Influencing the Self-Efficacy of Middle Eastern Women Through the Use of a Bulletin Board

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Gender studies across the world have produced a wealth of information generated by studies that seek to investigate the existence of a distinction between genders in mathematical-based courses, such as Computer Science courses. However, the Middle Eastern Region remained unexplored largely throughout this effort due to gender segregation during K-12 schooling and social restrictions. Therefore, the work presented here will study the effects of cross-gender, online collaboration on Middle Eastern women. A preliminary study is initially conducted on data collected from 1667 students who studied at the College of IT in order to set a benchmark for comparison between genders. Results indicated that female students lagged in Computer Science courses, leading to the introduction of an online bulletin board to allow interaction between all students in the Internet Technology course. Female students who participated in the board were compared to female students who did not participate, to male students who participated and to male students who did not participate. Results revealed a positive effect on the self-efficacy of female students who participated in the board as they electively chose to attempt a bonus task in greater numbers than their peers who did not participate in the task. These results inform us that these women lack the interaction required to be able to be competitive with their male peers. Additionally, it raises a question of whether classical instructional strategies are more aligned with male student requirements than with female student requirements, which place women at a disadvantaged position in class.

Gender differences in the field of mathematics, science and, consequently, computer science has attracted the attention of a large number of researchers. Female students worldwide are visibly under-represented in these fields with the trend continuing throughout their professional careers. With respect to computers, this difference starts at the level of computer use when women are compared to men in the same region. Therefore, the existence of a digital divide between Internet users in the Middle East and North Africa Region (MENA) and the rest of the world complicates matters for the average Middle Eastern woman. MENA has 4% of the world's population and only 0.75% of the 600 million Internet users worldwide (Wheeler, 2004). The Internet World Statistics report in 2006 indicated that the highest Internet usage rate is in the United Arab Emirates at 35.8% of the population with Bahrain following at 21.1%. This reveals that these countries represent Internet use at a higher rate than the others.

This high percentage use in only a few countries of a group that has a very low overall average reflects the wide variations that exist in the Arab world. This variation is also reflected on Arab women and makes it erroneous to assume that a uniform, stereotypical image of an Arab woman exists. According to the United Nations Economic and Social Commission for Western Asia on Arab Women ([ESCWA], 2003), over half of the female population in the Arab world aged 15 years and above are illiterate, according to the last available data for the year 2000. In general, women who study at universities tend to be concentrated in the fields of Arts, Education, and Humanities, which reflects some cultural biases as to the expected role of women in society.

This trend continues as only 20% of the economically-active populations in the Arab world are women, compared to 50% in the developed world. Statistics also reveal tremendous bias that exists against women in leading positions with only 11.4% holding positions in higher public, managerial, political, and business posts. In fact, Arab countries that have the highest rates of female educational achievement are among the countries with the poorest representation of women in public office.

Women's Status in Bahrain

The ratio of women to men in Bahrain is 42.5% to 57.5% according to ESCWA (2003). Literacy rates in the country for the age group of 15-24

have reached 100% for both women and men in the year 2000, which is the last available data. With respect to tertiary enrollment, 24% of women and 16% of men enrolled in the local universities, which reflects that male students are more likely to study abroad than their female counterparts.

With respect to the field of specialization, the available statistics lack information about the field of Information Technology, which is the subject of this study in reviewed reports. However, we can still benefit from the numbers collected for the 1995-1996 school year because Computer Science was taught as part of the College of Science, which has 8.6% women versus 4.4% men of those studying at the tertiary level. In addition, Computer Engineering was taught as part of the College of Engineering with 21.1% women versus 48.4% men.

Unfortunately, when it comes to economic activity, the United Nations report indicates that only 29.2% of the workforce is female while 88.2% is male. It also stated that unemployment rates were 11.8% for women while they were only 5.2% for men according to the last available data collected in 1991.

Comparing Genders in an Online Environment

Gender studies in the real world illuminate a number of distinctions that characterize each of the two genders in a way that may or may not allow gender to influence the online existence of each individual. Studies have revealed three possibilities: (a) the democratic agora, (b) a man's world, or (c) the village marketplace where women feel at home.

A Democratic Agora

This perspective offers a gender neutral meeting place where individuals can communicate equally (King, 2000; Morahan-Martin, 2000). This perspective was encouraged by the absence of any physical cues to the gender of the speaker, and, therefore, allowing the individual to conceal his or her own gender by assuming a gender neutral nickname in some cases (McAdams, 1996). Turkle (1995) suggested that gender is fundamental to human

interactions so it is not possible to have a genderless existence online, but it possible to pretend to be the opposite gender. Suller (2004) supported this conclusion by indicating that gender swapping is probably more common-place than we realize.

Turkle (1995) indicated that this requires practice and consideration of what shapes the opposite gender, in addition to the expectations of the environment as related to that gender. She also indicated that people reflect the values of the society that are attached to gender. This means that gender differences may exist in inflects on speech, manner, interaction with others, and the interpretation of experience.

This evidence is supported by Sherman et al. (2000) when suggesting that the difference between men and women's experience on the Internet is linked to broader questions about gender in the society, and predicts that gender issues that exist offline are likely to persist online. This argument should bring into perspective, the offline gender issues that were discussed in the previous section and the impact of the existing statistics on women's participation in the Internet Bulletin Board.

A Man's World

This perspective regards the Internet as an inherently male culture. Males are said to have dominated the Internet since its inception (Austin-Smith, 1995; Gerrard, 1999; Herring, 1993; Morahan-Martin, 2000; Schumacher & Morahan-Martin, 2001). Kantrozvitz suggested that "…computer culture is created, defined and controlled by men. Women often feel about as welcome as a system crash" (cited in Brayton, 1999).

Gerrard (1999) indicated that sexist jokes, pornography, stories about sexual harassment, and stalking tell women that virtual reality is a male reality. Morahan-Martin (2000) classified males as technological while females are technophobes. Men dominate the internet through their hostile behavior as they flame those who have opposite point of views (Brayton).

Whether or not, this is reflected in more recent studies is still under debate. Ferris (1996) indicated that the female presence on the Internet is on the rise, but this did not mean that the female presence is not still gendered in a

sense since it reflects femininity through attitudes, word selection and even the use of emoticons.

The Village Square

This perspective regards the Internet as the place where people meet, talk, learn and trade. In other words, this view regards the Internet as a place where women feel at home. Behar-Molad (2000) suggested that the Internet suits women's psychological profile and make-up.

Spender (2000) advocated that in the knowledge society of the future, valued characteristics include self-management, flexibility, multitasking, and the capacity to constantly re-evaluate and to collaborate. All of these are stereotypical traits of the female gender. Bruckman (2004) ran a study on 475 children over a period of five years, and found that girls spend much more time communicating than boys who focused more on the task at hand, which supports this view that women feel more at home with the Internet as a discussion medium.

Consequences of the Three Perspectives in the Region

> Unlike institutionalized systems of government, where the individual rights are guaranteed as a citizen regardless of gender, in most developing countries among which the Arab world is no exception, the political, social, economic, and legal realms of life are largely controlled through informal and personalized networks. (ESCWA, 2003, p. 4)

If we add the impact of a largely segregated society to this, we find that women face serious difficulties in penetrating these networks to achieve a more noticeable presence. Bahrain, of course, is no exception to the rule because the country has a small population, which makes it much easier for men to form their social networks and for these networks to exclude women.

Consequently, it is not surprising if there is a clear effect on how women interact on the Internet based on the restrictions they face off the Internet.

This article will examine the effects on learning through online collaboration.

Effects of Online Collaboration

Most of the work on educational collaboration relies on a basic premise that was set by Vygotsky (1962) when he indicated that children grow into the intellectual world of their parents. Through verbal interaction, parents coach their children by presenting them with goals just beyond their knowledge level and guiding them so that they can work towards these goals. This renders language as a key mode by which humans learn their culture and interact with their thought processes.

Based on this, researchers worldwide started to study the effects of verbal interaction among peers or students and educators in order to identify its effect on the learning process. Forman and Cazden (1986) observed that when students work together on a complex task, they assist each other in much the same way that adults assist children. Johnson and Johnson (1989) offered results that suggest that high achieving students gain much from their exposure to diverse experiences and from peer tutoring. This type of interaction is not common across genders in Arabic societies, due to social restrictions. Therefore, although classrooms are typically composed of both genders, each appears to function in semi-isolation, which limits the amount of learning that could be achieved from peers.

With the advent of the Internet, a novel mode of collaboration emerged offering new unexplored opportunities. McNeil, Robin, and Miller (2000) studied online communication highlighting its features. They indicated that online communication allows students to exchange thoughts and ideas unhindered by restrictions of the time of day and where they are located. However, they pointed out that this type of communication lacks the nonverbal communication that is only part of face to face interactions. Facial expressions and hand movements appear to add to the value of the words being communicated and these are not represented through online communication media.

Consequently, the medium has its known disadvantages and advantages. Clark (2001) indicated that the Internet offers a medium of education to

many students that would not have the ability to attend typical classes. He also highlighted additional advantages including that students have ample time to read other students' comments and to do research before preparing a response to others. This extra time offers the chance to get over the self-confidence hurdle faced by students before they volunteer a suggestion to the group they are working with.

Gender Differences Caused by an Issue of Self-Efficacy

Researchers use the term self-efficacy as a measure of confidence. The term is defined as the belief in one's capabilities to perform a certain task (Bandura, 1994; Zeldin & Pajares, 2000). Pagaris (2002) claimed that self-efficacy can affect the task effort, persistence, expressed interest, and the level of difficulty of the goals users attempt to attain. Affective issues were also raised by researchers including Traver, Kalsher, Diwan, and Warden (2001) who evaluated a biochemistry course, that uses web technology and student collaboration, and found that the main issue with respect to learning was self-confidence. Self-efficacy influences the choices of whether or not to engage in a task and how persistent the student is in accomplishing it (Bandura, 1977; Bandura & Schunk, 1981; Barling & Beattie, 1983; Bouffard-Bouchard, 1990; Brown, Lent, & Larkin, 1989; Hacket & Betz, 1989).

Therefore, it is likely to influence female student contributions to an online bulletin board in addition to directly influencing the amount of learning they achieve in an undergraduate course by influencing the choice to engage in attempting a bonus question. In fact, there is ample evidence that in end-user programming related to technology female students exhibit low levels of self-confidence when compared to that of male students (Busch, 1995; Durndell & Haag, 2002; Huff, 2002; Torkzadeh & Van Dyke, 2002). Busch, for example, showed that females are significantly less confident than males in completing complex tasks in a course that covers the use of word processing and spreadsheets in a business course. The same phenomenon also seems to exist in Computer Science courses, in particular, as in the case of the course selected here (Margolis, Fisher, & Miller, 1999; 2001).

GENDER DIFFERENCES IN THE UNIVERSITY OF BAHRAIN

Preliminary Study

A preliminary analysis of the data of 1667 students who study at the College of Information Technology in the University of Bahrain was obtained from the University registrar for all current students in the second semester of the year 2005. The college teaches Computer Engineering, Business Information Systems, and Computer Science. The data was converted into Excel format and then formatted to allow various statistical calculations to be run. Analysis of this data revealed that the ratio of women to men who study in this college is 61% female students to 39% male students. In addition, the average Grade Point Average (GPA), which sums their total score achieved for the courses they took in preparing for their degree, is 2.36 out of 4 for female students while that of the male students is 2.23 out of 4. Cohen's *d* (1969) metric can be obtained by subtracting the female student mean from the male student mean and dividing that by the between sexes standard deviation to give -.0181, which represents a binomial effect size of 0.90. This means the range difference is (from 45.5% to 54.5%), which is almost a full letter grade difference between students, with female students doing better than male students because of the minus sign that precedes Cohen's *d* value.

If the same procedure is then applied to one field, such as Computer Science, we find that the average GPA of female students is 2.28 while the average male student GPA is 2.38 making *d*= 0.146. The binomial range becomes 46.4 to 53.6, only this time in favor of male students as indicated by the positive sign on the *d* metric. The difference between these results and those obtained for the whole college of which Computer Science is part indicate that female performance in this field is inferior to male students in this department. One possible cause is the large number of practical courses that require coding in this particular program.

To investigate this possibility, we can examine a course that requires coding for only half the semester and that is Internet Technology. The number of female students who took the course from the population of 1667 students is 148 while the number of male students who took it is 86. The average GPA obtained by female students from this population is 2.34[1] for males and 2.18

for female students, which makes Cohen's $d= 0.14$ and the binomial range (46.5% to 53.5%). Therefore, the course results of the analysis are extremely similar to those of the department courses as a whole, which qualifies it as a good candidate for study.

Discussion

The preliminary analysis reveals that in the overall grades in the College of Information Technology program, female students do better than their male counterparts up to almost a full letter grade, although it does not reach statistical significance. Yet, these results are reversed in the Department of Computer Science, where male students do better than female students indicating that the overall trend does not extend to some of the courses taught in this department. One possible explanation based upon research is that female students may not do as well in courses requiring programming, so a sample course, namely Internet Technology, was selected. Results indicate that in this course, female students do slightly worse than male students in a fashion similar to the departmental level analysis results.

These results indicate that the overall female student group is not replicating their own average performance in the other courses. This difference may be caused by the social factors that influence female self-efficacy, especially in the Middle East region. If this is the case, then providing a medium through which to exchange information with the opposite gender may offer a window of opportunity to these students. When Vygotsky (1962) indicated that children learn through discourse, this also implies that social restrictions that deny students the ability to conduct a scientific discussion in a subject matter is likely to be counterproductive to their learning. Removing this inhibition by allowing cross-gender interaction may, therefore, influence the self-efficacy of female students, and positively making them more willing to engage in learning tasks that may influence their grades.

Main Study: Comparing the Effects of Two Types of Learning Materials on Gender While Using a Bulletin Board

The Internet Technology course in this university is divided into two main parts. The first focuses on the theoretical basics of the Internet while the

second focuses on writing scripts. The theoretical part of the course covers a short review of the history of the Internet, TCP, IP, DNS, and email including SMTP and POP. All topics are covered in general with just enough details to allow students to understand how the Internet works.

The second part of the course introduces three scripting languages. Hypertext Markup Language (HTML) is introduced during one week in two parts. One for basic scripting including table format and the other is for advanced HTML that includes frames and forms. JavaScript is then introduced in two parts, that cover basic commands in the first and functions that interact with the user in the second. Preprocessed Hypertext (PHP) is then only introduced in general, and students are asked to learn how to use it while solving their project task.

The second part of the experiment that was run here is to allow students of both genders to use an online bulletin board, which was only put up for discussions on the project with strict supervision to allow only posts related to project work. Both female and male students were divided into two groups by their own choice; one of the groups chose to actively participate in the board and another that did not participate. The full transcript of the discussion was later collected and the number of posts made by each gender calculated. Then an interaction activity map was drawn to make it possible to draw conclusions relating to the between gender interaction patterns and how this eventually affected student assessment. A copy of this map is represented in the Appendix.

All students had to sign up to the board using their student numbers only to conceal their identity and gender. The task itself was broken up into two parts, a compulsory part that all students had to solve and a bonus part for which they would earn extra marks. No instruction was provided on how to solve the problems presented in the project to enable students to discover the means to solve them through their online discussion. Instructor intervention in the discussion only came to clarify various issues about the question, and never to give any solution to any intermediate problem.

The theoretical part was assessed separately with a dedicated test while the second part was assessed by evaluating the project submissions in order to allow the comparison of genders for both types of learning materials. An additional metric for assessment that was used was the overall student grade for the course, because this grade was the one that revealed the lag of female students in the preliminary meta analysis.

Collaboration Lab

A bulletin board was installed on the Internet Technology Course host server and an official thread was defined as the destination to which students would direct any posts regarding a take home quiz. The test was a challenging task that was composed of the two following main parts: a Macromedia Flash part and a Preprocessor Hypertext part. There was also a bonus grade task that was offered to students as a more competitive solution of the Macromedia Flash part.

Students were randomly assigned to different question versions that were carefully set to ensure comparable levels of difficulty, so as to allow them to interact and to discuss the problem without resulting in one giving the full solution to others. Each student was randomly assigned a logical question and informed of a related graph. The student would then produce an animation while explaining the steps of how the graph was drawn using Macromedia Flash. Therefore, all tasks involved graph drawing, but the graphs themselves differed not in component types, but in numbers to ensure the equivalence in difficulty level necessary to ensure comparability of results.

The required Flash question requested students to produce a simple animation of the graph as it was being drawn. The second part was composed of a PHP question that was assigned to all students. It involved creating a form and inserting the output of the form into a MySQL database.

The bonus task was in Flash and the second required students to allow users to drag and drop the lines and ovals in their proper slots to teach the required graphing technique. Users could not drop an object except in the correct place. An extension to the same question allowed a user to place the dragged objects to be dropped anywhere on the screen area, and then to find a way of estimating how close a user was from getting the correct graph.

Subjects

The subjects were third year undergraduate students from the University of Bahrain, some of whom were taking it as an elective and others as a core course. Subject choice was made on a self-volunteer basis distributed as

follows: 15 female students participated in the online bulletin board and 10 female students did not participate while 9 male students participated in the online bulletin board and 13 male students did not participate.

Results (in Percentages)

Analysis of the data reveals that female participations exceeded that of male participation, which reflects a strong female interest in exploring the Internet as a means of learning and communication. Yet, this was not reflected in the number of posts as they resemble the number of posts made by their male peers. The complete activity map obtained from the discussions that took place can be referred to in the Appendix and in general posts ranged from three lines to two pages in length. During the first and second day of the interaction, female students restricted their interaction to their female peers and the same with male students who mostly restricted their interaction to their male peers. On the third day, cross gender interaction was initiated and continued throughout the remaining period of the study.

Since the theoretical part of the course is tested separately in a test of its own, Table 1 shows student assessment levels according to a test that was taken by all students in the course. The theoretical test results indicate that there is no difference between females and males in the theoretical part of the course. However, the data tell a different story when the theoretical is compared to the project grades shown in table 1. Female students achieve an average of 31% while male students achieve an average of 47.6%. If this compared to the expected grades based on the theoretical results in a Chi test, a significance of $p < 0.02$ is found. The project grades shown are provided only for the task performed by students while conversing on the board. They either solved the task on their own, or while conversing on the bulletin board without any lectures given during that period which qualifies this mark to be a fair instructor's assessment of student performance in the project.

Table 1

Female and Male Student Participation Levels and Results in the
Two Types of Tests

Data in Percentages	Female	Male
Number of Students who Participated	60% (15/25)	40% (9/22)
Number of Posts by Gender	53% (41/77)	47% (36/77)
Theoretical Test Mean Grade	79%	80.5%
Project Test Mean Grade	31.8%	47.6%

In Table 2 the results show the role that the bulletin board played on student grades. Female students who did participate made a significant improvement over female students who did not participate with $p < 0.0029$. If we also look at the number of students who benefited from the bonus task option, we find that the number of female participants in the board that exceeded this mark is over double the number of females who attempted the bonus task without participating in the board. In fact, only 20% of nonparticipants attempted the task, while 47% of participants attempted it. This shows that participations encouraged more female students to attempt and to succeed in a task that they would otherwise neglect if they did not participate in the online discussion board.

Table 2

Female and Male Project Grade Differences Between Participants
and Nonparticipants

	Participants		Nonparticipants	
	Female	Male	Female	Male
Mean Project Grade	33.3%	47.3%	29.1%	47.8%
Number of Students who received a grade above 15	47%	44%	20%	62%

We may also look at the letter grades that each student obtained at the end of the semester for the course while comparing the grades of female students who participated in the board to the grades obtained by female students who did not participate in the board (as shown in Figure 1). The graph clearly shows that the women who did participate are getting higher letter grades at the end of the course, than those who did not participate. If we then compare

this distribution to the obtained results from a total of 126 girls who previously took the course and did not use the bulletin board, by using the ANOVA test, we get an $F=4.9646$ and a significance measure of $p < 0.033$, which shows that female students did better with the collaboration lab than those who took the same course without these facilities. If we repeat the same tests for male students, we get no significant differences between those who used the bulletin board, and those who did not.
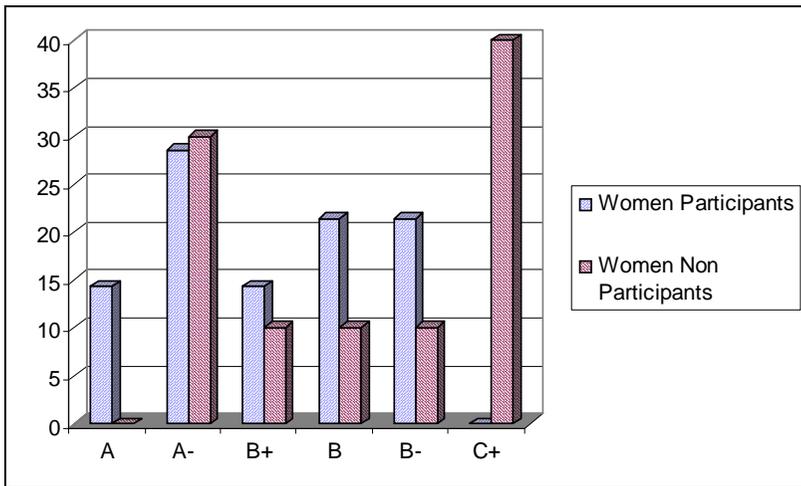

Figure 1. Percentages of the number of students who obtained each letter grade for participants and nonparticipants

CONCLUSION AND DISCUSSION

Results indicate that female students in this region were more interested in going online than their male counterparts in an educational domain, which was the case here. Results also support the results reported earlier that female students who did not participate in the board did exhibit low levels of self-confidence when compared to male students (Busch, 1995; Durndell & Haag, 2002; Huff, 2002; Torkzadeh & Van Dyke, 2002). This conclusion can be made because female students who did not participate in the board were more reluctant to try the bonus task than their peers who did participate in the board. This reluctance to engage in a bonus task is defined as a

characteristic of low self-efficacy (Bandura, 1977; Bandura & Schunk, 1981; Barling & Beattie, 1983; Bouffard-Bouchard, 1990; Brown, Lent, & Larkin, 1989; Hacket & Betz, 1989).

The bulletin board allowed female students to interact with their male counterparts in a supervised environment that concealed their identities. It also allowed them to overcome this self-efficacy hurdle that may have been caused by social restrictions and expectations to achieve better marks than their female peers who did not participate in the online discussion. This was mainly revealed by their elective participation, in the challenging bonus task that allowed their grades to exceed the 15 possible by attempting the basic task alone. This shows that the problem was not that they lacked the ability of master coding for computer courses. Bruckman (2004) in her study conducted on 475 children found that gender does not affect programming abilities, and that performance can be correlated with prior experience and the time spent on the task. This online bulletin board shows that the experience gap may be addressed through online collaboration on the task.

Another main conclusion is that the Internet as a medium of communication breaks through the social networks that were described in the United Nations Report (2003) on Arab women. The improvement in female student levels and the active interaction that took place supports this claim and offers a window of opportunity for Arab women.

Some may wonder whether or not the self-selected sample is biased. Ora (1965) found that volunteers are significantly different from the norm in among other things by being insecure and introverted. Consequently, if the bias reported exists then the results obtained in this work should have been of higher significance than what was actually found. The fact that the results obtained are already significant indicates that the causes are influential enough to overcome this bias if it did exist.

An interesting, future research path could be to examine whether learning differences can affect students who benefit from this type of collaboration. Albalooshi and Alkhalifa (2002) have shown that learners that are different with respect to preferring verbal, versus graphical representation can both learn effectively through an Internet-based, multi-media educational system. Consequently, this purely verbal medium may in turn be only beneficial to those learners who present a preference to verbal learning, but that remains to be tested.

Another issue that bids attention is whether or not the instructional approaches of mathematical-based courses are biased towards alignment with the male gender's characteristics. Under this assumption the pedagogical approach in these courses has to be reviewed. The work presented here indicates that encouraging cross gender interaction is likely to enhance performance through creating a medium of interaction. This would allow information to be shared between the two genders. Other similar, practical adjustments to learning strategies may need modification to ensure that the teaching medium is not biased to one of the genders and not the other.

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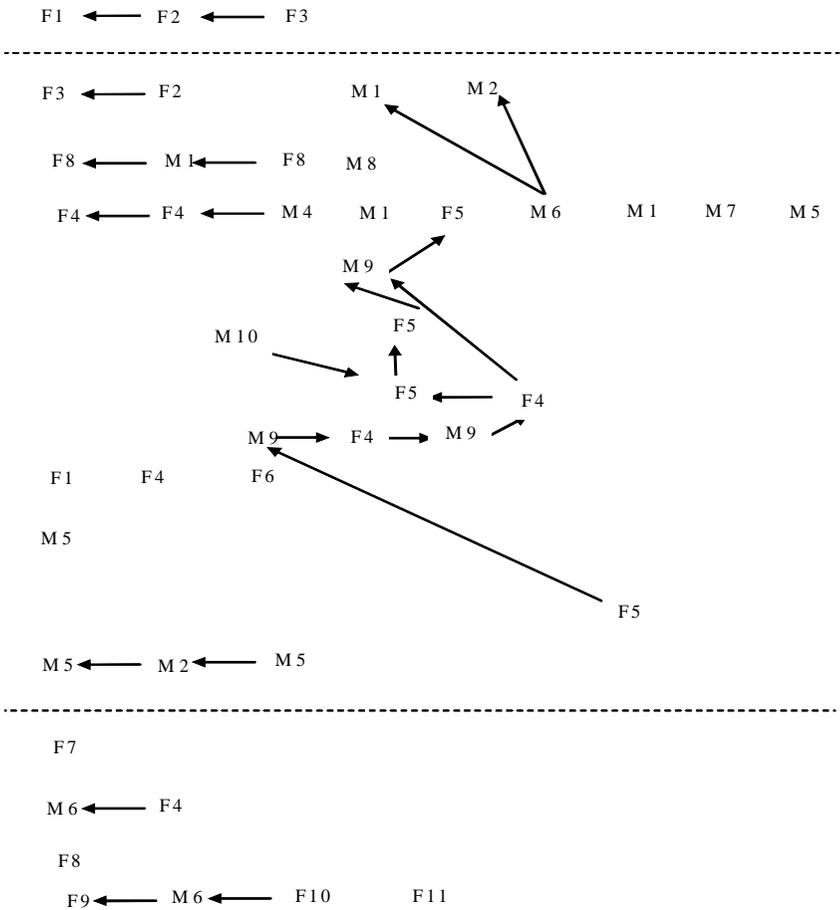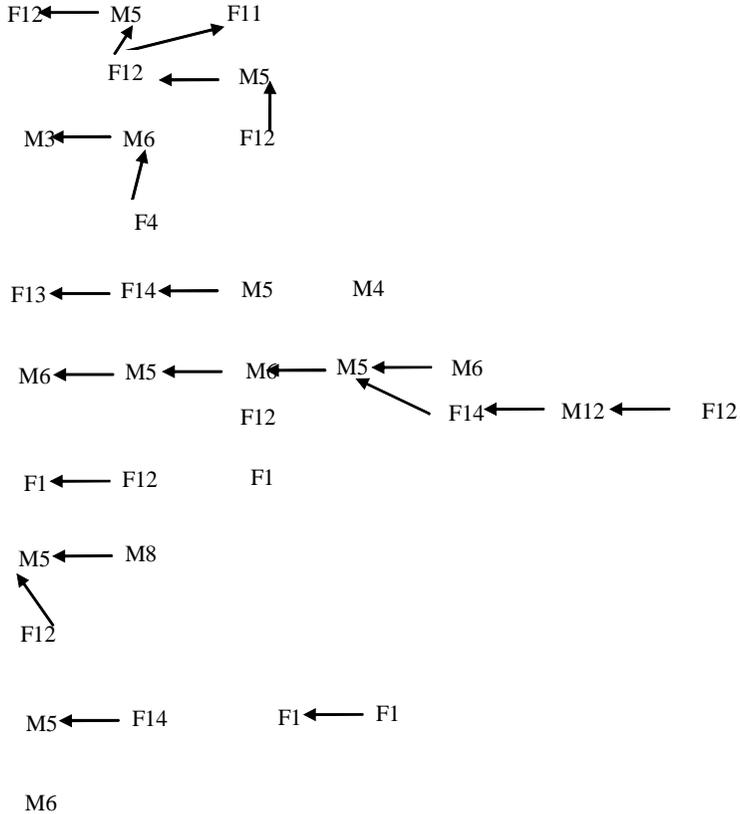
Acknowledgement

Note

1. Since the collected data is for a running semester a number of students had * for the course grade so it was eliminated from the calculations to avoid the system automatically interpreting it as a 0.

APPENDIX
ACTIVITY DIAGRAM

F1 ← F2 ← F3

F3 ← F2   M1   M2

F8 ← M1 ← F8   M8

F4 ← F4 ← M4   M1   F5   M6   M1   M7   M5

M9

M10   F5

F5 ← F4

M9 → F4 → M9

F1   F4   F6

M5

F5

M5 ← M2 ← M5

F7

M6 ← F4

F8

F9 ← M6 ← F10   F11

APPENDIX
ACTIVITY DIAGRAM (CONTINUED)

F12 ← M5   F11
        ↗   ↗
        F12 ← M5
               ↑
M3 ← M6   F12

        ↑
        F4

F13 ← F14 ← M5   M4

M6 ← M5 ← M6 ← M5 ← M6
                ↖
        F12   F14 ← M12 ← F12

F1 ← F12   F1

M5 ← M8
↑
F12

M5 ← F14   F1 ← F1

M6

Key:
M = male student
F = female student
Numbers indicate different individuals
Arrows indicate a direct reference to something said by another student
Lack of arrows indicate that a general statement is made that is not
explicitly related to anything else that was said.
Dashed lines indicate that a day or more passed between the posts.