

## **THE RELATIONSHIP BETWEEN GENDER AND STUDENTS' ATTITUDE AND EXPERIENCE OF USING A MATHEMATICAL SOFTWARE PROGRAM (MATLAB)**

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### **ABSTRACT**

This correlation study examined the relationship between gender and the students' attitude and prior knowledge of using one of the mathematical software programs (MATLAB). Participants were selected from one community college, one state university and one private college. Students were volunteers from three Calculus I classrooms (one class from each school) in which MATLAB was used extensively. A survey regarding students' attitude and experience on using the MATLAB program was administered to classes. The findings of the study indicated that gender differences are not related to students' attitude and experience on the program.

The results revealed slightly positive correlation between and students' attitude and experience on the program. The implications of this study shows that teachers who use MATLAB in their instruction and classroom practices must pay attention on how much students use it, the obstacles students had to overcome to succeed in its use, and their general issues and concerns regarding MATLAB use.

**Keywords:** MATLAB, gender, attitude, prior experience.

### **INTRODUCTION**

Research has shown that many mathematics teachers, today, began to integrate high-level mathematical software programs such as MATLAB into their curriculum and classes. The use of such programs showed that they include both a computer algebra system and the ability to provide visualization (Schlatter, 1999). Such flexibility provided more opportunities and different ways to approach to mathematical topics. On the other hand, however, some researchers (e.g., Hennessy et al., 2001) argued that over-reliance on such programs can be a problem for the students. Computer-aided software programs can be used mechanically, and student' understanding might prove superficial in even simple mathematical domains. In addition to this disadvantages, there is little research on how gender, student' attitude, and experience regarding the use of such programs effect achievement and performance in mathematic classes.

Thus, it is becoming important for educators and teachers to know students' perceptions and ability to use the program, if they want students to be more successful in mathematical classes. The purpose of the study is to investigate the relationships between gender differences and students' attitude and experience on MATLAB software program.

### **LITERATURE REVIEW**

With increasing use of computer technology in schools, many mathematical software programs began to appear in the classrooms and people favored to use them for the students. Studies focused on students' attitudes towards computer-aided programs report very positive effects. For example, Ponidi & Alhadi (1999) argued that computer-

aided software programs are useful in solving, comparing, and visualizing the solutions. They argued that MATLAB was the most effective program in this matter and found that students received more academic atmosphere in mathematical software programs. In addition, Schlatter (1999) developed, by using MATLAB, some graphical user interfaces which provided students more benefits on problem solution process. Similarly, Cretchley, Harman, Ellerton, & Fogarty (2004) found, in their survey research with undergraduate students, that students expressed positive feelings about the use of the MATLAB. They argued that the use of MATLAB has strong educational impact on student' learning of mathematics. They showed that with the use of MATLAB, students were able to compare, classify, analyze errors, and support the students who struggled with solving problems. The study proved that MATLAB improved students' attitude and confidence in mathematics.

Although most studies favored software programs like MATLAB for students, they rarely look at the role of the gender and students' prior experience of using the programs. Research on students' attitude and experience indicated there is a relationship between positive experience and future interest in software programs. For example, Mark & Hanson (1992) argued that students' attitudes toward the software program are significantly affected by experience. He mentioned that high experience reduces attitude differences between male and female students' abilities with the software program. Additionally, Bauer & Kenton (2005) expressed some concerns regarding the use of the software programs and recommended that teachers must give more attention on student skill levels and their dependency on using the software programs. Many teachers may feel that students become too dependent on the program and are consequently unable to master basic topics so crucial to the course of study.

Nathan & Baron (1995), regarding gender differences, investigated students' choice of software programs. The study found no differences between boys and girls' choices and recommended that software content was the major reason for the choice. However, in contrast to Nathan & Baron (1995), Sheldon (2004) found that male students are more likely to engage with software programs than females students do. Results of the study indicated that gender role stereotyping is still strong and present in students' use of software programs.

Interestingly, some studies clearly showed we need more research to find out what kind of factors have more affect on student' use of software programs. Based on previous research, it is clear that students using mathematical software programs like MATLAB do better than students who do not have such access on tasks that requires symbolization (Horton, Storm, & Leonard, 2004). However, students have to have enough knowledge on using MATLAB and instructor must know the complexity of the program and use it flexibly (Schlatter, 1999). This may explain the lack of use of such programs among college teachers (Cooney & Wilson, 1996).

Research does not tell exactly the type of the programs that improves students' ability and attitude most, in mathematical classrooms. Moreover, this study is not arguing that the MATLAB is the only technology that can be integrated to teach mathematics because research clearly shows that different technologies (e.g., graphing calculators, presentation packages, visual spreadsheets) can be combined to give students the opportunity to investigate and understand mathematical topics. However, based on previous research, the study argues that there might be relationship between student's attitude and prior knowledge of using the MATLAB and students' gender. In this sense, for example, Sherman, Divine, and Johnson (1985) found that gender did not make a difference in students' preference to use the certain programs. However, the study clearly showed that students mostly preferred to use problem-solving problems rather than drill-and- practice programs.

What is missing in most studies dealing with the use of mathematical software programs that they do not provide important information about what role such programs play in the

class environment? They rarely looked at the use of such programs as external tool that students are exposed to a new and cutting-edge technology without giving proper instruction. The students' attitudes, familiarity and flexibility on understanding of such programs were mostly ignored.

## RESEARCH QUESTIONS

The purpose of the present study was to further examine the relationships between gender differences and attitude and experience while using the MATLAB software program. More specifically, the following research questions were addressed by this study: (a) what kind of models emerge between gender and student's attitude and experience on software MATLAB? (b) Do gender differences play an important role while students use the MATLAB software program?

## METHOD

### Participants

A total of 70 students (total 3 classes) at three different colleges in Upper State of New York participated in the study. Three Calculus I classes were drawn from one community college, one state university and one private college. The sample was purposive since each class was using MATLAB in the class environment. Total, 23 female and 37 male students participated to study and females occupied 32% of the classes (Table 1).

Table: 1  
Gender and Classes

Class	Male	Female	N
Community	15	7	22
State	22	6	28
Private	10	10	20
Total	47(%77)	23(%32)	70

In order to diversify range of students, the researcher chose classes with differing ability of using MATLAB program. Secondly, it was essential to keep the course level consistent across the classrooms (Calculus I) and to give students the survey.

### Instruments

A survey developed by researcher was administered to students in order to find students' attitudes and prior use of MATLAB software program. The first section is (attitude) of the survey included Likert scaling based on the 5 point scales measuring student' attitudes toward MATLAB. The attitude survey included 23 questions. The second part (prior knowledge) was a closed-ended response format concerning MATLAB use. Prior knowledge survey was a set of 8 statements that were intended to find students' prior/initial knowledge and expertise of MATLAB. The second part consisted of four yes/no items, two Likert Scale items, one application question, and one qualitative question. Two experts in mathematics education independently reviewed the instrument and indicated that, in their opinion, it had content and construct validity.

Survey was analyzed for reliability, by using SPSS program. Since a reliability coefficient of .80 or higher is considered as "acceptable" in most Social Science applications, the survey reliability was shown to be okay using all items(in the survey) because alpha was .8090.

## RESULTS

The Pearson correlation coefficients are presented in Table 2 for relationship between gender and attitude toward MATLAB and between gender and prior knowledge (experience) on MATLAB program. Table 1 clearly shows that relationships between gender and attitude and gender and experience are unsteady. The coefficients of correlations which ranged from  $-.55$  to  $+.17$  showed that about 2% to 30% of the variation gender to attitude and gender to experience can be explained by a negative relationship.

Table: 2  
Correlations for gender/attitude and gender/experience

Class	N	r (gender/attitude)	r (gender/experience)
Community	22	$-.551^{**}$	$-.478^{*}$
State	28	$-.175$	$-.201$
Private	20	$-.192$	$.346$

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

Although relationship between gender and experience in Private college class seems slightly positive relationship, scatter-plot analysis of the data showed that there is no evidence that gender plays an important role for attitude and experience on using the software program. Relationship between gender and experience seems to follow a directional way (from  $-$  to  $+$ ) from community college and state university class to private college class ( $-.47 < -.20 < .34$ ) (Table 2).

The relationship between attitude and experience was explored separately for the classes. The correlation coefficients were statically positive and especially for community college class, relationship was significant. It can be concluded from the data that the students who had positive attitude toward the mathematical software program seemed to have high experience on using the program. The coefficients of the correlations ranged from  $.14$  to  $.57$  showed that about 1% to 32% of the variation in attitude scores can be explained by a linear relationship with experience scores.

Table: 3  
Correlations for attitude and experience

Class	N	r (Attitude/experience)
Community	22	$.574^{**}$
State	28	$.142$
Private	20	$.355$

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

Since there is a lack of either linear or non-linear relationship between gender and attitude and between gender and experience, the researcher looked at descriptive analysis of the data. Table 4 shows classes' mean scores and standard deviations on gender, attitude and experience. The results of mean scores indicated that there were not big differences between male students' attitude and experience score and female students' attitude and experience score. There is clear evidence that male students in three classes scored almost same on attitude and experience. Same trend was found in

female students' attitude score. The only difference appeared in female students' experience in community college class. This group scored quite low than the other female students' experience scores. Descriptive analysis of gender differences in attitude and experience supports the correlation analysis; because the differences in means and standard deviation were not found to be statistically significant.

Table: 4  
Descriptive Statistics

Class	N	Mean (SD)			
		Male		Female	
		Attitude	experience	Attitude	experience
Community	22	58.33(7.29)	10.5(5.61)	50.42(4.07)	4.57(4.58)
State	28	57.72(8.53)	11.18(4.15)	54.16(8.47)	9.08(5.13)
Private	20	58.9(7.44)	11.65(3.77)	56.7(4.52)	13.5(1.35)

## DISCUSSION

The findings of this study regarding correlations between gender and attitude and experience support the previous findings. Results of such studies (e.g., Nathan & Baron (1995)) showed that students prefer to use mathematical software programs, regardless of gender. Additionally, the results of this research suggest that software programs like MATLAB should be used according to students' attitude toward the program and experience on using the program. The descriptive results in the study clearly shows that gender does not make big difference in students' use of the program. Rather, what level students are on the software program, and how strong their knowledge and their familiarity with features of the software program seem makes difference. Thus, it is essential that teachers should become more aware of motivational factors that might affect students' enthusiasm and curiosity. Moreover, teachers must focus on developing students' experience with software program through class activities.

The results of the study indicate that there is positive correlation between students' attitude toward the program and students' prior knowledge of using the program. Thus, it is clear that students' familiarity and experience on the use of MATLAB clearly affects students' motivation. Teachers should use such programs according to students' expertise on the program and develop new strategies that might catch interest, curiosity and enthusiasm. It seemed clear that effective use of such programs like MATLAB in mathematics classrooms would be expected from all students who have positive attitude and high experience on the program. Therefore, more research on gender, attitude, and experience in such programs is needed to understand how students work with mathematical software programs and use them as learning tool in the class environment.

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