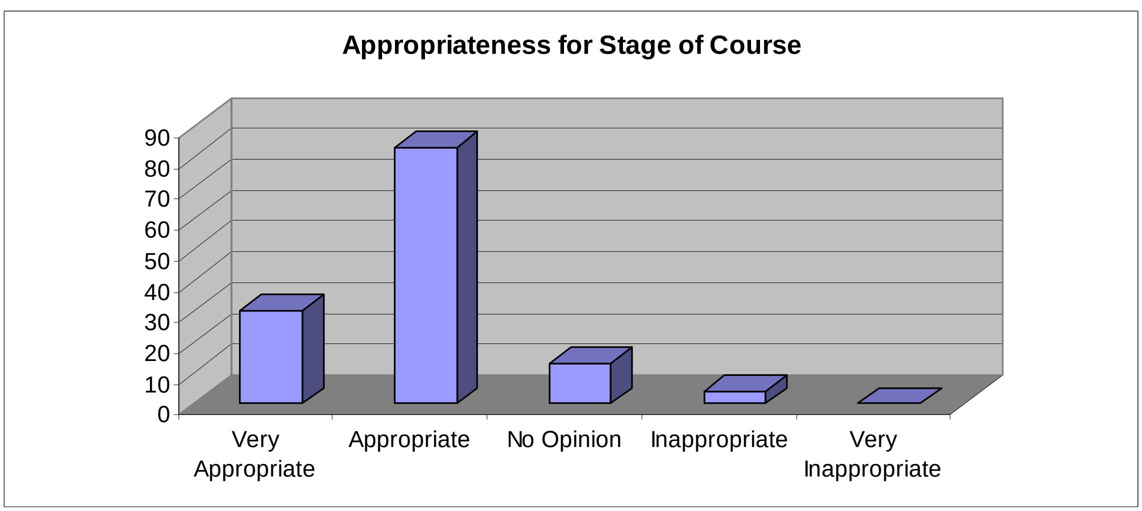


Fig. 4

- Individual staff tended to favour and emphasize a particular type of activity (e.g. the use of online discussions in the HCI module). However, this emphasis was not exclusive, and other activities were incorporated when appropriate. For example, the use of individual and/or group discussion of problems or issues was actively encouraged during the more formal sections of the delivery of a programming module.

  This strategy of focusing on a single learning activity was not popular with students. Only 23% of students thought that a particular activity should occur every week (see Fig 5). This disapproval is further emphasised if the data from the programming modules is excluded – then fewer than 19% of students expressed approval for the same activity occurring each week. Furthermore 38% and 23% thought that particular activities should occur every other week and occasionally, respectively. This suggests a student preference for a palette of differing learning activities throughout a module. Again further research might indicate if this approach might be effective.

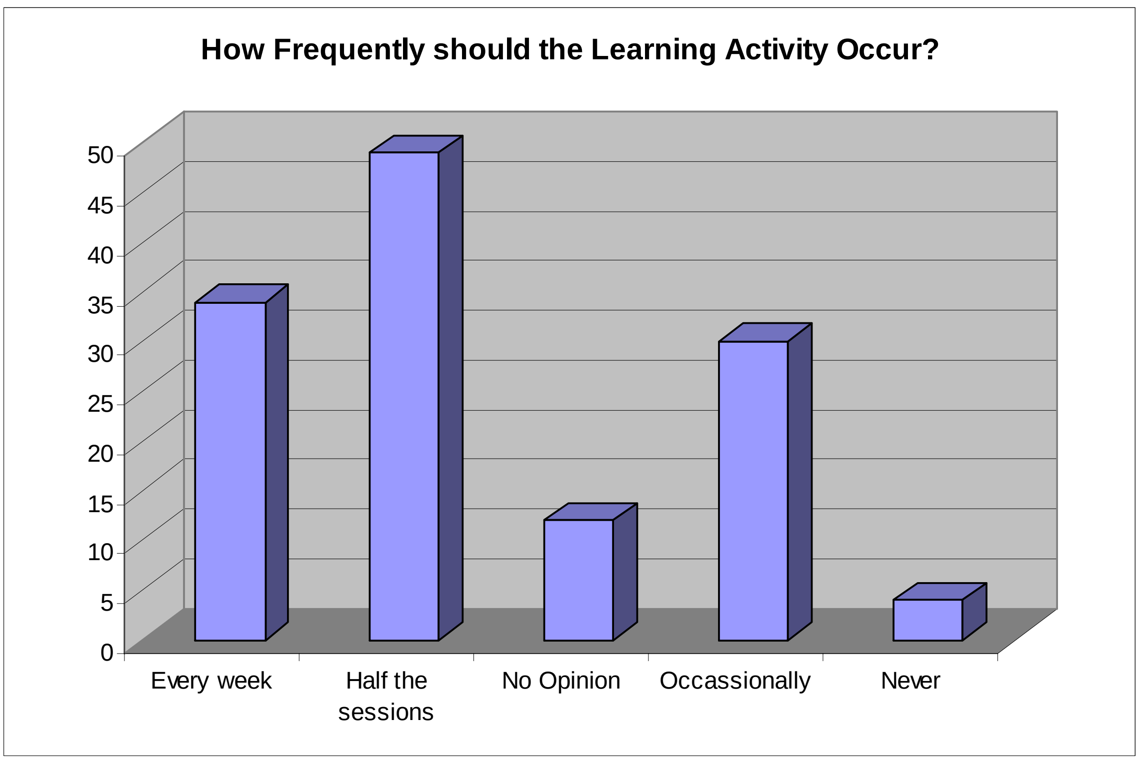


Fig. 5

- Disappointingly 68% of students expressed a view that individual activities have no effect on their attendance and only 15% expressed a view that their inclusion might encourage attendance (Fig. 6). If we accept the views of Biggs (2003) then we can also accept that the majority of students at UW would not have been in higher education 20 years ago and are similar to his example student named 'Robert'. Although this project supports the view that many such students become aware of higher level cognitive skills (see Fig. 4 and Table 1), the authors believe that they are not generally successful in nurturing these independently away from the structured support offered by orchestrated learning activities. Perhaps this suggests that we might investigate adopting other strategies with students that have a poor attendance record such as offering 'distance' learning activities or emphasising and supporting their need to independently engage in deep learning.

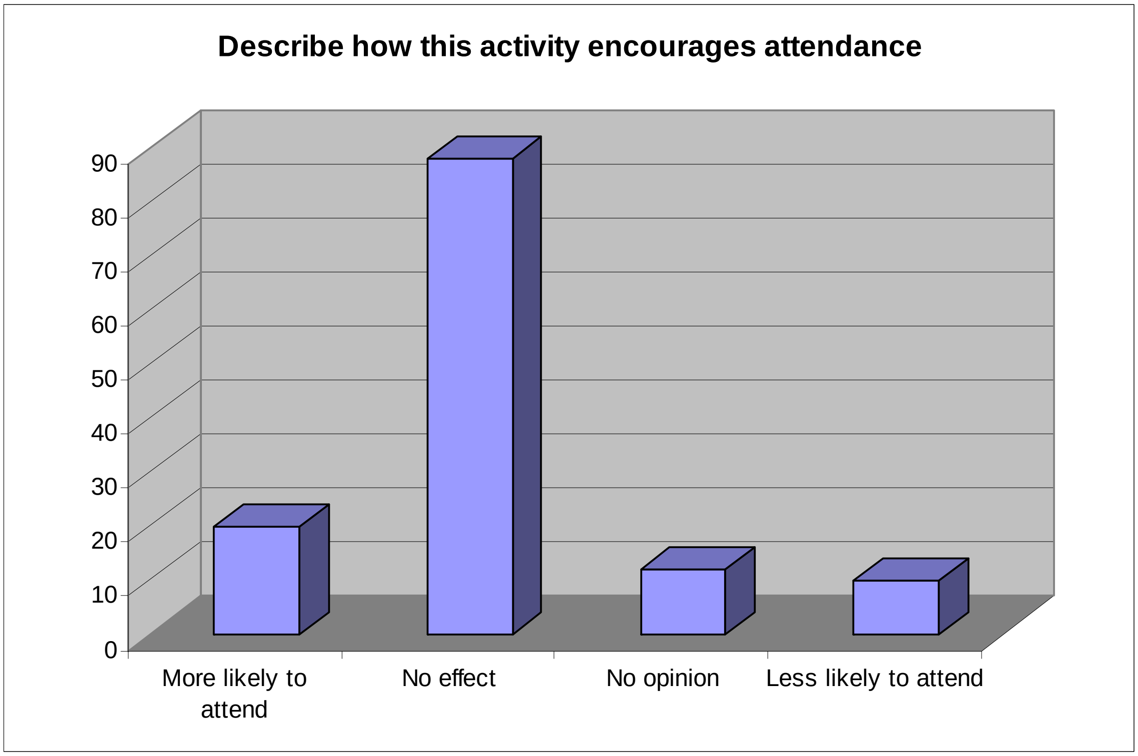


Fig .6

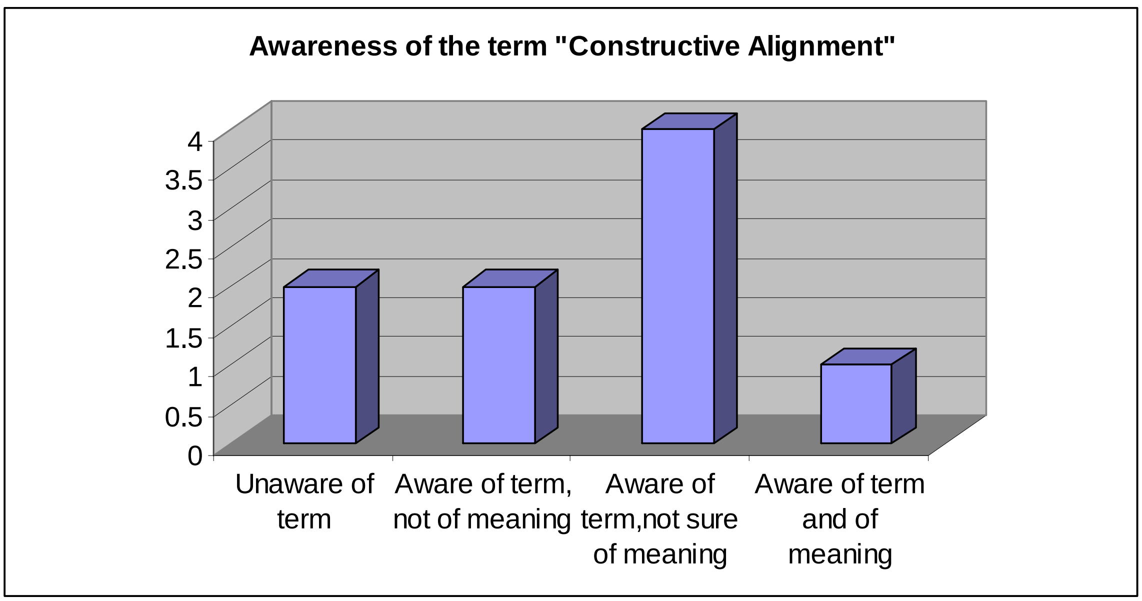
Rationale for Incorporating Learning Activities
The academics involved were offered six possible influences on their decision to incorporate their learning activity and asked to rank these. The results (see Table 1) support the view that these academic staff have a clear understanding of the nature of student learning, an understanding that resulted in good practice.

It is interesting to observe the near one-to-one correspondence between the views of the academics and the views of a sample of 34 students (see Table 1) from the project who completed a similar questionnaire. Although it is very reassuring to note this alignment of views, it does offer the opportunity for further investigation e.g. to monitor the development of students attitude towards learning over an undergraduate course in order to establish the influence on this of a variety of learning experiences.

Table 1		
Why were Learning Activities included?		
Influence	**Ranking**	
	Academics	**Students**
So that the lecturer does not need to talk for 3 hours	5th	5th
To encourage students to reflect on what they are learning	2nd	1st
To prevent students from being bored	4th	4th
To exploit the view that students learn better when ‘doing’	1st	2nd
To fill time	6th	6th
To encourage students to work autonomously	3rd	3rd

Although we believe the learning activities considered in this project may be located in the context of the Biggs’ Constructive Alignment theory, this was not the catalyst for this project. The authors were impressed both by the range of student-centred activities that some computing colleagues were employing and by the positive anecdotal evidence from students.

It is therefore appropriate to speculate about the influence of the Constructive Alignment theory on academic staff. During the course of the project, staff were asked what their understanding of the term “Constructive Alignment” was at the start of the project. Their responses (see Fig. 7) suggest that the theory is not yet fully appreciated even by progressive academic staff. Further research may be necessary to determine whether this is a general or a local phenomenon.



Conclusions

On the whole, the opinions of students were positive and were uniform across the different activities. The results supported the authors’ belief that our students find these learning activities interesting, challenging, supportive and appropriate for the stage of their course. The results also suggest that including such learning activities in our modules will encourage learning.

The authors were surprised to observe a student preference for a palette of differing learning activities throughout a module, as opposed to the tendency for staff to favour and emphasize a particular type of activity.

Disappointingly, very few students expressed a view that individual activities might encourage attendance. The disappointment arises from the authors' belief that our students are not generally successful at independently nurturing higher-level cognitive skills away from the structured support offered by orchestrated learning activities. However, it is reassuring to note the near one-to-one correspondence between the views of academics and students on the influences on the decision of academics to incorporate their learning activity.

Feedback from academics suggested that Constructive Alignment theory was not yet fully appreciated, even by these progressive academic staff.

Finally, further research is suggested -

- To correlate students' perception of learning outcome achievement against actual individual achievement.
- To correlate students' preference for the type of learning activities with their level of learning.
- To determine the effectiveness of including a palette of differing learning activities throughout a module to better student achievement.
- To investigate adopting other strategies with students that have a poor attendance record such as offering 'distance' learning activities or emphasising and supporting their need to independently engage in deep learning.
- To determine whether the lack of awareness of Constructive Alignment theory amongst academics is a general or a local phenomenon.

Contact Details

John Colvin – j.colvin@worc.ac.uk
Alan Phelan – a.phelan@worc.ac.uk

Acknowledgements

The authors wish to acknowledge the contribution of the students and academics who participated in the study.

References

Armitt, G., Slack, F., Green, S. & Beer, M., 2002. The Development of Deep Learning During a Synchronous Collaborative On-Line Course. *Proceedings of CSCL '02, January 7-11 2002, University of Colorado, Boulder, CO, USA* [Available at http://newmedia.colorado.edu/cscl/70.pdf].

Biggs, J., 2003. *Teaching for Quality Learning at University*. Maidenhead: Open University Press.

Cmor, D. & Lippold, K., 2001. Surfing vs. searching: the Web as a research tool. *Paper presented at the 21st Annual Conference of the Society for Teaching and Learning in Higher Education.*

Colvin, J., 2003. Extending the Academic Year for Mature Part-time Higher Education Students using a Web-based learning Environment. *Research in Post-Compulsory Education*, 8(3), pp.393-405.

Colvin, J. & Keene, J., 2004. Supporting undergraduate learning through the collaborative promotion of e-journals by library and academic departments. *Information Research*, 9(2), paper 173 [Available at http://InformationR.net/ir/9-2/paper173.html].

Entwistle, N., 2000. promoting deep learning through teaching and assessment: conceptual frameworks and educational contexts. *Paper presented at TLRP Conference, Leicester, November 2000* [Available at www.tlrp.org/pub/acadpub/Entwistle2000.pdf].

Fink, L., 2003. Creating *Significant learning Experiences*, San Francisco: John Wiley.

Gibbs, G. & Habeshaw, T., 1998. *Preparing to Teach: an introduction to effective teaching in higher education*. Bristol: Technical and Educational Services Ltd.

Marton, F. & Saljo, R., 1976a, On Quantitative Differences in Learning I. Outcome and Process. *British Journal of Educational Psychology*, 46, pp.4-11.

Marton, F. & Saljo, R., 1976b. On Quantitative Differences in Learning II. Outcome as a function of the Learner's Conception of the Task. *British Journal of Educational Psychology*, 46, pp.115-127.

Ramsden, P., 1992. *Learning to Teach in Higher Education.* London: Routledge.

Scouller, K., 1998. The influence of assessment method on students' learning approaches: Multiple choice question examination versus assignment essay. *Higher Education*, 35, pp.453-472.

Tait, H, & Entwistle, N., 1996. Identifying students at risk through ineffective study strategies. *Higher Education*, 31(1), pp.97-116.

Trigwell, K., Prosser, M. & Waterhouse, F., 1999. Relationships between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, 37, pp.57-70.