

Alternative to the essay to promote greater depth of learning

NORTCLIFFE, Anne <<http://orcid.org/0000-0001-6972-6051>>

Available from Sheffield Hallam University Research Archive (SHURA) at:

<http://shura.shu.ac.uk/14534/>

This document is the author deposited version. You are advised to consult the publisher's version if you wish to cite from it.

Published version

NORTCLIFFE, Anne (2006). Alternative to the essay to promote greater depth of learning. In: Higher Education Research Network, Sheffield Hallam University, 2006. Sheffield Hallam University, Sheffield Hallam University, 39-50. (Unpublished)

Copyright and re-use policy

See <http://shura.shu.ac.uk/information.html>

Alternative to the Essay to Promote Greater Depth of Learning

*Anne Nortcliffe, Sheffield Hallam University, Faculty of Arts, Computing, Engineering and Science,
City Campus, Howard Street, Sheffield, S1 1WB, UK, a.nortcliffe@shu.ac.uk*

Abstract

The traditional form of assessment using an essay can encourage students to adopt a surface approach to learning. With the growth of the Internet, a number of students commit plagiarism in generation of the essay. So what are students learning? We academics hope to inspire learning, encourage a deep level learning of a subject. There is a need for alternative methods of assessment that promote deep learning.

This paper will present the results of and analysis of an assessment method that requires the students to understand a topic area and therefore test the hypothesis that deep learning of a subject is achieved. The assessment task reported here requires the students to comprehensively research a subject area of a module and prepare 5 multi-choice or match questions to be used in a sample phase test for their peers.

Introduction

The traditional 'chalk and talk' lecture provides students with a limiting method of learning and encourages surface learning (Ramsden 1992). This approach is adopted as a quick and efficient means of conveying material to a large audience, presenting information on mass to learners as oppose to encouraging the students to uncover the information, (Fry el al 2001), and provides little opportunity for students to check their learning or understanding with an academic. Hence, course-work is commonly utilized to increase the student learning, an opportunity to provide feedback on a student learning (Glover 2005) and as a primary motivating factor for student learning (Entwistle 1997). However, assessment methods designed to measure module learning outcomes in fulfillment of QAA procedures can lead to uninspiring assignments, (Gibbs et al 2004-2005) and also lead to strategic learning approach by the students, i.e learning sufficient to pass, (Biggs 1987), rather than seek a deep level of learning. Increasingly students are utilizing the Internet to provide all the background material for course-work and or to complete an assignment through actual or partial plagiarism, which is, one can argue, poor study skills (Flint 2005). The worse case scenario is the buying and selling of essays on the Internet via sites known as "Paper Mills", (Heberling 2002). Therefore the level of learning is questionable and the long-term effects are reduced student learning skills and employability, (Hakel et al 2000). Traditional methods of assessment are restrictive on the level of learning as they limit a student's exposure to different learning, styles, methods and key skills. In terms of teaching vocational subjects, for example engineering, it is imperative that deep oppose to surface level learning is established so that the students are professionally competent to practice in their chosen vocation, (Pitt 2006). Therefore there is a need for more innovative methods of assessment that cannot be replicated or bought from the Internet. Ideally any assessment strategy should encourage the students to read a subject, and therefore promote a deeper level of learning. Any original assessment methodology ideally should not add to the pressures of an already heavy academic workload, (Powell 1998), i.e. increase the marking burden (Parket 2001). This paper presents an alternative assessment strategy to measure a module's learning outcomes and promote a greater depth of learning. The method includes an assessment that requires groups of students to research a topic area of a module, then design, develop and submit five multi-choice questions, answers, and answer justifications on the topic. The

results of this assessment strategy are analysed through the e-phase test results and student's reaction to ascertain if a greater depth of learning was achieved.

Learning Theory

A traditional lecture or assessment with untimely feedback is said to achieve a linear model of student learning, Figure 1, (Nortcliffe et al 2003), as the student receives no feedback to act upon and in reality the audience only partially retains the knowledge, therefore a disjointed level of learning is achieved, Figure 2, (Nortcliffe et al 2003). However a lecture with active audience participation or an essay with timely feedback promotes a simpler cyclical learning model, Figure 3, (Nortcliffe et al 2002), as traditionally the student has only one opportunity to reflect on their learning as they receive one form of feedback.

Ideally any innovative method of assessment should promote multi-facets of learning and therefore a greater depth of learning. Supplementary teaching, that is teaching others a subject, has been suggested to promote a higher level of learning, (Wallace 2001). Previous research has demonstrated a greater student depth of understanding of a subject can be achieved by instructing all the students to prepare material for each week's topic and selecting one student each week to present the material, (Mooney et al 2001). Applying supplementary teaching assessment has also been shown to be successfully applied to class size 73, 34 and 26, each class having demonstrated a higher level of student learning possibly via the complex cyclical model of learning, Figure 4, (Nortcliffe 2005a). In theory a group submission of multi-choice questions and answers has the potential to achieve a similar level of learning, Figure 5. The task would involve the students acting as both student and teacher, as one can argue researching, question development through designing and developing phase test questions requires the student to learn the subject at one level and ideally encourages a deeper level of understanding of the material before dissemination into suitable questions. Further levels of learning are theoretically possible upon combining the assessment process with group work as this requires the student to further disseminate and justify their question(s) and answer(s) for inclusion in the group's submission. This encourages their fellow peers to assess and feedback on the questions to one another. This method in conjunction with timely summative and formative academic feedback would further enhance the level of learning.

Learning, Teaching and Assessment Strategy

The course in question aims to assist the learning, teaching and assessment of a student's theoretical understanding and practical competence in the design, development and management of a commercial web site via a number of lectures, laboratories and assessments. Students achieve a pass if they are able to demonstrate a basic understanding and practical ability of the subject. However the subject matter, which is ever growing and changing each academic year with the arrival of new web based languages, protocols, security issues and solutions, promotes unfolding of the subject matter oppose to covering. Therefore groups of students are asked to design the course content and in keeping with unfolding of the course content the groups are asked to volunteer to deliver a ½- ¾ hr presentation of one of the lecture subjects in the lecture series (group supplementary teaching). This approach of group supplementary teaching forms assessment one part one of the assessment strategy, as this approach has been successfully applied in previous years where it induced greater depth of learning and understanding of a course topic, (Nortcliffe 2005a). The academic roles for the lecture element become that of facilitator rather than deliverer. Also the academic provides practical knowledge and support in laboratories. The design and delivery of the lecture course contents is all achieved within a framework that complies with QAA procedures, (Nortcliffe 2005a). In the past, students have provided highly informative lectures, for example live demonstration of weaknesses of network security systems. However supplementary teaching assessment was insufficient to promote greater depth of learning across the course subject matter, student learning demonstrated to be greatest in the subject on which they lectured, (Nortcliffe 2005a), we therefore needed to broaden student learning in a course. Previous assessment strategies of supplementary teaching one topic and an electronic summary of another topic have demonstrated that the e-summary (similar to an essay) has less potential for learning than supplementary teaching, (Nortcliffe 2005b). However, in theory, as illustrated in previous section, group submission of multi-choice questions and answers on a topic has the same potential for learning as supplementary teaching, Figure 5. Therefore each group of students was asked to volunteer to uncover another topic, then design and develop five multi-choice questions with justification of answers. The student submission was assessment one part two and fed into the sample phase test for all students. Figure 6 illustrates the assessment brief issued to the students for the latter assessment part of the assessment strategy.

In theory both parts of assessment one provide the opportunity for knowledge and understanding reaffirmation of the topic by each group and audience participating in the assessment (listening to lecture or completing sample phase test).

The final course assessments are:

- Assessment two: an applied application of theory to the research and development of a commercial web site (supported by laboratories)
- Assessment three: phase test to assess theoretical knowledge of the course

As the aims of the phase test are to assess a student's level of learning and knowledge retention of the course contents, multi-choice question and answers style of test is appropriate for assessing student's factual knowledge of a subject, (Caygill et al 2001).

Assessment one part two, sample phase test questions generated by the students has potential to aid student learning, familiarity and preparation for the fulfillment of assessment 3. Both parts of assessment one feed theoretical understanding to be applied in assessment 2. This learning, teaching and assessment of a course approach liberates academics from the work burden of marking a number of individual essay type assessments and promotes the academic as facilitator rather than knowledge deliverer.

Results in Practice

The Supplementary Teaching and Sample Phase Test Questions

The class size was 38 for this cohort. The student supplementary teaching assessment profile, Figure 7, mean mark of 60% and standard deviation of 8 is in agreement with the general consensus of opinion by the academic and the students that the quality of the lecture contents and delivery was very good, only some students demonstrated poor communication skills or research and dissemination skills.

The mean student mark awarded for the multi-choice questions was 53% and standard deviation 14. The quality of the submission for this assignment was lacking in comparison to the supplementary teaching, typically 2 questions out of 5 required modification and correction by the academic prior to posting on the

Blackboard sample phase test. Only one group of students generated 5 excellent questions and well justified answers. Figure 7 illustrates that the majority of students took the supplementary teaching assessment more seriously and researched the topic areas more comprehensively than the multi-choice question assessment. Students admitted privately that very few hours were applied to the multi-choice question assessment and only prior to the submission deadline as this was weighted less (15% weighting oppose to 25%) than supplementary teaching assessment, therefore they deemed it of lesser importance and effort, resulting in poorer student output, which is consistent with previous research (Grattan 1998). However, some students did make a significant effort and provided some thought-provoking applied questions, for example, Figure 8 and none of the submissions showed any evidence of plagiarism. The students' average grade and standard deviation (small) reflects that fact

The Phase Test Results

The phase test consisted of 50 moderated equal weighted multi-choice questions, covering all module lecture and laboratory topics, typically 4 to 5 questions per topic. The phase test was designed to assess the student's applied knowledge of the module. On the day of the phase test each student was presented with 25 randomly selected phase test questions of equal weighting. Figure 9 illustrates a typical phase test question of one-topic area of the module.

The class mean for the phase test was 39% and standard deviation of 7. Further analysis of the phase test results illustrated that:

- a mean of 53% and standard deviation of 39 was achieved on questions relevant to their chosen supplementary teaching topic.
- a mean of 49% and standard deviation of 39 was achieved on questions relevant to their chosen multi-choice questions topic.
- a mean of 46% and standard deviation of 41 was achieved on questions relevant to module laboratories.
- a mean of 35% and standard deviation of 10 was achieved on topic questions not researched and disseminated by the students either as a lecture or sample phase test questions.

- a mean of 40% and standard deviation of 11 was achieved by 9 students who completed the student generated sample phase test as part of revision (the mean sample phase test mark for these students was 36% and standard deviation of 13)
- a mean of 40% and standard deviation of 10 was achieved by 12 students who attempted, but did not complete the student generated sample phase test as part of revision

Note that typically only 2 out of 25 questions were in relation to the supplementary teaching topic; multi-choice questions (topic or laboratory) therefore induces a high standard deviation in the analysis. These results illustrate that; supplementary teaching, multi-choice questions and laboratories have an impact on student learning. Previous research has illustrated that assessment is a motivating factor for learning, (Entwistle 1997), as the level of learning demonstrated by phase test results correlate with the portfolio assessment strategy, that is the student learning is greatest on topic areas which relate to completed assessments; supplementary teaching, multi-choice questions and produce development in laboratories.

The results confirm the relationship between student commitment to fulfil an assessment to a high standard and the depth of learning of a topic. The original level of input by the students to supplementary teaching was more than multi-choice questions. Therefore the level of learning on the sample phase test topic would be anticipated to be less than for supplementary teaching and therefore reflected in the phase test results. The phase test results illustrate that the class mean phase test mark for the supplementary teaching topics is greater than the multi-choice questions topic, however only marginally by 4%.

The phase test results also indicate that the students' commitment to learning only occurs if it is tied to an assessment. Class mark is less on topics not assigned to an assessment. This commitment also extended to attendance, 38 students attended the first student lecture and 12 attended the last. This is as the supplementary teaching assessment was awarded in fortnightly blocks. Therefore as more students completed the assessment their commitment and learning motivation in the form of assessment diminished, resulting in reduced attendance. This also correlates with the readership of the academic and student lecture notes posted on blackboard. The initial readership is approximately 90 for academic notes, and 55 for student notes, in comparison for 38 for last academic notes and 25 for last student notes. The students took these actions despite the fact that there was an end of module phase test. These results illustrate again

the disengagement of the students in the learning process as they consider the learning is complete upon completion of an assessment. The lack of readership of the lecture notes and number of students who attempted the sample phase test also illustrated the lack of examination preparation on the part of the students. The latter in particular demonstrating the students' lack of ability to react to the sample phase test results to improve their learning prior to the phase test as these students only marginally improved their phase test score on the actual phase test. This further demonstrating students do not take phase tests seriously and this correlates with academic observations over a number of years that students consider multi-choice examination as easy, and therefore do not warrant any input on their behalf. However post the phase test the students' opinion of the phase test is that it was harder than they anticipated, countering their assumptions and actions that it merits no revision.

Student Reflections

The following tables illustrate the students' reflections on the supplementary teaching, multi-choice questions and resultant student sample phase test respectively in Table i-iii. The survey feedback response rate was 31%. Both assessment strategies, Table i-ii, demonstrate that the majority of students perceive that the assessment empowered them, but were unsure whether the exercises gave them a sense of being in charge of their learning. They agreed that they learnt more from the experience than receiving lectures on the topic; however, they were unclear whether they would like to repeat this assessment strategy again. The results for supplementary teaching are consistent to previous years', which suggest that they found the exercise gave them a sense of being charge of their learning, (Nortcliffe 2005). The results do clearly indicate the students prefer having the option to choose the topics for the assessments.

The resultant on-line student sample phase test is considered by the students to be helpful in supporting the teaching material and for revision purposes for the phase test, illustrated in Table 3. It should be noted that the survey was completed by the student's post completing the actual phase test and receiving their marks. Therefore the students do consider the student sample phase test a valuable tool for revision. This is despite the students' ability to only marginally improve their performance in the actual phase test.

Conclusion

The phase test results illustrate that students gained a deeper level of learning on a topic associated with an assessment. However the weighting of an assessment is critical to encouraging and motivating students to complete an assessment to a high quality, incorporating a greater depth of learning. The smaller the weighting the more likelihood the students will consider it of less academic worth and therefore warrant it less effort. The results of the students' reduced quality of input into completing an assignment is reflected in the phase test results. Previous research indicates this is true, however when a high weighting is used as an incentive to encourage student learning in new skills, a high weighting is perceived as too much risk with greater potential to fail, (Grattan 1998). There is need for balance, as when some students did apply themselves and invested their time they provided thought provoking applied questions for multi-choice assessment strategy (the assessment of lesser weighting). One solution to the problem would be to indicate the level of dedication required to complete an assignment in terms of study hours, rather than weighting. For example for a 10-credit module a student is expected to apply in addition to attending lectures and laboratories 120 hours of study. Therefore 15% weighted assignment requires 18 hours of commitment; as oppose to the couple of hours actually applied by the majority of students. All questions submitted by the students demonstrated no evidence of plagiarism that is question and answers were original. In addition due to lack of an active use of the sample phase test and effort applied to the question design and development by the majority of the class, Figure 3 best represents the model of student learning.

The module assessment and attendance results also illustrated that students disengage from learning a topic if it is not associated with an assessment. Therefore students are only willing to engage in the deep learning of topic areas of a module if coupled to an assignment, which is in line with previous research (Entwistle, 1997). However the phase test assessment did not provide the same motivation as the majority of the students failed to prepare for the phase test. This can be concluded by the fact that students believe multi-choice examinations are easy, in practice this has proven to be true as students find it easier to recognise a complex answer than construct an answer, (Caygill et al 2001), however students still need to know and understand a topic in order to recognise a correct answer amongst incorrect ones. It is also noted

that previous research has indicated that a quarter of multi-choice questions are guessed correctly, (Clements et al 1995), therefore for 4 multi-choice question and answers a grade of 25% is achievable by guessing alone, but this is still insufficient to pass. One future solution would be to encourage students to prepare for the phase test by demonstrating regularly the collated student comments from previous cohorts about the phase test.

Reflective practice has been shown to be an effective method of learning improving metacognitive understanding, (Cuthbert 1998). Therefore in future, encouraging the students to regularly attempt the student phase test, ideally each time it has been updated with a new set of student phase test questions or utilize student multi-choice questions to quiz the students after each lecture would be an effective method for students to check their learning, (Gibbs 1994). This regular testing would provide an opportunity for the students to reflect upon their learning in the lecture and identify any shortcomings in their understanding and knowledge and encourage further reading of a topic.

An extra level of learning could be achieved for the multi-choice questions assignment through providing a discussion forum for the students to feedback their opinion on the questions. This would provide additional feedback for the students who developed the questions and another metacognitive understanding of a topic. This approach is not dissimilar to that adopted for the supplementary teaching assessment exercise whereby each audience member is required to provide a feedback sandwich at the end of each lecture for the student deliverers. This method of feedback provides timely feedback for the student deliverers and due to the greater number of assessors generates more reliable feedback, (Falchikov 1998), for the students to act upon and reflect on their learning.

In conclusion students achieved a greater depth of learning of a topic associated with an assignment and multi-choice questions assignment has the potential for deep learning if deemed by students to have more worth i.e. a greater investment of their time, otherwise lesser model of student learning is achieved. By indicating number of hours of commitment required oppose to assessment weighting has the potential to encourage students to make that investment. Equally applying multi-choice questions or a discussion of the questions after each lecture will assist students to reflect on their learning.

References

- Biggs, J. B. (1987) *Student approaches to learning and studying*, (Hawthorn, Victoria: Australian Council for Educational Research)
- Caygill, R. and Eley, L. (2001) Evidence about the effects of assessment task format on student achievement, in *Proceedings of Conference of the British Educational Research Association, Leeds, UK*,
- Clements, M. A. and Ellerton, N. F. (1995) Assessing the effectiveness of pencil and paper tests for school of mathematics, *Proceeding .of 18th National Conference of the Mathematics Education Research Group of Australia, Darwin, Australia*
- Cuthbert, K. (1998) An action research evaluation of a first year 'learning to learn' unit: the role of reflection and metacognition, in Rust, C. (Ed) *Improving Student Learning: Improve Students as Learners* (Oxford: Oxford Brookes University)
- Entwistle, N. (1997) Contrasting Perspectives on Learning in Marton, F., Hounsell, D. & Entwistle, N. (Eds), *The Experience of Learning* (2nd ed. Edinburgh: Scottish Academic Press)
- Falchikov, N. (1998) Involving students in feedback and assessment: a report from the Assessment Strategies in Scottish Higher Education (ASSHE) Project, in Brown, S (ed) , *Peer Assessment in Practice* (Staff Education Development Association (SEDA): Scotland,)
- Flint, A. (2005) Defining Plagiarism, *Workshop on Defining Plagiarism: Faculty Of Arts Computing Engineering and Science, Sheffield Hallam University*
- Fry, H., Ketteridge, S. & Marshall, S. (2001) *Handbook for teaching in Higher Education enhancing academic practice*,(Kogan Page: London)
- Gibbs, G., Habeshaw, S. and Habeshaw, T. (1994) Chapter 8: Checking Learning in *Interesting ways to teach: 53 Interesting things to do in your lectures* (Bristol: Technical and Educational Services)
- Gibbs, G. and Simpson, C. (2004-2005) Conditions under which assessment supports students' learning *Learning and Teaching in Higher Education*, 1, 1, pp. 3-31

Glover, C. (2005) Summary of FAST project findings, *Workshop on Student Feedback: Subject Area SET, Faculty Of Arts Computing Engineering and Science, Sheffield Hallam University*

Grattan, J. (1998) IT Skills Emplacement: learning environment and assessment *Journal of Geography Higher Education*, 22, 3, pp 407-412

Hakel, M.D. and McCreery, E.A.W. (2000) Springboard: student-centred assessment for development in Fallows, S and Steven, C (Eds), *Integrating key skills in higher education : employability, transferable skills and learning for life* (London : Kogan Page,) pp. 131- 139

Heberling, M. (2002) Maintaining Academic Integrity in Online Education, *Online Journal of Distance Learning Administration*, V, I, <http://www.westga.edu/~distance/ojdla/spring51/heberling51.html>

Mooney, M. A. and Mooney P. J. (2001) A student teaching-based instructional Model *International Journal of Engineering Education* 17, 1, pp. 10-16

Nortcliffe, A. L., Featherstone, S., Garrick, R. and Swift, G. (2003) Supplemental Instruction a Higher Level Learning? in W Aung, M. W. H. Hoffmann, N. W. Jern, R. W. King and L. M. S. Ruiz, (ed.), *Engineering Education and Research – 2002: A Chronicle of Worldwide Innovations* (USA: International Network for Engineering Education and Research) pp. 30

Nortcliffe, A., Featherstone, S., Garrick, R. & Swift, G. (2002) Student engineers: lecturing, teaching and assessing, in *Proceeding of International Conference on Engineering Education Manchester, UK*

Nortcliffe, A. (2005a) Student driven module: to promote independent learning, *International Journal of Electrical Engineering Education*, 42, 3, pp. 247-266

Nortcliffe, A. (2005b) How can Blackboard assist in Assessment and Facilitation of Knowledge Exchange?, in *Proceeding of International Conference on Engineering Education Gliwice, Poland*

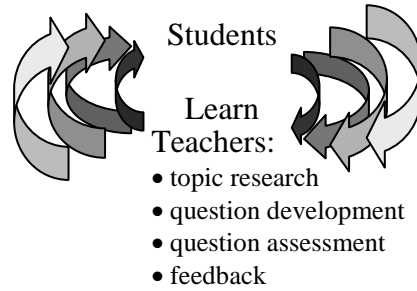
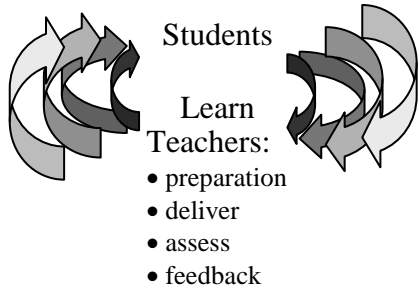
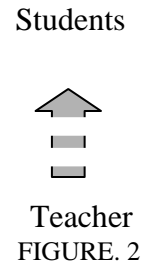
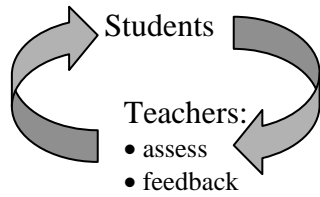
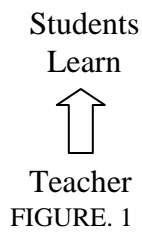
Parker, N. (2001) Student learning as information behavior: exploring Assessment Task Processes, *Information Research*, 6, 2

Pitt, M (2006) Introduction to Plagiarism: providing strategies to address the issues Workshop *The Higher Education Academy Plagiarism Workshop, Sheffield*

Powell, J.J. (1998) Reducing Teacher Control in Boud, D.(Ed), *Developing Student Autonomy in Learning* (Kogan Page: London) pp. 109-118

Ramsden, P. (1992) *Learning to teach in Higher Education* (Routledge: London and New York)

Wallace, J. (2001) Supporting and guiding students, in Fry, H., Ketteridge, S. & Marshall, S. (ed), *Handbook for teaching in Higher Education enhancing academic practice*, (Kogan Page: London) pp182



Assessment Brief: Sample Phase Test Questions

Research the topic area comprehensively and prepare 5 multiple-choice or match questions on the topic. For each question justify the validity of the question and each response answers in your own words in reference to your research findings. The questions are required to comprehensively test the knowledge of the user of the topic area. The questions will be placed on blackboard and utilised for discussion forum and to provide a sample phase test for fellow students on this topic area.

FIGURE. 6

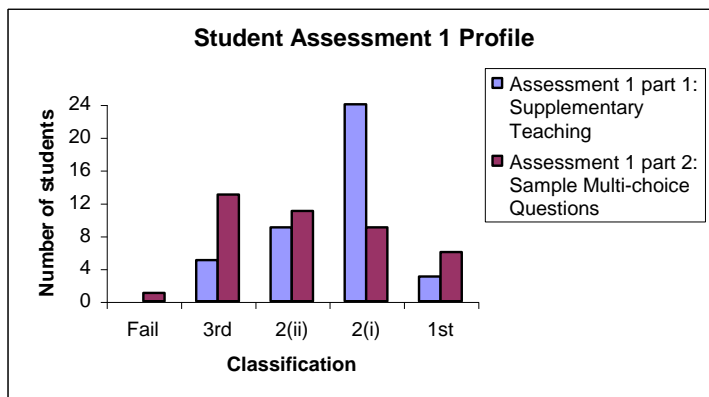


FIGURE. 7

Example Assessment 3 Phase Test Question

Which of the following biometric methods of security is **not** currently practical for adoption in a large 'University type' environment?

- a) Swipe Card
- b) Fingerprint recognition
- c) Iris recognition
- d) Finger blood vessel recognition

FIGURE. 8

Student Question

✓
Many distributed object protocols such as DCOM, RMI and IIOP are blocked by corporate firewalls (see Figure i). How does SOAP overcome this problem?

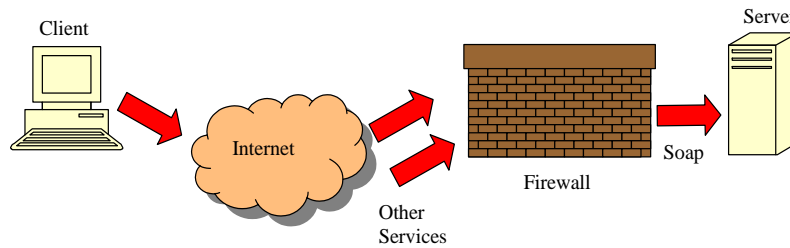


Figure i

- a) SOAP tunnels through the firewall using HTTP and port 80.
- b) SOAP protocol has its own specific port numbers, which allows it through the firewall.
- c) The system administration can easily set up the firewall to allow SOAP through.
- d) SOAP uses port spoofing, which enables it to change its port 'on the fly'.

FIGURE. 9

TABLE i

STUDENT'S REFLECTION ON SUPPLEMENTARY TEACHING

QUESTION	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	MAYBE	DON'T KNOW
Did developing and giving the lecture empower you?	15	23	23	31	0	0	8
Did developing and giving the lecture give you sense of being in charge of your learning?	15	15	23	31	8	0	8
Did you find developing and giving the lecture stressful?	23	23	31	23	0	0	0
Would you like to do the developing and giving the lecture again?	0	46	0	23	31	0	0
Did you learn from developing and giving the lecture experience?	15	39	23	15	8	0	0
Did you learn more from developing and giving the lecture than if you had lecture on the material?	15	23	15	30	15	0	0
Did you like being able to choose your topic for lecture?	15	46	15	15	8	0	0

TABLE ii

STUDENT'S REFLECTION ON MULTI-CHOICE QUESTIONS

QUESTION	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	MAYBE	DON'T KNOW
Did developing and posting the phase test questions empower you?	0	38	15	15	8	8	15
Did developing and posting the phase test questions give you sense of being in charge of your learning?	8	31	15	23	15	0	8
Did you find developing and posting the phase test questions stressful?	8	31	23	23	15	0	0
Would you like to do the developing and posting the phase test questions again?	8	31	23	15	23	0	0
Did you learn from developing and posting the phase test questions experience?	8	31	31	15	15	0	0
Did you learn more from developing and posting the phase test questions than if you had lecture on the material?	8	31	31	8	23	0	0
Did you like being able to choose your topic for phase test questions?	8	61	15	8	8	0	0

TABLE iii

STUDENT'S REFLECTION ON RESULTANT STUDENT ON-LINE PHASE TEST

QUESTION	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	MAYBE	DON'T KNOW
Were the student on-line phase test questions helpful in supporting the lecture contents?	0	31	23	15	15	0	15
Were the student on-line phase test questions helpful in supporting revision for the phase test?	0	31	38	15	8	0	8