AC 2007-2385: A STUDY OF FRESHMEN STUDENTS' OUTLOOK TO MEDIA BASED TUTORIALS OF MATLAB/JAVA IN COMPUTING FOR ENGINEERS

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A Study of Freshmen Students' Outlook to Media Based Tutorials of MATLAB/JAVA in Computing for Engineers

Abstract

Adequate time is not made available in modern four year engineering curricula to teach introductory programming the traditional way. One way to improve the introductory programming outcomes is to employ media based tutorials. This paper explores the assessment results of a study of freshmen students' outlook to media based tutorials. The study is based on a survey completed by thirty two students enrolled in "Computing for Engineers" at Georgia Southern University. The students major in different engineering disciplines, namely aerospace, computer, civil, chemical, electrical, and mechanical. The tutorials are designed to introduce freshmen students on how to use MATLAB/JAVA programs to simulate simple problems. The results from the study will be analyzed to evaluate the freshmen students' outlook to media based tutorials. The students responded favorably to the developed media based tutorials.

Introduction

In this paper, we present the results of a study and feedback that the students completed based on their outlook toward a media based tool that was used in the instruction of MATLAB/JAVA for computing for engineers. Our analyses follow other studies on media based instruction. Cohen et al[1] found that students learned more from such instruction methods compared to traditional methods of instruction. Powell et al[2] took their analyses further and found that such instructional methods had the effect of raising the GPAs of the students.

BlueJ[3] is a Java™ development environment specifically designed for teaching at an introductory level. It was designed and implemented by the BlueJ team at Deakin University, Melbourne, Australia, and the University of Kent at Canterbury, UK. More information about BlueJ is available at http://www.bluej.org.

Computing for Engineers

The course deals with foundations of computing with an introduction to design, analysis of algorithms and an introduction to design and construction of programs for engineering problem-solving. The sole prerequisite is Calculus I. Students from aerospace, civil, chemical, computer, electrical and mechanical engineering programs enroll in this course, as it is required for their majors. It is a three credit hour course (two 50 minutes lecture combined with a two hour laboratory meeting each week). The pilot study was conducted for this course. At the completion of this course, students should be able to:

1. Have a working knowledge and general understanding of the MATLAB[4] environment.
2. Know the basic types of arrays such as numeric, cell and structure arrays that are implemented in the MATLAB environment.
3. Implement functions (mathematical, user-defined, and advanced) in MATLAB and gain experience with data file management.

4. Understand program design, development process and basic programming skills including debugging in MATLAB.
5. Implement rational and logical operators, conditional statements, loops and switch statements.
6. Gain experience with advanced plotting and model building techniques.
7. Solve elementary linear algebra problems in the MATLAB environment.
8. Gain exposure to basic programming and plotting techniques in Microsoft Excel.
9. Understand the basic topics of JAVA[5] object-oriented programming.

The course outcomes support and attain the ABET Criterion 3 outcome and assessment, as described in their criteria for engineering programs[6].

Assessment Technique and Information Assortment

The goal of this paper is to report on the outcomes and feedback of a study that the students completed. These were based on their outlook to the media based tutorial that was used in the instruction of MATLAB/JAVA for computing for engineers.

Students

The number of participant students at Georgia Southern University who were enrolled in the Computing for Engineers course and participated in the study was thirty-two. Out of the pool, 94% were freshman and 6% were sophomore. The age of students' ranged from 18 to 21 years old. 66% were 18 years old, 31% were 19 years old, and one student was 21 years old. The average student age was 18.4 years old. Students ranked themselves regarding computer skills based on a 1 to 10 scale. Of the thirty two respondents, 67% believed their level of computer skills to be 7 or higher and 33% below 7. There were 87% male and 13% female respondents.

Technology based tutorial

A new media based tutorial was created for teaching MATLAB/JAVA for computing for engineers. This media based tutorial was housed in WebCT and students had to use the internet to log onto their accounts and download the tutorial. It starts by giving step-by-step simulated instruction to teach some of the basic maneuvers of using BlueJ program and JAVA engine through a simple example – hello world program. The tutorial starts under the assumption that BlueJ is installed on the students' machines. The tutorial shows all the required setups, file saving, running the program, and viewing the results through text editor and screen captures. All the main points and steps are explained in detail. Students can go through the tutorial at their own pace and in their own time. There is no rush or time constraints to go through the tutorial. As an example of what the tutorial looks like, Figure 1 shows a snapshot on teaching students how to create an object toward the bottom of the screen labeled 'hello1'.

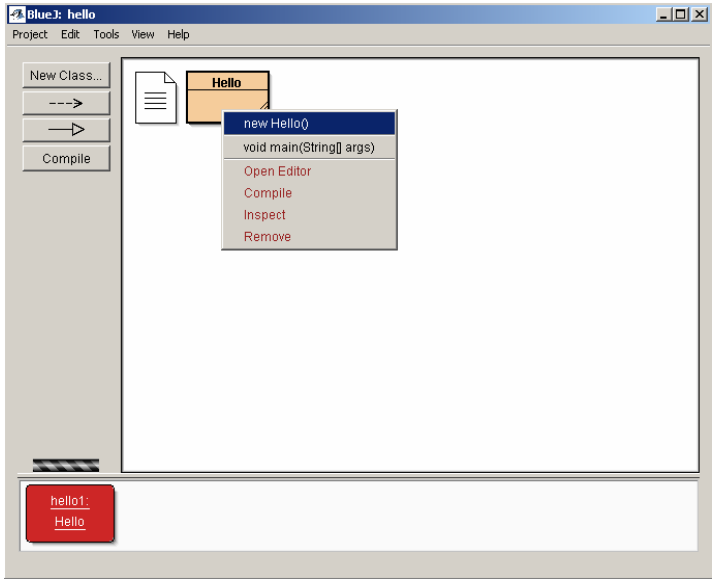

Figure 1. A Snap Shot (Step to Create an Object)

Procedures

Each student was asked to log into their WebCT account and download the tutorial. The students then went over the tutorial by themselves. All students had never been exposed to JAVA programming at the time of the implementation of this media based instructional tool. They were able to follow and comprehend the tutorial with relative ease and without using a great deal of time. Then in the following laboratory session they used BlueJ to run and simulate the given laboratory that was due for that day.

The main assessment objective was to evaluate students' outlook to media based tutorials. To accomplish this goal, a questionnaire that consists of 12 questions was given to students enrolled in Computing for Engineers at the end of the laboratory session. The full questionnaire used in this study is shown in Table 1.

The questionnaire was given to the students by asking them to give their level of agreement on each statement using a five point Likert scale with higher values indicating greater levels of agreement with the statements. The scale is designated as 5 for strongly agree, 4 for moderately agree, 3 for no opinion, 2 for moderately disagree, and 1 for strongly disagree. This style of questionnaire is usually used to ensure that students make some assurance toward outlook.

Table 1. Questionnaire

ENGR 1731 Computing for Engineers
Survey of Students' Outlook of Technology Based Instruction Techniques

Major: AeroE CivE ChemE ComE EE ME Rank: Fr So Jr Age:____

From a 1 to 10 scale, 10 being best, I consider my computer skills at _____ Sex:____

Please choose one answer for each of the following questions:	SA	MA	NO	MD	SD
1. I am highly conversant with using a wide array of computing applications such as MS Office.	5	4	3	2	1
2. I feel technology driven instruction techniques facilitate ease of learning programming languages such as JAVA.	5	4	3	2	1
3. I would prefer to use technology based instruction techniques while learning to use MATLAB/JAVA when I practice by myself.	5	4	3	2	1
4. Technology driven instruction plays a paramount role in making learning enjoyable.	5	4	3	2	1
5. I think learning programming languages will be beneficial to my prospects.	5	4	3	2	1
6. I feel technology related instructional materials are easy to understand.	5	4	3	2	1
7. Technology based instruction techniques are more helpful than textbooks in the learning process.	5	4	3	2	1
8. Technology based instruction techniques are intriguing and help me concentrate on the subject matter better than other techniques.	5	4	3	2	1
9. Traditional methods do a mediocre job when dealing with learning programming languages.	5	4	3	2	1
10. I can learn in an unhurried manner and pace myself using technology based instruction techniques.	5	4	3	2	1
11. Technology based instruction techniques get me more involved in the subject matter.	5	4	3	2	1
12. I was encouraged to experiment and learn more due to technology based instruction.	5	4	3	2	1

Notes: The following abbreviations are used for the majors.

AeroE: Aerospace Engineering; CivE: Civil Engineering
ChemE: Chemical Engineering; ComE: Computer Engineering
EE: Electrical Engineering; ME: Mechanical Engineering

Statistical Results

The full data from all 32 respondents regarding the twelve questions are reported in Table 2 below. The group average scores for all questions are above 3.0, indicating that collectively, students either strongly agree or moderately agree to all statements which indicate that they have favorable attitudes toward media-based instruction. Comparing average scores across individuals, 84% of the students (27 out of 32) have favorable responses.

Table 2. Data from All Respondents

ID#	Sex	Age	Rank	Major	Comp Skill	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Ave.
1	M	18	Fr	ComE	6	4	4	4	3	4	3	2	4	4	4	4	4	3.7
2	M	18	Fr	ME	5	3	2	4	2	1	2	2	2	3	3	3	2	2.4
3	M	19	So	ME	5	4	4	4	4	3	4	2	3	4	4	4	5	3.8
4	M	21	So	EE	7	2	3	3	2	4	2	1	2	4	4	2	3	2.7
5	M	18	Fr	ME	7	5	4	4	4	5	3	4	4	3	3	5	4	4.0
6	M	18	Fr	EE	7	4	3	4	3	2	3	4	3	4	3	4	5	3.5
7	M	19	Fr	EE	7	4	4	4	4	5	3	4	4	3	4	4	4	3.9
8	M	18	Fr	EE	10	5	5	4	5	5	5	5	5	5	5	5	5	4.9
9	M	19	Fr	ME	7	5	5	5	5	5	4	5	5	4	5	5	5	4.8
10	F	18	Fr	AeroE	3	2	4	4	3	3	1	4	4	3	4	4	3	3.3
11	F	18	Fr	ME	3	2	2	2	2	1	1	3	2	4	3	4	3	2.4
12	M	19	Fr	ME	6	4	3	2	2	2	2	2	4	3	4	4	5	3.1
13	M	19	Fr		4	3	2	4	3	2	2	3	2	3	1	4	3	2.7
14	M	19	Fr	ME	5	3	3	3	3	2	3	3	3	3	2	2	3	2.8
15	M	18	Fr	CivE	7	4	3	4	4	3	3	4	4	3	3	4	3	3.5
16	M	19	Fr	EE	9	5	5	3	4	5	5	5	5	5	4	5	5	4.7
17	F	18	Fr	ME	7	4	4	4	3	4	3	5	4	4	4	3	3	3.8
18	M	18	Fr	EE	7	5	4	3	4	2	2	5	4	4	4	4	3	3.7
19	M	18	Fr		6	3	3	2	5	4	3	3	4	5	3	3	3	3.4
20	M	18	Fr	CivE	7	3	5	4	5	5	4	5	5	5	5	5	5	4.7
21	M	18	Fr	ChemE	6	4	5	5	4	3	4	4	4	5	5	4	5	4.3
22	M	18	Fr	CivE	7	5	5	4	4	5	4	4	5	5	4	4	5	4.5
23	M	18	Fr	CivE	9	4	4	4	4	4	4	5	4	4	4	4	4	4.1
24	F	18	Fr	ComE	7	5	4	4	4	5	4	3	5	5	5	4	5	4.4
25	M	18	Fr	EE	7	4	5	4	5	5	5	5	5	5	5	5	5	4.8
26	M	18	Fr	EE	8	5	4	4	5	5	4	5	4	4	5	5	5	4.6
27	M	19	Fr	EE	9	5	5	5	5	4	4	5	4	5	5	4	4	4.6
28	M	18	Fr	ME	8	4	5	5	5	5	5	4	5	5	5	4	5	4.8
29	M	19	Fr	ComE	8	5	5	4	3	4	3	3	4	5	4	4	5	4.1
30	M	18	Fr	ME	6	3	3	5	4	4	3	4	4	3	4	4	5	3.8
31	M	19	Fr	ME	9	5	5	4	4	4	4	5	5	4	5	4	5	4.5
32	M	18	Fr	ME	8	4	4	3	4	3	3	4	4	4	4	4	4	3.8
Average		18.4			6.8	4.0	3.9	3.8	3.8	3.7	3.3	3.8	3.9	4.1	4.0	4.0	4.2	3.9

Tables 3 and 4 compare the majors of the students. The participants consist of 1 aerospace engineering major, 4 civil engineering majors, 1 chemical engineering major, 3 computer engineering majors, 9 electrical engineering majors, 12 mechanical engineering majors, and 2 undecided engineering students. With the exception of aerospace engineering, there are no major differences across disciplines. The students are mostly male and freshmen with average ages of approximately eighteen.

Table 3. Gender and Class of Respondents by Major

	AeroE	ChemE	CivE	ComE	EE	ME	Undecided	Total
Proportion Male	0%	100%	100%	67%	100%	83%	100%	88%
Proportion Freshman	100%	100%	100%	100%	89%	92%	100%	94%
Number of Respondents	1	1	4	3	9	12	2	32

Table 4. Average Age of Respondents by Major

	AeroE	ChemE	CivE	ComE	EE	ME	Undecided	Total
Average	18.0	18.0	18.0	18.3	18.7	18.4	18.5	18.4
Standard Deviation	--	--	0.0	0.6	1.0	0.5	0.5	0.7
Number of Respondents	1	1	4	3	9	12	2	32

Table 5 summarizes the average responses by major. While there is not enough data points for each major to conduct meaningful comparisons, the table serves to convey similarities and differences in the attitudes of students. In general, the average scores for the undecided majors were lower than those with declared majors, as expected. The aerospace engineering student's experiences regarding the media-based instruction were not as positive as all other majors. All other disciplines have indicated that their experiences were good, as supported by the numerical responses and by their comments that follow in the next section. The computer engineering majors provide an interesting perspective. For question 7, regarding whether technology based instruction techniques are more helpful than textbooks in their learning process, their average response is a 2.7, indicating that they moderately disagree. Taken together with the student comments, the experiences of the students seem to indicate that while they liked the media-based instruction in Matlab/ JAVA, they prefer to use this in conjunction with traditional teaching techniques.

Table 5: Average Response for Each Question by Major

	Question	AeroE	ChemE	CivE	ComE	EE	ME	Undecided	Total
1	*I am highly conversant with using a wide array of computing applications such as MS Office.*	2.0 (--)	4.0 (--)	4.0 (0.8)	4.7 (0.6)	4.3 (1.0)	3.8 (0.9)	3.0 (0.9)	4.0 (1.0)
2	*I feel technology driven instruction techniques facilitate ease of learning programming languages such as JAVA.*	4.0 (--)	5.0 (--)	4.3 (1.0)	4.3 (0.6)	4.2 (0.8)	3.7 (1.1)	2.5 (1.2)	3.9 (1.0)
3	*I would prefer to use technology based instruction techniques while learning to use MATLAB/JAVA when I practice by myself.*	4.0 (--)	5.0 (--)	4.0 (0.0)	4.0 (0.0)	3.8 (0.7)	3.8 (1.1)	3.0 (1.2)	3.8 (0.8)
4	*Technology driven instruction plays a paramount role in making learning enjoyable.*	3.0 (--)	4.0 (--)	4.3 (0.5)	3.3 (0.6)	4.1 (1.1)	3.5 (1.1)	4.0 (1.1)	3.8 (1.0)
5	*I think learning programming languages will be beneficial to my prospects.*	3.0 (--)	3.0 (--)	4.3 (1.0)	4.3 (0.6)	4.1 (1.3)	3.3 (1.5)	3.0 (1.4)	3.7 (1.3)
6	*I feel technology related instructional materials are easy to understand.*	1.0 (--)	4.0 (--)	3.8 (0.5)	3.3 (0.6)	3.7 (1.2)	3.1 (1.1)	2.5 (1.2)	3.3 (1.1)
7	*Technology based instruction techniques are more helpful than textbooks in the learning process.*	4.0 (--)	4.0 (--)	4.5 (0.6)	2.7 (0.6)	4.3 (1.3)	3.6 (1.2)	3.0 (1.0)	3.8 (1.1)
8	*Technology based instruction techniques are intriguing and help me concentrate on the subject matter better than other techniques.*	4.0 (--)	4.0 (--)	4.5 (0.6)	4.3 (0.6)	4.0 (1.0)	3.8 (1.1)	3.0 (1.1)	3.9 (0.9)
9	*Traditional methods do a mediocre job when dealing with learning programming languages.*	3.0 (--)	5.0 (--)	4.3 (1.0)	4.7 (0.6)	4.3 (0.7)	3.7 (0.7)	4.0 (0.7)	4.1 (0.8)
10	*I can learn in an unhurried manner and pace myself using technology based instruction techniques.*	4.0 (--)	5.0 (--)	4.0 (0.8)	4.3 (0.6)	4.3 (0.7)	3.8 (0.9)	4.0 (1.3)	4.0 (1.0)
11	*Technology based instruction techniques get me more involved in the subject matter.*	4.0 (--)	4.0 (--)	4.3 (0.5)	4.0 (0.0)	4.2 (1.0)	3.8 (0.8)	3.5 (0.8)	4.0 (0.8)
12	*I was encouraged to experiment and learn more due to technology based instruction.*	3.0 (--)	5.0 (--)	4.3 (1.0)	4.7 (0.6)	4.3 (0.9)	4.1 (1.1)	3.0 (1.0)	4.2 (1.0)
	Number of Respondents	1	1	4	3	9	12	2	32

Note : Standard deviations in parentheses below averages

Student Comments

Students were asked to write some comments regarding technology based instruction at the back of the questionnaire. The following is a summary of the student comments:

- I enjoy using Technology Based Instruction, and prefer it over using traditional methods. I look forward to using it in the future.
- Technology is a good based instruction
- It's a lot easier to learn the program with the tutorials. MATLAB was hard, but using BlueJ seems a lot easier; probably because of the tutorials.
- Its not as passive as a lecture. Its fun and exciting!
- I feel that it helps me out a lot more when I get the hands on training. It is a very good process.
- Technology based instruction should be used with traditional instruction styles
- Need more explanation on how to operate the program
- More emphasis on learning the program and how to use
- Technology based instruction seems to me to be too vague. Studying an unknown subject on something I have never experienced, such as writing programs with a computer and running them seems to be non-efficient. Learning well for me has always been with book, pen, and paper then transferring it to computer rather than technology trial and error.
- It is the most beneficial teaching method
- Technology based instruction is definitely new to me, so it takes me time getting used to
- I like it but, need to come into class assuming no one has had experience with Java/Matlab

Conclusions

This paper examined the usefulness of media based instruction in an introductory computing course for engineering majors at Georgia Southern University. From the survey results and student responses in this pilot study, it is concluded that media based instruction, in conjunction with traditional teaching methods, is preferred by students. The media based instruction provides a positive reinforcement to the traditional teaching methods.

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