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An Evaluation of deep learning achieved by students studying environmental science modules using the Wolverhampton Online Learning Framework (WOLF)

Clive Roberts and Andrew Simkins,
School of Applied Sciences

Background and Rationale

The Division of Environmental and Analytical Sciences uses the Wolverhampton Online Learning Framework (WOLF) for part of its module delivery programme at all 3 levels within all Awards. This initiative followed from the mission statement that the University of Wolverhampton is committed to broadening access to the widest range of students capable of succeeding in higher education. It is however difficult to assess the level of success achieved by WOLF-based modules in terms of the student's true understanding of module concepts, although end-of-module evaluation forms completed by students have allowed some feedback on satisfaction of the way in which modules use WOLF. There has been limited information available on specific learning and teaching issues that might help guide the style of module delivery using the WOLF system. Indeed if WOLF-based modules are intended to be an alternative form of delivery for modules that are delivered by conventional methods, evaluations for the level of true understanding achieved by students (whatever their chosen platform for studying the module) would be very useful information to develop.

The research involved canvassing the opinions of students on modules that are committed to the use of WOLF as part of the module delivery. Tracking facilities within the administrator's role on WOLF gives feedback on the amount of time students spend on WOLF pages. However it is not possible to evaluate the level of learning or understanding that has been achieved by students from tracking statistics alone. There are therefore 3 main aims for this research:

1. To evaluate the level of deep learning achieved by students studying environmental science students who have accessed the modules via WOLF.
2. To study the quality and style of approaches to learning adopted by students that have accessed modules through WOLF.
3. To assess the effectiveness of module delivery by utilising WOLF.

Approaches to Learning

Ramsden (1992) expanded the idea that learning might be thought about as a change in the way we conceptualise the world around us. From this perspective, learning is seen as 'what' and 'how' students learn by experiencing and organizing the subject matter of a learning task, as summarised by the following Table.

Table 1: The logical structure of approaches to learning (from Ramsden (1992) and based on Marton (1988))

HOW: 'structural' aspect - the act of experiencing, organising and structuring		WHAT: 'meaning' aspect - that which is experienced and the significance of the task	
HOLISTIC	ATOMISTIC	DEEP	SURFACE
Preserves the structure, focusses on the whole in relation to the parts	Distorts the structure and focusses on the parts	Focusses on what the task is about (i.e. the author's intention)	Focusses on the 'signs' (e.g. the word-sentence level of the text)

A deep approach to learning encapsulates the intention to understand and students are able to maintain the structure of the task. The following elements are found in deep learning:

- A focus on 'what is signified', e.g. the author's argument or the concepts applicable to solving the problem
- Student relates previous knowledge to acquiring new knowledge
- Student relates knowledge from different modules/courses
- Student relates theoretical ideas to everyday experiences
- Student can distinguish evidence, argument and opinion
- Student can structure and organise content of learning into a coherent whole.
- An overall 'internal' emphasis ("... a window through which aspects of reality become visible and more intelligible." (Marton *et al.*, 1984)

A surface approach to learning is characterised by an intention by students only to complete the immediate task requirements. Furthermore students often distort the structure of the task. The following elements are found in surface learning:

- A focus on the 'signs', e.g. the words and sentences of the text or unthinkingly on a formula needed to solve a problem
- A focus on unrelated parts of the task
- Student memorises information for assessments
- Student associates facts and concepts unreflectively
- Student fails to distinguish principles from examples
- Student treats the task as an external imposition
- An overall 'external' emphasis: learning is controlled by the demands of assessment, knowledge is cut off from everyday reality

Ramsden (1992) emphasises that both the deep-holistic and surface-atomistic approaches to student learning are adopted successfully in different circumstances. For example, a student might adopt a surface approach the night before an exam. However such an approach imitates authentic learning and is a temporary solution to the immediate task. Marton *et al.* (1984) stated that "We are not arguing that the deep approach is always the best: only that it is the best (indeed the only) way to understand learning materials". Biggs (1989) suggested that "... there is no such thing as a deep or surface learner only students who adopt a deep or surface approach to learning". Within the context of this research, deep learning is used as a yardstick through which true understanding of course material can be judged.

The Research

The research involved canvassing the opinions of students on various aspects of modules they had just studied through specific questionnaires. The 3 modules chosen for the questionnaire survey were

- EA1001: Introduction to Environmental Science
Core Level 1 module for all named Awards (population = 98)

- EA2001: Environmental Sustainability
Core Level 2 module for some Awards (population = 57)
- EA3002: Environmental Resource Studies
Popular Level 3 module (population = 60)

The total student population for the questionnaires was thus 215. Each questionnaire consisted of 20 statements, for which students were required to choose 1 out of 6 possible responses ranging from strongly disagree to strongly agree. A further 3 open-ended questions allowed students to respond in a more subjective manner. Appendix 1 shows the questionnaire for EA1001.

The rationale for choosing the statements was influenced by 2 main suppositions. Firstly, the delivery of modules on WOLF encourages either a deep or surface approach to learning and secondly, the study regime adopted by the student encourages either deep or surface learning. Statements thus attempted to ascertain the amount of deep learning achieved by both module delivery and strategies for learning adopted by the student. For example, agreement with the statement “The material on WOLF was stimulating and was relevant to my degree” is suggestive that the style of module delivery encouraged a deep approach to learning in the relevant module being evaluated. Conversely, agreement with the statement “The module assessment mainly emphasised the recall of facts in assessment” suggests that the module encouraged a surface approach to learning. Similarly, agreement with the statement “I passed most of the module components by memorising a good deal of what we learnt” suggests that students have adopted a surface approach to learning, whereas agreement with the statement “I spend a lot of my study time finding out more about interesting topics that have been discussed in class” is indicative of a deep approach to learning. The level of deep learning achieved by the module could therefore be ascertained by discriminating the amount of agreement or disagreement with each statement.

The Outcomes

The responses from the questionnaires indicated that there was significant variation in the data between all 3 Levels. In response to the question “Did you find WOLF helpful?”, 92% of students replied positively with 25% of students responding that they found WOLF very helpful. There is therefore a significant degree of student satisfaction with the way in which modules are delivered on WOLF.

In terms of module delivery on WOLF, student responses indicated that module material encouraged a surface approach to learning at Level 1 (69% agreement with surface learning), but that there was a clear progression towards deep learning in Levels 2 and 3. Level 2 students indicated 45% agreement and 35% slight agreement with deep learning, whereas Level 3 students recorded 66% strong agreement with deep learning.

In terms of student approaches to learning, responses indicated that students tended to adopt a surface approach to learning at Level 1 (37% slight agreement and 30% agreement with surface learning), but adopted a deeper approach to learning at Levels 2 and 3. Level 2 students indicated 38% agreement and 25% strong agreement with statements linked to a deep approach to learning, whereas Level 3 students suggested 56% agreement and 18% strong agreement with deep learning.

Overall student responses showed a clear difference between the amount of deep learning occurring at Levels 1 and 2 with a significant amount of surface learning occurring at Level 1. As EA1001: Introduction to Environmental Science is essentially a systems-based module in which students are introduced to the four major systems of the Earth (biosphere, atmosphere, hydrosphere and geosphere), it follows that surface learning might be appropriate for those students who have not come across such concepts in their previous educational experiences. As this module is a core module, knowledge and concepts accrued in EA1001 are developed in all other Environmental Science modules (where deep learning

can be addressed). Consequently, there is more intellectual engagement with course material at Levels 2 and 3 and it follows that the amount of deep learning achieved by students is greater. The amount of deep learning is also linked to an important non-WOLF aspect, namely the need for students to undertake wider reading and to access high level academic journals and other referenced work. This is essential for degree standard work and so there may be scope for more interaction with students on WOLF using journal papers and other referenced work as case study material.

Responses indicated that there was no difference in gender in terms of deep/surface learning. Students who accessed WOLF a lot tended to provide responses linked to deep learning whereas those students who did not use WOLF a great deal tended to give responses linked to a surface approach to learning. It could be argued that students with a higher academic interest would tend to engage with WOLF and so would tend to adopt a deep approach to learning. It may therefore be difficult to differentiate between students who use WOLF extensively and those who do not.

Students indicated that the best aspects of modules on WOLF were

- Self assessment questions at the end of relevant sections
- Flexibility on lecture attendance
- Links to other WWW sites and reference databases
- Ability to re-visit lecture material at a later date
- Save time in taking notes during lectures
- Open access to WOLF material at all times
- Able to access material from off-site locations
- Inclusion of visual material, including mobiles and video clips

Students indicated the worst aspects of modules on WOLF were

- Difficulty in printing material
- Slow speed to load on occasions
- Expensive when working at home (phone bills)
- Lack of associated printed material
- Looking at a computer screen for long periods
- Difficulty in locating specific material within modules quickly
- Not enough feedback or follow-up on academic papers within WOLF

Benefits

The benefits of the research are really related to a greater understanding of how students access modules on WOLF. Modules that are structured in a way that allows students to realise their full potential are obviously more useful than those that are laid out in a less accessible way. This research has given insight into how students access module material on WOLF and consequently will inform the style of future conversion of modules onto WOLF.

Future Developments

The intention is to publish the findings of this research in an academic journal. In future, a series of student interviews will be undertaken to ascertain more information on student understanding of module concepts and strategies adopted by students for effective learning. Although this research has provided some insight, questionnaires alone do not provide enough flexibility to allow a detailed assessment of the amount of deep learning that has been achieved by students. Face-to-face interviews will provide that additional information.

References

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EA1001 QUESTIONNAIRE

Student Name (please print)

1. The module assessment mainly emphasised the recall of facts in assessment

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

2. The style of module assessment created anxiety, rather than stimulating interest in the topic area.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

3. There was an excessive amount of material to learn in this module.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

4. There was not enough feedback on my progress during the module.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

5. There was little opportunity for me to develop my own study regime during the module

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

6. I had little interest in the subject matter in the module

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

7. I had no previous background knowledge of environmental science before I started the module.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

8. I have not developed any new skills from studying this module.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

9. The WOLF system allowed me to foster an active and intellectual interaction with the topic of environmental science.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

10. The material on WOLF was stimulating and was relevant to my degree.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

11. The material on WOLF had clearly stated academic objectives and learning outcomes.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

12. After studying this module, I have developed an interest in environmental science

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

13. After studying this module, I have developed an interest in one or two particular sub-disciplines within environmental science.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

14. After studying this module, I find that I have learnt something from the phase tests that might be useful in my future studies.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

15. After studying this module, I find that I have learnt something from the essay assignment that might be useful in my future studies.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

16. After studying this module, I find that I have learnt something from the precis exercise that might be useful in my future studies.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

17. I passed most of the module components by memorising a good deal of what we learnt.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

18. I don't usually have time to think about the implications of what I have read whilst studying.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

19. In reading new material on WOLF I often find that I am reminded about material I already know and this changes my perception of the concept or idea.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

20. I spend a lot of my study time finding out more about interesting topics that have been discussed in class.

Disagree	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Agree

21. Please summarise HOW you have studied this module. For example, did you take notes from the reading material or did you highlight text in the book or did you just memorise facts and figures etc? Did you take extra notes from the lectures?

22. How did you deal with material on WOLF? For example, did you print off any information? If so, how much? How much of WOLF did you look at? Did you answer all the self assessment questions? Did you try to memorise all the information or did you have some other strategy?

22. Did you find WOLF helpful? Please explain your answer.