

Enhancing Class Communication by E-learning Platform

Assoc.Prof.Dr.Arnat Leemakdej

Faculty of Commerce and Accountancy, Thammasat University

ABSTRACT

E-learning platform has been used in academic institutes with hope that it can enhance the learners' performance. This study investigates how Moodle, a free E-learning platform, can be used as additional channel for learners to communicate with an instructor. Through a sample of five courses in finance conducted at Thammasat University during 2007-2008, the paper finds significant improvement in the performances of learners who intensively use Moodle. There is no difference in terms of users' gender and the level of their studies.

Index Terms— E-learning, Moodle, Hybrid learning

1. INTRODUCTION

E-learning can be offered in various forms. Welsh *et al* (2003) extensively reviewed e-learning literature and classified it into three forms, asynchronous, synchronous, and hybrid. Asynchronous e-learning is a system in which an instructor pre-produces learning materials and learners can study by themselves any time. Synchronous e-learning requires learners to log into the system at pre-defined schedule and allows them to interact with instructors real-time. Hybrid e-learning is a blended e-learning. The hybrid also includes the case when any form of e-learning is mixed with classroom style. Zhang and Nunamaker (2003) emphasized the contributing role of e-learning to constructivism theory in learning. This approach focuses on learners' participation and reflection by learners. Learners can choose their own way of learning. Moodle (www.moodle.org) is a Learning Management System (LMS) that was developed with this feature in mind. Moodle's features reflect this in various design aspects, such as making it possible for learners to comment on entries in a database or even to contribute entries themselves.

This paper investigates the role of Moodle to enhance communication in the class. The author has conducted 5

classes during 2007-2008 at the Faculty of Commerce and Accountancy, Thammasat University in a hybrid form. Classroom teaching is blended with asynchronous e-learning platform. Moodle is not meant to replace conventional teaching in these classes but it is considered as additional channel for instructor and learners to communicate outside classroom. The main objective of this paper is to study the behavior of learners on Moodle usage. The characteristics of the learners can be classified by sex, level of education, and their past performance. The pattern of Moodle usage will be quantified into score and then link with the performance in the class. The result of this study can give insight on how the new technology can enhance learners' understanding on the subject.

2. MOODLE LMS SYSTEM

Moodle is a free open source software and widely used in many educational institutes. The data from Moodle.org website claims that there are 38,896 registered sites with 16,927,590 users as of January, 2008.

The author installed Moodle on the server where learners can log on at <http://learn.velocall.com>. The course list and short description are displayed on the first page as shown in Figure 1.

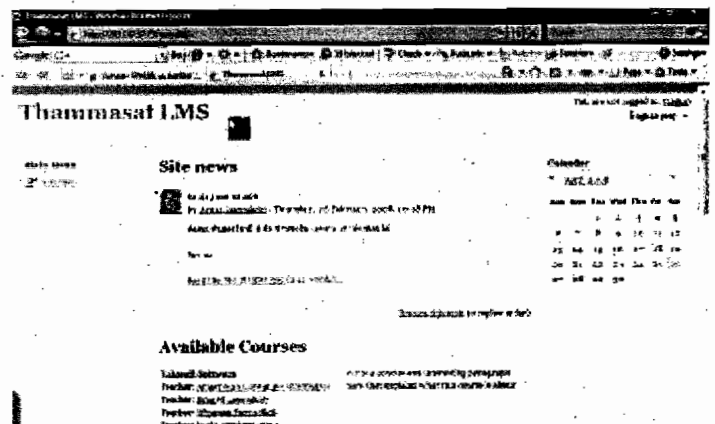


Figure 1 Moodle Homepage

When learners want to see detail in any course, they need to log into the system. In order to keep track with learners' behavior, Moodle requires the learners to identify themselves. There are many methods to create the user account, the author considers that the e-mail verification method is the most convenient. For the first time, learner needs to create his own account by giving personal information including name, e-mail, and location to the system as shown in Figure 2. Moodle will create the user account and send e-mail to the user. The user needs to click link given in the e-mail in order to activate his account. The method enables instructor to authenticate the learner by linking identities of the learners with their e-mail's address.

Figure 2 Creating User Account by Moodle

This method has some drawback as some learners' e-mail system might consider the mail sent from the system as spam. The author occasionally needed to manually activate the accounts that were created by learners.

The author encouraged all learners to use the system but not obligation. All handouts and supplement readings are only available in the system. However, the learners could access to those materials by getting a copy from their classmates who subscribed to the system. Those who did not use the system merely lacked the ability to communicate with the instructor by this channel. This gives us an opportunity to investigate the performance of the learners who use Moodle as additional communication channel and

those who did not. For the total learners of 182, there were 110 of them who subscribed. Some of them still use the system even after the class was over.

Figure 3 shows the class teaching materials that learners can download from the system. There are power points used in the class, related articles, and supplement readings. Occasionally, a group assignment will be posted in the forum as shown in Figure 4. Representative of the group needed to subscribe and posted assignment on the web. The assignment could not be viewed by other learners but the instructor. Score and comments from the instructor were posted on the web where each group can monitor the score given to them. Moodle is so flexible that an instructor can either allow learner to write the answer directly on the system or upload the file to the system. This makes it more convenient for learners to submit their assignment that needs spreadsheet or picture.

Figure 3 Contents of the Course

Week	Topic	Assignment type	Due date	Submitted	Grade
4	Financial Derivatives	Group assignment	Monday, 11 June 2007, 10:30 AM		
5	Financial Derivatives	Group assignment	Monday, 11 June 2007, 10:30 AM		
11	Financial Derivatives	Group assignment	Monday, 11 June 2007, 10:30 AM		

Figure 4 Group Assignment

The author encouraged the learners to use the web board in Moodle to post questions and expect answers via this channel so the information can be shared with others. However, other channels such as e-mail, telephone, and face-to-face meeting are still available.

Post info auto learn Ref how if th mes:

Fig As com that lear prev typ

3. ENHANCING COMMUNICATION VIA MOODLE

A number of studies have been conducted on the effectiveness of e-learning in comparison with classroom training. The results are mixed. Janniro (1993), Wisher and Priest (1998), Keene and Carry (1990) supported the superiority of e-learning over classroom. Whetzel *et al* (1996) found no significant difference. Rivera and McAlister (2001) compared three forms of learning, namely, e-learning, classroom, and the hybrid of both. They found that the performances of learners are not significantly different in three forms. However, the learners were less satisfied with pure e-learning. The results of these studies should be interpreted with caution. The comparisons in these studies were conducted among different groups of learners with different learning approaches. There is no guarantee on the control on the quality of learners or the similarity of contents delivered by instructors. In other words, the results from the studies might be influenced by these factors rather than the learning format.

Hiltz and Wellman (1997), McCloskey *et al* (1998) found evidences that e-learning improves access to instructors. This study contributes by investigating the communication enhancement by an e-learning platform, Moodle, on classroom learning. Moreover, a unique dataset from the same group of learners allow us to compare the performance of those who use Moodle as additional communication to instructor and those who did not. The study does not suffer from the bias which might happen when comparing different sample groups with different teaching approaches as in the past studies.

The author has conducted 5 classes during 2007-2008 at the Faculty of Commerce and Accountancy, Thammasat University with 182 learners. There are 3 distinctive subjects in the sample. Two subjects, namely FN413 and FN426, were conducted repeatedly in semester 1/2007 and 2/2007. Both subjects are for senior undergraduate learners. Another subject, BA 726, was conducted once in semester 2/2007 for graduate learners. Details for all courses are shown in Table 1.

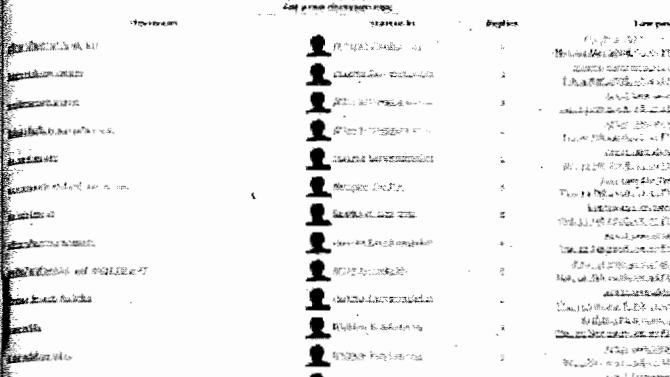


Figure 5 Web Board in Moodle

Posting information on Moodle's web board makes information public instantly since Moodle will automatically send e-mail to all subscribed learners. The learners can respond to new message by clicking link 'Reply' in the e-mail as shown in Figure 6. The users, however, need not to log on the system to read the content if they did not want to respond since all contents of the message have been shown in the e-mail.

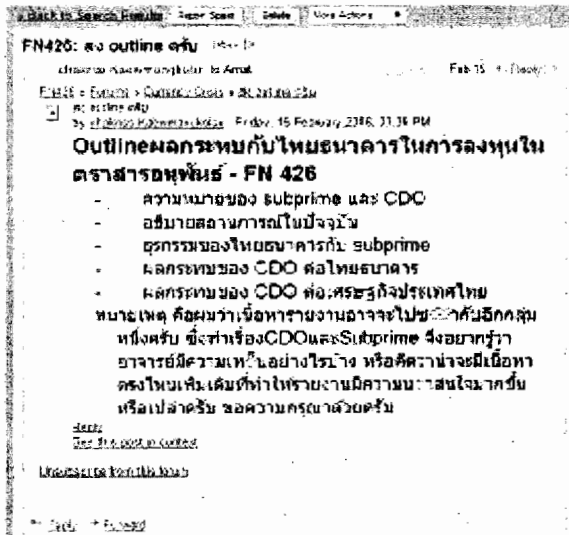


Figure 6 E-Mail Notification When New Message is Posted

As Moodle has provided vast opportunity for learners to communicate with an instructor, this paper hypothesizes that there shall be linkage between the use of Moodle and learners' performance. The next section will review previous literature and elaborate on how to test this hypothesis.

Table 1 Courses Detail

	FN413	FN426	BA726
Undergraduate Course Title	Yes Strategic Financial Planning and Control	Yes Financial Derivatives	no/ MBA Financial Option and Futures
Course Description	Forecasting, Financial Ratio Analysis, Financial Strategies in purchasing, investing, inventory management . Financial statement fraud.	Basic financial derivative pricing and hedging.	Advanced investment strategy by using financial derivatives
Class Schedule	Monday (9:00-12:00)	Wednesday (14:00- 17:00)	Monday (18:00- 21:00)

All classes were arranged in face-to-face classroom style that requires learners to attend the class. However, Moodle is added as an alternative channels for learners to communicate with an instructor. Basic knowledge on how to use Moodle had been introduced at the beginning of all classes and the learners were encouraged to use the system but not mandatory. For the first time user, he must subscribe by giving some personal information at the website. The system will send e-mail to the subscriber and he needs to click a hyperlink in the e-mail to activate his account. This process is to authenticate the real identity of the learners. It is a time consuming process that the learners need to invest some effort to use the system. Some of them decided to shun the system. There were 110 learners who registered for Moodle or roughly 60% of total learners. This gives us a good opportunity to study the result of Moodle users and non-Moodle users within the same group.

Figure 7, 8, and 9 illustrate how the Moodle users use the service classified by subjects. The horizontal axis represents time intervals during the day while the vertical axis represents the numbers of activities taken by Moodle users. The activities in FN413 shown in Figure 7 peaked on Monday which is the lecture day. On the average, the learners logged into the system from noon until 23:00.

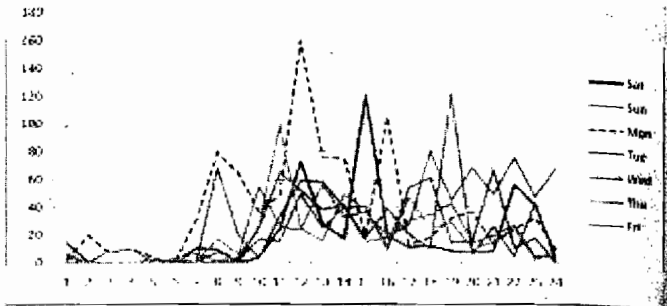


Figure 7 Moodle Activities in FN413

Like FN413, the activities Moodle users in FN426 shown in Figure 8 peaked on the lecture day. This class started at 14:00 on Wednesday. The Moodle users logged into the system since 9:00 until 13:00 before the class on that day and after the class. There is similar pattern on Tuesday which hints us that the learners in this course used the system effectively by preparing themselves for the class one day in advance. For other days, the users prefer to log into the system during 15:00 until midnight.

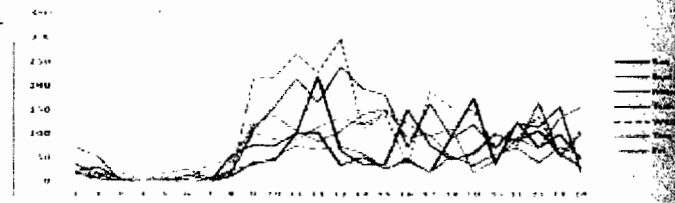


Figure 8 Moodle Activities in FN426

For the graduate learners in Figure 9, their behaviors are quite stable during the day. This pattern can be explained by the fact that the course is an evening program and all learners are full-time employees. They are more likely to use the system from their offices during lunch and after office hour (16:00-20:00). There is unique pattern for the graduate learners that the number of activities intensifies on Saturday and Monday. There is, however, a spike on Tuesday during 22:00-24:00.

Figure 9 Moodle Activities in BA726

The patterns of Moodle users reveal us two facts. First, there are clear different patterns between undergraduate users and graduate users. Second, all users seem to

effectively employ the system to prepare themselves before the class. These behaviors comfort us to hypothesize if there is any difference in performance between the learners who intensively used Moodle and those who did not.

Although we can count the activities for each Moodle user, it would be a crude measure to consider each activity as being equivalent. One of the nice features in Moodle is the report that allows instructor to keep track on how the learners use the system. This benefits our study since we can use the database in the report to classify the activities taken by each user. We can construct the score to measure users' behavior in terms of frequency and significance of the activities. The score will be called Moodle Intensity Score (MIS) in this study.

The null hypothesis in this study is

H₀: There is no difference in performance between Moodle and Non-Moodle Users

The performance of learner is measured by the equally weighted scores from mid-term and final examination. The real scores include class participation and group assignment with the scores from exams. Therefore, the score in this study is recomputed by excluding score from group activities and class participation. The MSI for each learner will be investigated if there is any correlation with the reconstructed score.

In order to control other factors, the regression model as shown in equation (1) is estimated by the Ordinary Least Square.

$$Performance_i = f(Sex_i, Faculty_i, Level_i, Past Performance_i, Moodle Intensity Score_i) \quad (1)$$

where

$Performance_i$ = Examination score for learner i ,

Sex_i = Dummy Variable represents sex of learner i : Male=1 and Female =0,

$Faculty_i$ = Dummy Variable represents Faculty of learner i : Faculty of Commerce and Accountancy =1 and Economics = 0,

$Level_i$ = Dummy Variable to differentiate between undergraduate and graduate program of learner i : Graduate =1 and Undergraduate = 0,

$Past Performance_i$ = The GPAX (Cumulative Grade Point Average) of learner i in previous semester,

$Moodle Intensity Score_i$ = The score measuring how learner i uses Moodle. It is the summation of appropriate weight multiplied by the number of related activities done by learners.

The gender of learner is put as explanatory variable due to the study by Kass *et al* (1998) and Makkonen (2001). However, the empirical results from studies are contradictory. The former found no different impact from gender in e-learning while the latter found that female outperformed male.

The dummy variable on faculty, level, and past performance are added as proxies to learner's experience. Adam *et al* (1997) found that this is an important factor in determining e-learning success. While many studies found that computer literacy is also important factor, this study considers the sample in the study is unique and all learners possess basic computer skill. We do not include this factor in the model.

$Moodle Intensity Score$ or MIS is computed by defining different weights to a particular action taken by Moodle users. This study classifies the actions taken by users stored in Moodle's database into 3 main activities, namely viewing, interacting, and initiating. The weight for each main activity is given by the following criteria.

Weight = 1 for viewing general content (excluding forum/web board),

Weight = 2 for activities involve downloading, viewing forum,

Weight = 3 for participating in forum by posting message or uploading content.

Note that the weight will be higher when the Moodle users use the system to communicate with the instructor. This enables us to detect the sensitivity of Moodle usage and the performance. It adds to the objective of our study if Moodle enhances the communication between instructor and learners. The MIS for non-Moodle users is zero. To verify the hypothesis, we will investigate the estimated coefficient of MIS variable on performance model.

Figure 10 shows the distribution of all Moodle users in the sample. The average MIS is 143.8 while the median is 102.5. It is obvious that the distribution is positively

skewed so standard deviation is not a good measure of data dispersion. The maximum score is 550 while the minimum is 1. We can investigate the pattern of MIS separately by courses but the results are not shown here to save the space. Judging from the median, the Moodle users in FN426 are the most intensive user while the users in FN413 are the least one. All courses are positively skewed similar to Figure 10.

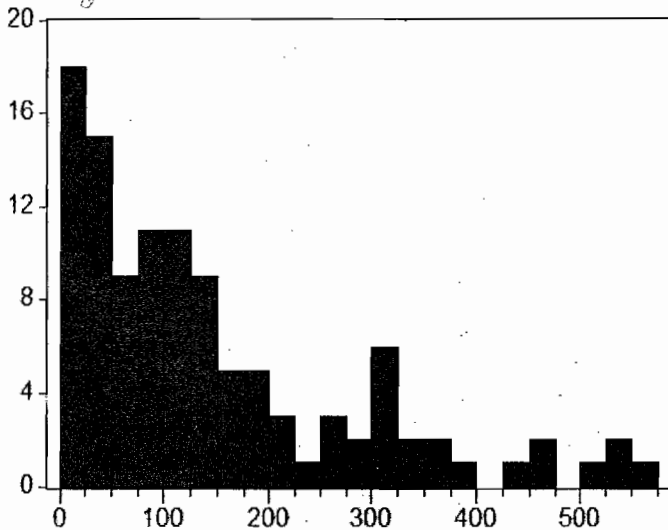


Figure 10 Moodle Intensity Score (MIS) Distribution for All Moodle Users

4. EMPIRICAL RESULTS

The data in this study is from the author's scoring database. The MIS is calculated from Moodle database based on the formula discussed in section 3. GPAX is collected from the Data Processing Office of Thammasat University. The learners in undergraduate program consist of students from two faculties, the Faculty of Commerce and Accountancy and the Faculty of Economics. The learner ID allows us to separate the sample and define the dummy variable FACULTY to differentiate between both groups. There is one learner from the faculty of Arts who attend FN413. Single observation is too small to differentiate the learner from this faculty. Therefore, the study omits this sample. The learners who withdraw from the course are also excluded. The final sample size is 178 learners.

The performance model will be separately estimated for each course first. The data from two semesters of FN413

are pooled. The estimation result is shown in Table 2. The most significant factor is GPAX or past performance of the learner. SEX and FACULTY are also significant. Male learners outperform their female classmates. Economics learners have some advantage over the Commerce learners obviously. To our surprise, the use of Moodle represented by MIS is not significant. Using Moodle or not seems not to affect the learners' performance in FN413. However, low R-squared and significant intercept term (C) suggest us that the FN413 model might suffer from misspecification.

Table 3 shows the estimation model of learners' performance in FN426. The data from both semesters in this course are pooled. The R-squared is satisfactory high for cross-section data. Three exploratory variables emerge as significant ones. The Commerce learners beat the Economics learners in this course. GPAX is still the most significant factor. Moodle usage evidently boosts the learner's score. There is no sign of omitted variable since the intercept term is not significant.

For the graduate program, all learners are at the same faculty so the dummy variable to differentiate faculty is dropped. The result is also in support of the Moodle's role in class performance as shown in Table 4.

Table 2 Performance Model in FN413

Dependent Variable: PERFORMANCE
Method: Least Squares

Sample (adjusted): 150 53 70

Included observations: 66 after adjustments

White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49.08503	9.344963	5.252565	0.0000
FACULTY	-6.942790	3.249799	-2.136375	0.0367
SEX	4.760842	2.519486	1.889609	0.0636
GPAX	10.28276	2.924946	3.515538	0.0008
MIS	-0.002381	0.010850	-0.219491	0.8270
R-squared	0.205513	Mean dependent var		74.6377
Adjusted R-squared	0.153415	S.D. dependent var		8.582826
S.E. of regression	7.897063	Akaike info criterion		7.043593
Sum squared resid	3804.180	Schwarz criterion		7.209476
Log likelihood	-227.4386	F-statistic		3.944765
Durbin-Watson stat	2.133113	Prob(F-statistic)		0.006517

Table 3 Performance Model in FN426

Dependent Variable: PERFORMANCE
Method: Least Squares
Sample: 1 81
Included observations: 81

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.27876	7.915183	1.551292	0.1250
FACULTY	5.894158	2.172580	2.712977	0.0082
SEX	-0.316706	1.831819	-0.172891	0.8632
GPAX	17.06141	2.393490	7.128255	0.0000
MIS	0.022936	0.005637	4.068962	0.0001

R-squared	0.496498	Mean dependent var	72.31640
Adjusted R-squared	0.469998	S.D. dependent var	10.41741
S.E. of regression	7.583999	Akaike info criterion	6.949699
Sum squared resid	4371.295	Schwarz criterion	7.097505
Log likelihood	-276.4628	F-statistic	18.73571
Durbin-Watson stat	1.930650	Prob(F-statistic)	0.000000

Table 4 Performance Model in BA 726

Dependent Variable: PERFORMANCE
Method: Least Squares
Sample (adjusted): 1 32
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.43001	31.13732	-0.655590	0.5176
SEX	3.014637	3.233154	0.933277	0.3589
GPAX	23.50660	0.781070	3.004397	0.0031
MIS	0.057034	0.021411	2.667670	0.0149

R-squared	0.437219	Mean dependent var	53.55393
Adjusted R-squared	0.376637	S.D. dependent var	13.96300
S.E. of regression	6.096850	Akaike info criterion	7.233714
Sum squared resid	2342.103	Schwarz criterion	7.458745
Log likelihood	138.8977	F-statistic	6.941957
Durbin-Watson stat	1.837193	Prob(F-statistic)	0.001252

Table 5 All Sample Performance Model

Dependent Variable: PERFORMANCE
Method: Least Squares
Sample: 1 82
Included observations: 173
Heteroskedasticity, Constant, Standard errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25.75150	3.043753	8.462412	0.0016
FACULTY	3.032019	2.597735	1.122903	0.1565
SEX	0.053773	1.479846	0.036311	0.9837
LEVEL	1.038777	2.196131	0.500323	0.6175
GPAX	13.36855	2.638113	5.054769	0.0001
MIS	0.016743	0.007404	2.250223	0.0202

R-squared	0.328501	Mean dependent var	74.52367
Adjusted R-squared	0.306903	S.D. dependent var	13.26179
S.E. of regression	8.532863	Akaike info criterion	7.188541
Sum squared resid	12520.23	Schwarz criterion	7.206105
Log likelihood	631.1383	F-statistic	15.82364
Durbin-Watson stat	1.875524	Prob(F-statistic)	0.000009

When all samples are pooled, variable LEVEL is added to separate between the undergraduate and graduate program. Although Table 2 suggests different results on Moodle use for FN413, this study ignores this evidence. In order to get a generalized result, no dummy variable is used to separate courses taken. Table 5 shows the estimation result. The result suggests that differences in FACULTY, SEX, and LEVEL have no impact on the learners' performance. This study is in support of Kass *et al* (1998) who proposed that gender has no impact on e-learning performance. The past academic performance of learner measured by GPAX is the most significant factor which is not surprising. The coefficient of MIS is positive and significant suggesting the role of Moodle in enhancing performance. The significant intercept term suggests that the model is incomplete. We leave the issue to be explored in future study.

5. CONCLUSIONS

Pooling learners' scores from 5 courses in finance during 2007-2008 supports the role of Moodle, a free E-learning platform, in enhancing the learners' performance. All courses employ Moodle as complementary channel for the learners to communicate with the instructor. It is not a substitute of classroom participation. Therefore, enhancement in learners' performance after controlling other factors can be considered as the result of better communication between the learners and the instructor.

It shall be noted that Moodle is not always appropriate for all courses. Moodle cannot contribute to the score of learners in FN413, Strategic Financial Planning and Control. This is the course that requires intensive learners' debate in the class. Moodle, however, improves understanding in courses like FN426 and BA726. Both courses deals with financial derivative pricing and hedging. The courses require intensive mathematical derivation. Moodle offers an opportunity for the learners to post question to the instructor any time. The ideas exchanged via Moodle are shared with all Moodle users since the system automatically sends e-mail to all users. This is the evidence that Moodle can complement the study in sophisticated subjects.

The study in the future might extend in two areas. First, the application of Moodle in other disciplines shall be investigated. Second, Moodle is built to support the constructivist approach in learning. This study just shows the contribution of Moodle in enhancing communication. Although we allow the learners to submit the group

assignments online, the information is limited only to the instructor to grade. The learners cannot see the reports made by other groups. The instructor might encourage the learner to create blog or post their ideas so the learner can learn from one another. The research on the use of Moodle's constructivist feature will shed some light on teaching improvement.

REFERENCES

- [1] Adam, A., W. Slonim and, Y. Yesha, 1997, 'Globalizing business, education, culture through the Internet,' *Communications of the ACM*, 40(2), 115-121.
- [2] Hiltz, S., and B. Wellman, 1997, 'Asynchronous learning networks as a virtual classroom,' *Communications of the ACM*, 40(9), 44-49.
- [3] Janniro, M., 1993, 'Effects of computer-based instruction on student learning of psychophysiological detection of deception test question formulation,' *Journal of Computer-based Instruction*, 20, 58-62.
- [4] Kass, S., R. Ahlers, and M. Dugger, 1998, 'Eliminating gender differences through practice in an applied visual spatial task,' *Human Performance*, 11, 337-349.
- [5] Keene, S, and J. Cary, 1990, 'Effectiveness of distance education approach to U.S. Army Reserve component training,' *American Journal of Distance Education*, 4, 14-20.
- [6] Makkonen, P., 2001, 'Who benefits from WWW-presentations in the basics of informatics?' in *Proceedings of 2001 Information Resources Management Association International Conference*, May 20-23, Ontario, Canada.
- [7] McCloskey, D., Y. Antonucci, and J. Schug, 1998, 'Web-based vs. traditional course development: Identifying differences in user characteristics and performance outcomes,' in *Proceedings of the International Business Schools Computing Association Annual Conference*, Denver, Colorado.
- [8] Rivera J., and M. McAlister, 2001, 'A comparison of student outcomes & satisfaction between traditional & Web based course offerings,' in *Proceedings of 2001 Information Resources Management Association International Conference*, May 20-23, 2001, Ontario, Canada.
- [9] Welsh, E., C. Wanberg, K. Brown, and M. Simmering, 2003, 'E-learning: emerging uses, empirical results, and future directions,' *International Journal of Training and Development*, 7 (4), 245-258.
- [10] Whetzel, D., D. Felker, and K. Williams, 1996, 'A real world comparison of the effectiveness of satellite training and classroom training,' *Educational Technology Research and Development*, 44, 5-18.
- [11] Wisner, R., and A. Priest, 1998, 'Cost-effectiveness of audio teletraining for the U.S. Army National Guard,' *American Journal of Distance Education*, 12, 38-51.
- [12] Zhang, D., and J. Nunamaker, 2003, 'Powering E-learning in the new millennium: An overview of E-learning and enabling technology,' *Information Systems Frontiers*, 5(2), 207-218.