

EVALUATION OF COMPUTING STUDENTS PERFORMANCE USING GROUP BASED LEARNING ONLINE AND OFFLINE

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Abstract

The context of this research relates to work started over four years ago to investigate the importance of on-line learning in Higher Education (HE). This study reports on our most recent work undertaken at the University of Hertfordshire over a one-year period related to the evaluation of group working assignments. One hundred and eleven second year students participating in a combined studies course took part in this study. The main motivation for this research was to investigate the potential of a Managed Learning Environment to support assessment of collaborative working and collaborative learning. The study described in this research therefore, involved the use of a Managed Learning Environment to set up, manage and support student group working and assessments. The study was a comparison between performance on assessments and attitude in matched group activities performed by learners online and offline. A range of quantitative and qualitative methods were used to investigate student performance and attitude in this study. The results of the quantitative analysis on mean assessment scores demonstrated that learners performed better online than offline ($p < 0.001$) in matched assessments. Correlation analysis showed that individual learners in groups performing well online also performed equally well offline ($p < 0.001$) and groups performing well in online environments also performed well in offline environments ($p < 0.02$). An analysis of student logbooks using an expert rater showed that the number of positive comments reported by students was similar for online and offline group working. However, there was some evidence that some students were more negative in their comments of the online learning experience, preferring offline group work. Details of the qualitative ratings and analysis of individual student logbooks is reported in the paper.

Keywords

Managed Learning Environment, Evaluation, Group Work, Online, Offline.

Introduction

There are a number of driving forces at present in Higher Education (HE) to use online technology to support teaching and learning. The government policy to widen participation as set out in the White Paper on the future of HE and the Dearing Report (NCIHE, 1997). The Department for Education and Skills e-learning strategy (DfES, 2005), and HEFCE's e-learning strategy (2005). Furthermore, with JISC funding research in this area, the increased availability of the infrastructure, the availability of the internet and networking means that online technology can be used as a resource in supporting teaching and learning and a tool for collaborative learning. Group work is a means of working more creatively and a means to improve learning (Thorley & Gregory, 1994; Edwards & Clear, 2001). Group working is a way of dealing with large student numbers and time constraints (Edwards & Clear 2001; Pilkington et al 2000; Doolan & Barker, 2001). Group work is also necessary because of growing employer demands for a better quality of graduate (Harvey & Mason (1996); Dearing (1997); Doolan & Barker (2004). The study described in this research therefore, involved the use of a Managed Learning Environment (MLE) to set up, manage and support student group working and assessments.

The following research questions relating to the use of group working in online contexts are explored in this study. These are answered by using qualitative and quantitative comparisons of student group work.

- RQ1. Is there a difference between learner performance in on-line and off-line group working?
- RQ2. What is the students' attitude to using on-line group working as compared to offline group working?

In this study learner performance was measured in terms of learning outcomes thus the learner performance in the online and offline group work was regarded as a measure of learning in this study.

The Course

One hundred and eleven second year students studying an undergraduate information systems development course on a combined modular programme took part in this study. The overall aim of this course was for students to develop a computer-based, user-friendly information system. The course was built around information systems case studies. For this assessment the students were provided with a case study based on a child-minding agency, which required a computer system to replace the current paper based system. The case study was as realistic as possible requiring students to role-play. For the assessment the students were required to undertake five activities which demonstrated application of the principles and techniques of system development in a team environment, thus fostering and developing collaborative working skills and acquiring practical experience in the application and evaluation of techniques for development. Full assignment specification including activities and assessment

criteria was distributed to students. Students were made aware that all activities were assessed after the final submission deadline. Students were provided with two lectures on group work. An introduction to the group area online was provided by means of screen shots on OHP slides in a scheduled lecture. This took place in a lecture when distributing the assignment specification. It was not felt necessary to train students to use the system as these students were introduced to the MLE in their first year of study.

The Study

This study was carried out over a one-year period with one hundred and eleven second year students studying an information systems development course. The study was a comparison between performance on assessments and attitude in matched group activities performed by learners online and offline. Students were divided into groups which were randomly selected from a tutorial class list and allocated by the tutor. The groups were randomly selected to ensure a cross section of learning ability and learning style. Groups were paired in order to perform both on-line and off line activities. As tasks involved role playing, groups acted as clients and developers for part of the assignments and later switched roles. Groups were provided with their own personal 'group discussion' area on the MLE for the group to work securely to complete the activities for the assessment. Communication exchange was therefore asynchronous. Students used the discussion facilities via the MLE in their own unsupervised time. Students had the opportunity to share documents, resources, news and also to plan their project. Students were encouraged to use these facilities freely to complete the activities according to the needs of the group. Students were provided with all the relevant templates required to undertake the activities for this assignment with all activities based on the case study provided for the assignment.

Methodology

A mixture of quantitative and qualitative evaluation was used to assess the effects and effectiveness of the MLE in supporting group work. To do this, an analysis of student reflective logs was used in the evaluation, as all students had to fill them in as part of the assessment. Quantitative data related to scores obtained in two summative assessments for the course. In the two assessments, students undertook five matched activities, both online and offline. The online and offline assessments were similar in every respect for the groups. For both activities the following is a summary of the group activities:

- Task 1 was an organisational task where students had to provide group information and basic planning for the problem.
- Task 2 required the completion of an information gathering activity
- Task 3 related to gathering the requirements for a software development task

- Task 4 related to reporting on issues in the design of an appropriate computer interface, based on the requirements for a computer system.
- Task 5 was the production of an individual student reflective logbook.

In performing the tasks, a range of communication, information gathering and role play activities were employed, the difference being that the online assessment required all activities to be completed using the MLE, and the offline assessment relied only on e-mail and basic word processing on the computer.

Student attitude was measured by detailed examination of logbooks. Issues to be considered and reported in the logbook were designed to investigate a set of topics related to student perception of online and offline group working and assessment. Topics raised in the log books were therefore open in their nature, in an attempt to allow the students freedom to provide their own accounts of meaning and for information about their learning experiences to emerge. The emphasis of this approach in the study, using mixed qualitative and quantitative methods, allowed a variety of educational practices and learners experiences to be integrated, while identifying best practice and problems with practices and pedagogy. The sample of one hundred and eleven students were requested to complete the reflective log, forming part of their group report, submitted by the student for assessment. The logbook responses submitted in this way were coded and analysed for positive and negative responses related to online and offline experiences. The total number of positive comments made by each individual group member and the total number of negative comments made by each individual group member for online and offline group work was recorded. Students' attitudes were also rated using a Likert type numbering scale between one and ten, where one represented poor five represented average and ten excellent. To check for researcher bias in selecting positive and negative comments an inter-rater reliability test Cohen Kappa was performed. It was intended to provide a level of confidence in the data. Every positive and negative comment was given a number between one and four and sorted by number, a total of twenty positive and negative comments were selected (all number four). These were merged and mixed in a file and sent for independent analysis. An independent expert researcher was used in order to check the reliability of the rating system employed. In order to address inter coder and intra coder reliability, the above mentioned strategy was followed individually and then carried out by two independent researchers. The results in the form of an agreement matrix are shown in table 1.

Table 1 Researcher comparison intra coder reliability test			
	Pos.	Neg.	DK.
Pos.	17	1	0
Neg.	0	15	0
DK.	1	2	1

Table 1. Agreement matrix

Values highlighted in bold in the table show agreement between the two individual researchers. The table shows how the researchers agreed on positive and negative comments elicited from the student evaluation documents. The reliability of these categorisations is tested using Cohen's kappa (k) statistic where agreement between the evaluations of two raters (rating the same comments) is measured. The result is shown in table 2.

Table 2 Result of Cohen's kappa test for inter-rater reliability			
Measure of Agreement Kappa (k)	Value	Std. Error ²	Sig.
	.808	.085	.000
N of Valid Cases	37		

² Not assuming the null hypothesis

Table 2. Cohen's kappa

As the table illustrates the Measure of Agreement k is above .7 which shows a reliable agreement thus the value in the table .808 shows that the problem classification is reliable and that the ratings were in agreement.

Results

In the following section, the results of the study are presented. Eighty-four percent of students' reflective logs were analysed. Sixteen percent were not used as these students either did not submit their individual reflective log and therefore gained zero or partially submitted (they did not submit both online or offline students' reflective logs). These were not used as they would skew the data. The results to the research questions presented in the introduction relating to the use of group working in online contexts are explored in this study.

RQ1 Is there a difference between learner performance in on-line and off-line group working?

Learner performance we measured in terms of learning outcomes thus the learner performance on the online and offline group work was regarded as a measure of learning in this study.

As stated previously, an important objective of this research was to compare performance for learners and groups of learners when working online and offline. It was important to understand how online group working compared to offline group working in this respect, since the research took place in a real educational context and was used for summative assessment in a university context. It was also important to understand whether or not some learners were disadvantaged by our approach. The hypothesis was that the online environment would facilitate greater opportunity for collaboration and that the supportive opportunities afforded would lead to better performance. It was further hypothesized that those performing well offline would also perform well online and thus not be disadvantaged by the approach.

It was therefore decided to perform a statistical analysis of on-line and off-line learner performance in the two module group work assessments, which were designed to be equivalent. The mean scores obtained by learners in these assessments are shown in table 3 below.

Table 3 Mean scores obtained by individuals in online and offline group working (N=111)	
Mean Score Online (SD)	Mean Score Offline (SD)
6.46 (1.83)	4.43 (1.94)

Table 3. Mean Scores Individual Online and Offline

A repeated measures analysis of variance (ANOVA) was performed to test the significance of the difference in the mean score obtained by learners. The results of this ANOVA ($F=126.11$, $df= 109$, $p<0.001$) support the hypothesis that performance was improved for learners in online group work as compared to offline.

In order to test whether individual learners were performing relatively the same in each environment, a Pearson's Product Moment Correlation was performed on the individual test scores summarised in table 3 above. Online scores were correlated with offline scores for each individual. The results of this analysis showed that the scores were significantly related and well correlated ($N=111$, $\rho=0.488$, $p<0.001$). This supports the hypothesis that individual learners performing well offline also perform well online, though online performance was better.

It was decided to investigate whether group performance behaved in a similar way and that the findings for individuals was also true for the groups, as might be expected.

Table 4 below shows the mean scores obtained by the groups in the study in online and offline environments.

Table 4 Mean scores obtained by groups in online and offline group working (number in GP = 4)		
Group No	Mean Score online	Mean Score Offline
1	8.00	6.38
2	8.00	6.50
3	8.00	.00
4	8.00	6.00
5	8.00	3.17
6	8.00	6.17
7	7.75	6.13
8	7.50	2.88
9	7.50	4.63
10	7.50	5.50
11	7.50	5.50
12	7.38	4.13
13	7.33	5.17
14	7.00	6.50
15	6.88	6.25
16	6.75	5.13
17	6.75	4.50
18	6.50	4.75
19	6.25	4.38
20	6.25	2.83
21	5.83	5.83
22	5.63	4.00
23	5.63	5.13
24	5.50	4.75
25	5.17	4.33
26	5.00	1.50
27	4.88	3.88
28	3.67	3.67
29	3.13	2.63
30	2.88	1.00

Table 4. Mean scores obtained by groups

A repeated measures ANOVA was performed on the group data in table 4 above ($F=45.43$, $df=29$, $p<0.001$). This analysis supports the hypotheses that groups

perform better in an online environment than offline. In the same way that we had to be sure individuals were not disadvantaged by online working, a Pearson's Product Moment correlation was performed to test the relationship between scores obtained in online and offline environments. The results of this analysis (N=30, $\rho=0.456$, $p=0.011$) support the hypothesis that those group performing well in the offline environment also perform well online.

RQ2 What is the students' attitude to using on-line group working as compared to offline group working?

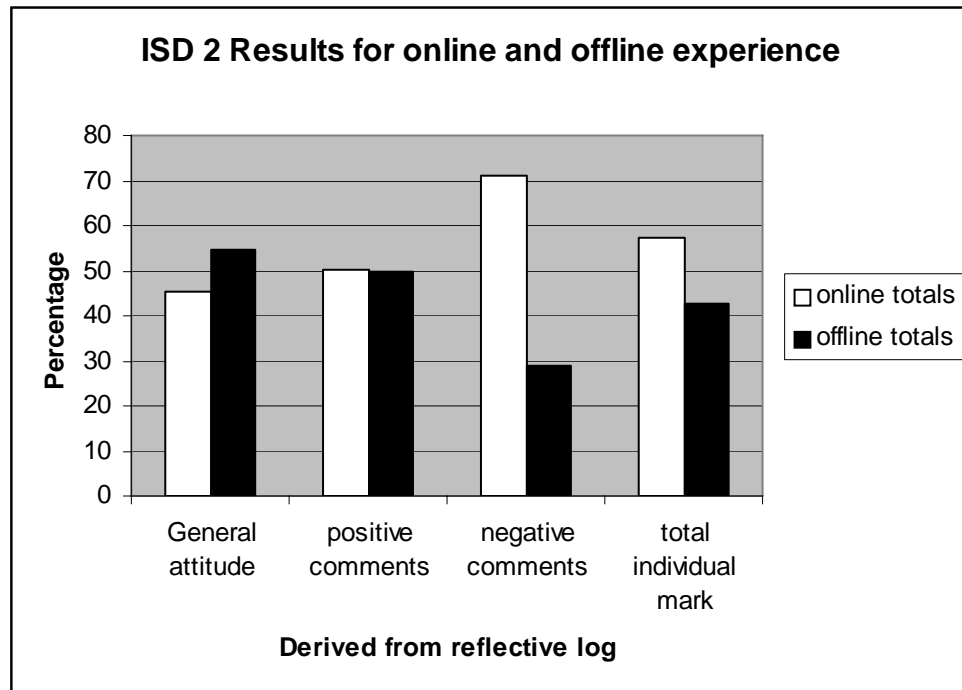


Figure 1. A comparison of attitude to online and offline group working and assessment

Student attitude was derived from the students' reflective logs by taking an overall view about student observations of their online and offline learning experience as documented in the students' reflective logs. Attitude was rated between one and ten. The individual group members received an attitude rating. All percentages in figure 1 were rounded up. A very positive attitude gained ten while a negative attitude gained one with five representing average. Results indicate that the number of positive comments reported by students was similar for online and offline group working. However as shown by the results in table 5 the students were more negative in their comments of the online learning experience preferring offline group work. Students reported that undertaking interviewing was particularly difficult online. They found difficulty in understanding how to perform the interviewing activity online and reported that insufficient guidance was available from the tutor. Students found particular difficulty in understanding how asynchronous communication could be used in this way. As the communication was not in 'real time' students reported the delay in

responses. Students also reported that it was difficult to get all group members online at the same time. Reasons given were timetable constraints, difficult to find a time that suited all, organisational difficulties, not knowing other members in the group, and a reluctance to provide contact details such as mobile phone numbers. This was an interesting finding given that in general the reasons provided here tend to be cited as problems for group work in the traditional face to face manner. Generally to overcome the difficulties reported students cited the use of email, mobile phones, MSN and meeting face to face.

Positive comments for group work online included: "I found the interviewing task very easy on line as both groups had come to an agreement prior to the interviews commencing that each time an interview was conducted each person would reply as soon as possible to make the whole process easier". Other groups cited using online methods for interviewing was easy though this was not the experience of the majority as previously discussed. Some students reported that working online provided the opportunity for groups to meet at times and locations convenient to them a student quotes "interviewing online had the advantage of being able to be done at the convenience of everyone". Some students reported that they found interviewing online a lot better than face to face as they felt comfortable and less exposed asking questions.

Discussion of Findings

RQ1 Is there a difference between learner performance in on-line and off-line group working?

One indication of evidence of performance was the comparison of online group work and offline group work. A statistical analysis was performed and results shown in table 3 indicate that the mean score (sd) for online group working is 6.46 (1.83) and 4.43 (1.94) for offline group working. These results were taken to indicate that students performed better working in groups online than offline. Performance is an important measure of learning outcomes for learners and lecturers. This study found that performance was improved for learners in online group work as compared to offline as there was a significant difference in the mean score obtained by learners. ($F=126.11$, $df= 109$, $p<0.001$). In order to test the relationship between scores obtained online and offline for individual students, a Pearson's Product Moment Correlation was performed. This showed that scores were significantly related and well correlated ($N=111$, $\rho=0.488$, $p<0.001$) hence, individual students who performed well online also performed well offline.

One could ask, does student preference for online or offline working have an effect on performance? Evidence from the student reflective logbooks in table 3 show that a positive attitude to online group work possibly led to greater motivation. Valenta (2001) reported that students perceive that they would get a better result online than offline. It is not unusual for students to perform better

online than offline (Koch 1999; Bee 1998 as cited in Valenta 2001). Valenta (2001) suggest that distance education students earned higher grades than students in conventional versions of the same classes. Bee (1998) found that students who participated in web-based learning improved their course performance (as cited in Valenta 2001). Parker (2001) compared conceptual and technique learning online and offline and found no significant difference in the final exam scores between traditional and online students. Students taking the online option scored significantly higher on conceptual section of the final exam than the traditional students. There were similar findings in our study, in that students performed significantly better online in the summative assessment than offline.

RQ2 What is the students' attitude to using on-line group working as compared to offline group working?

As might be expected, attitudes were often somewhat mixed to online group working and assessment. Some students reported an increase in workload with a time delay, they found that it took time to receive a response to a question posted online, particularly throughout the second task, which required them to complete an online interviewing exercise. This probably resulted in increased workload immediately prior to the assignment submission date, leading perhaps to a negative attitude. (Barrow, Jeong, & Parks 1996; Guernsey 1998; as cited in Valenta 2001) also found that students' workload was increased. Students often reported difficulty communicating online and that they felt that they needed to physically be in contact with other group members. (Guernsey 1998; Larson 1999; Hiltz 1998; as cited in Valenta 2001). Doolan & Barker (2001) similarly found that students preferred face-to-face contact in many online group situations. An interesting finding from this study was that some students reported that when using the online technology, it lacked person-to-person interaction and this was reflected in a lack of leadership. This would enable the group to gel together in an offline situation and provide direction for undertaking tasks in the assignment.

The finding that performance was improved online for groups and individuals was an important outcome of this study. We also showed that individual learners who scored well online also scored well offline, and were thus not disadvantaged by the online component of the assessment. The attitude measures were able to show that despite some problems, students had a positive attitude to online group working. It is possible that increased motivation was a factor in the observed improved online performance, and also the greater organisational facilities provided by the online environment were also a factor.

Future Work

In carrying out the analysis for this study, qualitative data collection was by means of student reflective logs to establish how MLEs impacted on learners

working in groups. Learning was measured in terms of learning outcomes, i.e. student performance. This study essentially focused on the product in terms of student performance. In the future it would be beneficial to revisit the students' reflective logs, to establish a deeper understanding of how the individual students' learning took place, looking specifically at individual learners and their role in the group process, whether being in a 'good' group has helped or hindered learning and visa versa. The students carried out online group work followed by offline group work. It would be interesting to see the results of offline work followed by online work. Some of the problems identified by students in their reflective logbooks such as being unfamiliar with other members in their group, being reluctant to exchange contact details in particular mobile phone numbers may have been resolved by carrying out the offline group work prior to the online group work. For the next cohort of students' studying on this course, the author intends to change the case study, provide the students with similar set of activities, carry out the offline group work first followed by the online group work and make a comparison with the findings from this years study thus a longitudinal study will be undertaken to better understand and identify sources of differences.

Online assessment is becoming increasingly common in HE. Greater reliance is also being placed on group assessments, both online and offline. This is because group working is an important life skill and also for reasons of economy, as student staff ratios increase. It will be important in the future to understand how computers can be used to support the kind of complex assessments as were employed in this study. Students will need to use online group working in their studies and in their lives and we as educators need to be clear about the processes involved. It is hoped that this study will be useful in designing future group working assignments and in understanding their effect on learner performance.

References

Dearing, R (1997). Higher Education in the learning society: Report of the National Committee of Inquiry into Higher Education, London: NCIHE Publications (HMSO), July.

DfES, (2005). The Department for Education and Skills e-Strategy, 'Harnessing Technology: Transforming learning and children's services", 15 March 2005.

Doolan, MA. and Barker, T. (2001). An Online Discussion Forum to Support Assignments: Exploring The Problem Of Ownership, in Proceedings of the Computer And Learning (CAL) 2001 Conference, April 3 -4, Warwick, p.44-45.

Doolan, MA. and Barker, T. (2003). Measuring The Effectiveness of StudyNet In The Context Of Online Learning Environments, in Proceedings of the Computer And Learning (CAL) 2003 Conference, April 8-10, Belfast, p.83.

Doolan, MA. & Barker, T. (2004). "Evaluation of the use of "StudyNet" a Managed Learning Environment to support collaborative working and collaborative learning". Proceedings of Online Educa, Berlin 2004.

Edwards, M.A. & Clear, F. (2001). Supporting the collaborative learning of practical skills with Computer-Mediated Communications technology. Educational Technology and Society 4(1), ISSN 1436-4522.

Harvey, L.& Mason, (1996). A quality graduate. In Tait, J. & Knight, P. (Eds) The management of independent learning, pp 30-28. Kogan Page: London.

HEFCE's e-learning strategy (2005) Higher Education Funding Council for England, Joint Information Systems Committee and Higher Education Academy, March 2005.

Parker, D. (2001). Inside online learning: comparing conceptual and technique learning performance in place-based and ALN formats. JALN, (5), Issue 2, September 2001.

Pilkington, R., Bennett, C., Vaughan, S. (2000). An evaluation of Computer Mediated Communication to support group discussion in continuing education. Educational Technology & Society 3 (3) 2000 ISSN 1436-4522.

Thorley, L. & Gregory, R. (1994). Using group based learning in higher education. Kogan page: London.

Valenta, A. (2001). Identifying students attitudes and learning styles in distance learning. JALN (5) Issue 2, September 2001.