The Attitudes of Students with Diverse Backgrounds on Computer and Information Literacy Subjects: Evidence from a First Year Course

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Abstract – **Teaching computer and information literacy subjects to students with diverse backgrounds is an instructional challenge. This study aims to identify the students' attitudes towards a first year computer and information literacy course. Several factors such as student gender and student's department have been taken into consideration in order to understand the effects of the homogeneity of the classes in learning. Students' final term grades have been used to discern the factors that are effective in learning. This research study aimed to explore if the students with similar backgrounds, i.e. students who study in the same department or faculty, would work well together, would learn from each other and would be more successful and the course objectives would be more effectively met when compared to mixed classes.**

Index Terms - Blended learning, class homogeneity, computer literacy, information literacy.

INTRODUCTION

Since 1998, a computer and information literacy course named as 'IS100 Introduction to Information Technologies and Applications' has been offered to the students at Middle East Technical University in Turkey. The aim of the course is to introduce the students to the basic information technology concepts and applications and make them both computer and information literate. Every semester, more than 1000 students register for this course. At the beginning of the term, all of the first year students are expected to take a proficiency exam after which their computer literacy level is determined. The students who perform above a threshold are waived from the course. Students who perform below a lower threshold value are required to take this course in a blended learning environment, where face-to-face teaching is combined with online teaching and online-assessment. The remaining students who are in between these two thresholds take this course exclusively online.

The course contents include various topics such as word processing, spreadsheet use, presentation techniques, computer maintenance and security issues, effective information search techniques, information assessment, and information technology basics.

Students enrolled in this course - all blended learning and exclusively online environments – come from various departments throughout the university and they have disparate educational backgrounds. The inherent challenge has been introducing some of the students to new material while building on existing knowledge for others. One of the main concerns we have is that the pace at which the students learn may be affected by the knowledge level of their classmates. In the previous years, feedbacks both from the students and the lecturers have been received and evaluated. The major feedback from some students studying in social sciences is that if the majority of the class comprises engineering or science students, they perceive themselves unconfident and incompetent in the course. However, in the online classes we have not observed a similar challenge since the student's learning in a fully online environment is more individual. This is one of the reasons why we have introduced the exclusively online way of conducting this course.

There are a number of factors that are important when developing the learning environment. This study aims to determine if differences existed in sense of achievements of students in computer and information literacy topics in terms of learning environment, gender, the department at which the student is studying, size of the class, and the instructor of the class.

LITERATURE REVIEW

Blended learning combines the strengths of face-to-face classes and online learning by harmonizing the in-class teaching with online materials such as videos, tutorials and simulations [1]. It offers the students the convenience of working in individuals at different times and places. In addition, students still retain the benefits of face-to-face education. Interaction among peers is achieved through various means such as in-class discussions, forums, and chats which consequently enrich students' learning experiences. It is stated that cooperation with classmates has favorable effects on achievement and productivity,

psychological health and self-esteem, inter-group attitudes, each of which affects students' attitudes toward learning [2] [3] [4]. Hence, blended learning can be thought to act as a facilitator for effective collaborative learning. Also, the sense of community in blended learning environments was shown significantly superior to that of traditional classroom education and fully online higher education classes and said to promote a strong community among learners [5]. The positive impact of blended learning by facilitating a community of inquiry on students' learning was also shown by Garrison [6] and Taradi [7]. Blended learning provides a learning environment that the condition for free and open dialogue, critical debate, negotiation and agreement.

A number of research studies have been conducted to measure students' attitudes to computers, anxiety about computer use, information and communication technology skills, satisfaction and attitudes to the Internet and computers [8] [9]. There are several factors which may affect the students' achievements particularly in information and communication technology skills (ICT). In Madigan [10], gender effect on ICT skills of the first year undergraduate students was investigated and it was concluded that although female students possess similar skills to their male counterparts, they do not perceive themselves as competent as male students in ICT skills.

The instructor has profound impact on the student learning in an online course since the instructor has a role of catalyst to help students to find their own learning [11] [12]. Moreover early research suggests that small class size has a positive influence on the students' learning and students get higher grades than those studying in large classes. But using multimedia and related instructional technologies can help to reduce the negative effect of large class size and lower the overall cost of teaching [13] [14].

Possessing computer literacy skills is a requirement for most degree and certificate programs in most college campuses. As technology advances, the demand for related classes increases in higher education. Hence, students accommodated in different sections and laboratories which suit their schedules best, result in computer labs and classrooms with diverse student population [15]. In such classes, students' learning is affected by the knowledge level of their classmates. Since, the heterogeneous level of computer literacy courses makes it difficult to pitch lectures at a level at which all students can follow; students without the assumed computer literacy knowledge and skill may be at risk of failing or underachieving in diverse student populated class [16].

However the effect of the diverse backgrounds of students on learning outcomes specifically in computer and information literacy courses has not been investigated yet in detail. Diversity can emerge in several ways i.e. departments at which students study and previous ICT experiences give rise to diversity. Early studies show that students' learning style, speed and interests are affected by their different backgrounds i.e. different college majors and curricula [9].

In addition to diverse background effects, class size, gender effect, students' behavioral intention toward learning, class interaction and the level of students' prior ICT skills are important indicators which may affect students' learning outcomes.

This study examines the attitudes of students with diverse background toward computer and information literacy course in a blended learning environment.

METHODOLOGY

The aim of this study is to identify the factors which affect the students' achievements in a blended collaborative environment. The analysis was conducted on 267 students who attended the classes regularly during the term. We did not take into consideration the irregular students who repeated the course and the students who participated only to the online classes. The students' term grades were used as an indicator to gauge their academic achievement (learning effectiveness). We have limited the probable effects of achievement to certain criteria such as demographic properties and learning environment, which constituted the independent variables in the analyses. We have used t-test, ANOVA, Kolmogorov-Smirnov test and Confidence Interval to investigate the individual and multiple effects of the factors. K-means clustering algorithm was also utilized to label the type of a given class i.e. a class may consist of students who study at similar or different departments, which defines the homogeneity of classes.

The students subject to the study have diverse backgrounds i.e. they are studying at different departments from five faculties which are Economic and Administrative, Education, Engineering, Sciences, and Social. The female and male students constituted 64% and 36% of the population respectively. As a prerequisite of the course, each student should be provided a computer to work with. Hence, a maximum of 31 students is allowed to register for each section of the course as the number of computers in each laboratory does not exceed this number. Although there are other courses to which more than 31 students are registered and those can be considered as large classes, this may not be the case for an in-class taught computer and information literacy course. In such a course, where classes are student-oriented and interactivity is an effective way of teaching the students are frequently needed to be guided by the lecturer. Therefore, satisfying needs of the students in a class where the capacity is full may be more difficult than that of those to which fewer students are attending. This difficulty was also stated by the instructors of the course. The instructors attending both small and large classes alleged that the larger the class size, the more the individual assistance is required. Therefore, in order to finish the topics in large classes in lecture's allocated time, they sometimes could not give sufficient assistance to the most students. For that reason, we have considered the class size as a factor which may affect learning effectiveness and included it in the analysis. In our case, the number of the registered students to the classes was between 13 and 31. We discarded the students who did not

attend the lectures in order to find the exact size of the classes and labeled them as large, medium and small if the number of students was more than 20, between 13 and 20, and less than 13 respectively. Almost half of the classes were small size and the others were medium size. We did not observe any large class after discarding unattended students. There were 11 instructors attending the classes with varying degree of academic expertise (different graduation school levels). There were 28 classes (sections), which were given in four different laboratories at different times and days in a week. Students coming from various departments enrolled a section, which suited their time schedule best.

RESULTS

The individual effects of four factors (gender, class size, faculty and instructor) on students' academic achievement represented by Term Grade have been analyzed. Descriptive statistics of the factors can be found in Table I. In the analyses, we have used T-test and ANOVA. Firstly, we have compared means of term grades for the males and females groups. T-test results (t= -2.2768, p=. 0240) show that male students obtain significantly higher grades (M=61.68, SD=9.52) than that of female students (M=59.05, SD=7.80). Effect size of the gender is small to medium (d=0.302). The medians of the term grades for male and female students are 62 and 59 respectively.

Secondly, the individual effect of the class size on students' success which has been claimed as important on students' learning by the instructors has been tested. However, t-test results (t=0.9233, p=.3567) show that there is no significant difference between means of term grades for small and medium classes.

TABLE I
DESCRIPTIVE STATISTICS

Factor	Factor Level (Coded)	Factor Level (Description)	Number of Samples	Mean of Term Grade
Gender	1	Female	170	59.05
	2	Male	97	61.68
Class Size	1	Small	124	60.53
	2	Medium	143	59.56
Faculty	1	Econ. & Adm.	61	59.75
	2	Education	59	58.03
	3	Engineering	100	62.37
	4	Science	23	60.52
	5	Social	24	55.33
Instructor	1	Ph.D.	37	62.67
	2	Ph.D.	33	59.87
	3	Ph.D.	39	58.53
	4	MS	21	61.76
	5	MS	26	61.96
	6	MS	28	56.53
	7	MS	11	62.36
	8	MS	23	57.26
	9	Ph.D.	17	60.82
	10	MS	21	59.76
	11	MS	11	60.45

The effect of instructors on students' success in terms of grades has been analyzed. All sections of each instructor have been aggregated, and the average of students' term grades by the instructors were calculated and compared. ANOVA results shown in Table II (F=1.54, p=.1254) indicate that the difference is not significant. One-way ANOVA with small and unbalanced sample sizes may not have sufficient power to detect any significant difference among the samples, even if the means are different. Therefore, a pair-wise non-parametric comparisons by using Kolmogorov-Simirnov (K-S) test has been applied to compare the means. According to the results of K-S test, the mean difference of four pairs is found to be significant (pairs: 1-8, p=.012; pairs: 5-6, p=.014; pairs: 1-2, p=.016; pairs: 1-3, p=.044), which state that means of students' term grades significantly differ across those pairs of instructors. However, no effect of graduation level of the instructors on the students' success has been observed.

TABLE II
ANOVA: IMPACT OF INSTRUCTOR ON STUDENTS' ACHIEVEMENTS

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1098.8	10	109.883	1.54	.1254
Within Groups	18265	256	71.348		
Total	19363.9	266			

Finally, the means of term grades of the students across the faculties have been compared. ANOVA results (F=4.8, p=.0009) show that the effect of the faculty on *Term Grade* is significant and at least one faculty is significantly different from the other(s) in the sense of students' achievements. ANOVA results of faculty factor are given in Table III.

Confidence Interval comparison procedure has been used as a multiple comparison method to look for specific differences between faculties. Table IV shows post hoc test result of the faculty groups. In the table, the groups confidence interval of which does not contain 0.0 are significantly different. According to the results, 2 and 3 (Education –Engineering), 3 and 5 (Engineering-Social) are significantly different from each other.

TABLE III
ANOVA: IMPACT OF FACULTY ON STUDENTS' ACHIEVEMENTS

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1322.2	4	330.56	4.8	.0009
Within Groups	18041.6	262	68.861		
Total	19363.9	266			

TABLE IV
POST HOC TEST FOR FACULTY GROUPS

Group 1	Group 2	Estimated Mean Difference	Confidence Interval	
			Lower	Upper
1	2	1.720	-2.413	5.854
1	3	-2.616	-6.293	1.062
1	4	-0.768	-6.306	4.771
1	5	4.421	-1.034	9.875
2	**3**	-4.336	-8.052	-0.620
2	4	-2.488	-8.052	3.077
2	5	2.701	-2.780	8.181
3	4	1.848	-3.386	7.083
3	**5**	7.037	1.892	12.182
4	5	5.188	-1.417	11.793

Faculties found to be similar by post hoc test have been aggregated and tested the resulting groups against similarity. Finally, the two significantly different main groups (t= -3.6435, p=.0003) have been determined. One of the groups is the combination of Economic and Administrative, Engineering and Sciences, and the other includes Education and Social. It can be deduced that the former (Faculty Group 1) represents students from more science and mathematics-oriented domains, and the latter (Faculty Group 2) stands for students from more social-oriented domains. Results show that students from faculty Group 1 obtain significantly higher term grades (M= 60.00, SD= 11.51) than that of students from Faculty Group 2 (M= 55.09, SD= 12.30). Effect size of faculty group is medium (d=.41). We have used resulting faculty groups to identify homogeneity of learning environment in terms of student backgrounds and capabilities. Each class has been defined by two variables. One of the variables represents proportion of the students falling into Faculty Group 1, and the other is proportion of the students falling into Faculty Group 2. To calculate proportions, the number of students from each faculty type has been divided by the class size for each section. Then, k-mean clustering algorithm was applied on the data (just on the faculty information, term grade is not included) to extract natural clusters. Several cluster numbers have been tried and 5 clusters have been found to fit the data best (select the one which gives smallest intra-cluster and largest inter-cluster distances). The following class labels below have been defined by taking into consideration the characteristics of the clusters such as cluster centroids:

- ***hm-so:*** homogeneous- social class in which only students who are from Faculty Group 2 attend.
- ***hm-sc:*** homogeneous- science class in which only students who are from Faculty Group 1 attend.
- ***ht-cdsc:*** heterogeneous- considerably dominant in science class in which there is a considerable number of Faculty Group 1 students compared to Faculty Group 2 students. For example, 80% for the former and 20% for the latter present in a class.
- ***ht-sdsc:*** heterogeneous- slightly dominant in science class in which the numbers of students in Faculty Group 1 and 2 are almost similar but slightly favored to Faculty Group 1. For example, 60% for the former and 40% for the latter.
- ***ht-sdso:*** heterogeneous- slightly dominant in social class in which the numbers of students in Faculty Group 1 and 2 are almost similar but slightly favored to Faculty Group 2. For example, 40% for the former and 60% for the latter.

Among the classes, we have not observed any class which has equal number of Faculty Group 1 and 2 students and in which the majority of the class constitutes Faculty Group 2 students. In order to investigate the effect of learning environment on the success of students belonging to Faculty Group 2, the means of cluster groups by using K-S test were compared. Results show that students from social domains perform worst in heterogeneous but slightly social dominant classes (ht-sdso). Interestingly, they are most successful in heterogeneous but slightly science dominant classes (ht-sdsc). Their performance is slightly worse in heterogeneous –considerably dominant in number of science students (ht-cdsc) classes. In summary, the most significant difference exists between heterogeneous but slightly science dominant classes and heterogeneous but slightly social dominant classes. When the success rate of the students from social domains in these two class type, that is, the proportion of the students passing the course, were examined, it has been observed that success rate dramatically decreases in the latter as shown in Figure 1.

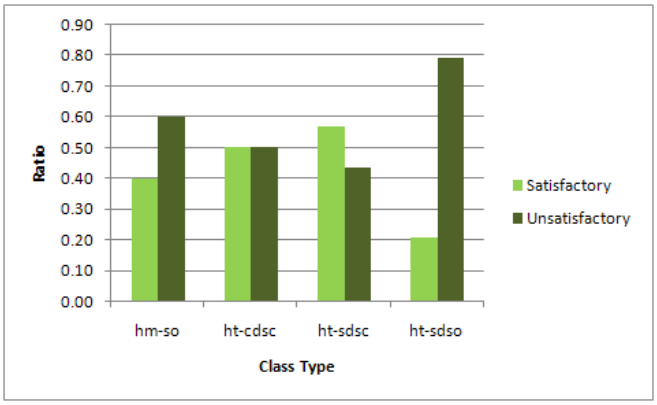

FIGURE 1
RATIO OF SUCCESSFUL AND UNSUCCESSFUL STUDENTS FROM SOCIAL DOMAINS IN DIFFERENT CLASS TYPES.

When the effect of learning environment on the success of students belonging to Faculty Group 1 was investigated, no significant difference within the clusters was observed. That means that neither class homogeneity nor the heterogeneity affects the success of those students. It may be due to the fact that the students from the science and engineering domains are much more self-motivated in learning computer and information literacy subjects than the students who are from social domains in their first year of undergraduate studies.

In the previous analyses, the individual effects of the factors on the students' achievements have been examined. However, usually a single factor cannot completely explain a phenomenon; instead, many factors and their interactions

may have effect on it. Therefore, multiple effects of the factors have been analyzed. According to n-way ANOVA results in Table V, two terms, faculty (p=.0001) and two-way interaction of the faculty and gender (p=.0116), are significant on students' achievements. In other words, there is no main effect of gender but there is a main effect of faculty. There is also an interaction between them. Insignificance of gender effect may be caused by faculty factor included in the model. Preferences of students in career, and thus, in education are associated with gender. Consequently, in some departments, the distribution of gender may be imbalanced and those departments may represent majority. For instance, it has been found out that male students comprise 93% of all mechanical engineering students who attend the course whereas 95% of all foreign language education department students who attend the course are female. Therefore, improvement of model by adding gender factor may not be significant if faculty factor is already included.

TABLE V
N-WAY ANOVA

Source	Sum of Squares	Df	Mean Square	F	Sig.
Faculty	1588.9	4	219.876	3.31	.0116
Faculty*Gender	879.5	4	397.234	5.97	.0001
Error	17162.1	258	66.52		
Total	19363.9	266			

TABLE VI
CROSS-TABLE FOR FACULTY AND GENDER BASED ON AVERAGE TERM GRADES

Faculty	Gender		Grand Total Average
	Female	Male	
Econ. & Adm.	60.00	58.95	**59.73**
Education	58.00	58.14	**58.03**
Engineering	59.75	64.35	**62.37**
Science	59.98	62.03	**60.51**
Social	57.02	46.55	**55.28**
Grand Total	**59.06**	**61.69**	**60.01**

According to n-way ANOVA model and term grades of the students in different factor levels, on average, grades of females and males are similar as it can be seen in Table VI. Whether they are female or male, engineering and science students are more successful than the others. The differences of grades among the faculties are smaller for females compared to males. Females are more successful than males if they are studying at social, economic and administrative sciences. Males are, on the other hand, more successful than females if they are from engineering and science departments.

DISCUSSIONS

Contrary to the researchers' initial expectations, the results have shown that students from social domains are more successful in classes where the number of students from science domain is greater than the others. Those students are, however, less successful in homogenous social classes. On the other hand, students from science domains perform well in all classes. Students from social domains may see themselves incompetent and more reluctant in learning computer and information literacy topics but heterogeneous classes may also motivate them to compete with their classmates, and thus, to study hard.

It has also been found that the departments at which students study have a significant impact on their academic achievements. For example, science and engineering students perform better than those studying at social and education departments. Gender influence alone is significant in overall grades but when the effect of both gender and faculty information are investigated together, faculty is found to be a dominant factor in learning effectiveness leaving gender less significant. However, this may be due to the fact that gender aspect has intrinsically existed in departmental information since engineering departments are mostly preferred by male students whereas social departments are favored among female students.

However, the success of male and female students varies according to the departments they belong to. Female students perform better than their male counterparts in social, economic and administrative sciences and vice versa in engineering and science departments.

The results have showed that instructor also has a direct effect on students' learning. As the class size does not allow exceeding 31 students in the present blended learning environment, it has been found that the size of the classroom does not have any impact on learning effectiveness. However, the results may change if this number is exceeded.

CONCLUSION AND FUTURE WORK

This study has attempted to identify the attitudes of first year students towards a computer literacy course. A number of factors have been considered and their effects on student learning have been investigated within a sample of 267 students. The analyses have been conducted based on the final term scores of the students who studied the course during 2008-09 Fall semester. A larger sample size in number of classes (sections) should be taken into account to validate the obtained results so the experiments will be repeated in upcoming semesters. Because of the small number of class sizes, the ability to generalize findings beyond this study is limited. Interviews will be held with a number of students who are studying at different type classes and several factors affecting student learning will be taken into consideration in the analyses in the future.

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