

Student Attitudes Towards Homework Tutor Programs

ICTCM March 17, 2006
Beverly K. Michael Ph.D.
University of Pittsburgh
bkm@pitt.edu

The mathematics department at the University of Pittsburgh has been involved with College Algebra reform since 1989 when graphing calculators were first used. Then in 1996 we began a course called Applied College Algebra for the non-math and non-science majors and in 2001 we began using several different kinds of computer tutor software packages that accompany various College Algebra textbooks. All students who enter the College of Arts and Sciences with an SAT score less than 600 must take an algebra placement test and if not passed, students are placed in either College Algebra, Trigonometry or Pre-calculus. This talk is intended to give feedback on student attitudes about the use of computer tutor software packages used in College Algebra, which is taught in various forms.

The courses and the programs used:

We examine the computer tutors used in the fall of 2005 in three variations of college algebra:

- College Algebra, a three-credit course that meets for three lectures and one problem solving recitation per week. Undergraduate teaching assistants lead the recitations. This course is a traditional college algebra for students intending to take calculus. The course covers linear, polynomial, rational, exponential, and logarithmic functions and matrices. Graphing calculators are required. In the fall the course is taught as two large lectures of no more than 150 students. In the spring the course size is about 50 students. The text used is *Algebra and Trigonometry* 2nd ed. Beecher, Penna, Bittinger. Addison Wesley 2005. The computer tutor used is MyMathLab, which counts for 15% of the student's grade. In addition students turn in written homework once a week.
- Applied College Algebra, a three-credit course for the non-math, non-science major that meets for three lectures and one problem solving recitation per week. Undergraduate teaching assistants lead the recitations. This course is more of a reform college algebra concentrating on rates of change, linear, exponential, logarithmic, power and quadratic functions. Polynomials are discussed briefly with regard to transformations of functions. Projects or Explorations are a major part of the course. Graphing calculators are required. In the fall the course is taught as one large lecture of no more than 150 students. In the spring the course size is about 50 students. The text used is *Explorations in College Algebra* 3rd ed. By Kime, Clark, and Michael. John Wiley and Sons, 2005. The computer tutor used is eGrade, which counts for 15% of the student's grade. . In addition students turn in written homework once a week.
- College Algebra Part 1, a 1.5 credit course that is the first half of College Algebra, followed the next semester by College Algebra Part 2, the second half of college algebra. The course meets for two lectures and one problem solving recitation per week. Undergraduate teaching assistants lead the recitations. Graphing calculators are required. In the fall the course size is no more than 60 students, in the spring the course size is no more than 30. The text used is *College Algebra* by Sisson. Hawkes Publishing, 2003. The computer tutor used is Hawkes Learning Systems, which counts for 15% of the student's grade. . In addition students turn in written homework once a week.

Who are the students in the class?

It is very important for an instructor to know his/her student backgrounds. Many departments make decisions about what topics to include in a College Algebra course based upon the fact that the students might take calculus. From a first day of class survey, we get a very clear picture of who is in each class. We know that the students are required to take the course, many do not want to be in the course and do not like mathematics. Our two versions of College Algebra are designed for different majors, however we find that even in the "traditional" College Algebra only 50% plan to take calculus. Both classes had more female students than male students; a majority of students had used graphing calculators and were comfortable using them; students with undecided majors were equally represented in both courses and students majoring in the social sciences were equally represented in both courses. This last fact might have

been due to scheduling conflicts since there was only one section of the Applied College Algebra. Below we find the class summaries for College Algebra (CA) and Applied College Algebra (APP CA).

Summary	CA	Percent	APP CA	Percent
Female	97	63.0	98	66.7
Male	57	37.0	49	33.3
total	154		147	
Highest Math taken				
Algebra	7	4.6	5	3.4
Geometry	19	12.5	33	22.4
Algebra 2	6	3.9	10	6.8
Trigonometry	37	24.3	46	31.3
Precalculus	47	30.9	41	27.9
Calculus	36	23.7	12	8.2
	152	100	147	100.0
Calculator Skill Level				
None	0	38	24.7	15
	1	17	11.0	19
	2	23	14.9	47
	3	50	32.5	55
	4	19	12.3	7
Expert	5	2	1.3	1
Average	2.04		2.19	
Plan to take Calculus				
No	76	49.4	142	96.6
Yes	78	50.6	5	3.4
Major/interest:				
Arts	4	2.6	3	2.0
Biological Sciences	52	33.8	8	5.4
Business	12	7.8	3	2.0
Foreign Languages	3	1.9	9	6.1
Engineering	1	0.6		
English/lit/theater	14	9.1	40	27.2
Physical Sciences	10	6.5	1	0.7
Social Sciences	37	24.0	54	36.7
Undecided	20	13.0	25	17.0

Why use tutor programs?

Especially when a class is taught in large lecture format, computer tutors seem an acceptable tool to use.

From the instructor's viewpoint the main reasons to use tutor programs are:

1. to have students do homework problems.
2. to have students do homework in a timely manner, as due dates can be assigned.
3. to grade homework automatically and record in a grade book.
4. to have students identify their weaknesses, then remediate.
5. to give students immediate feedback.

From a free response questionnaire given at the end of semester, this is what the students had to say that was the best part about using either MyMathLab or eGrade:

Question 1 Best part about using tutor programs	MyMathLab	Egrade
Opportunity to Practice	7	22
Step-by-step solution presentation	20	29
Being made aware of mistakes/clarify procedures not explained in class	23	20
Easy to use		7
Easy Grade	3	
No Best Part	3	8
Reinforces Lecture/HW Topics	9	7
Helps to Learn (general)	3	1
Forces to Practice	6	1
Using the Program to Study From	4	4
Allows for Random Guessing	1	7
Shows many problem types	2	
Helps to Teach Self	10	6
Being able to check work	3	11
Easier/quicker than written homework		5

All tutor programs are not created equally

Since we are using three different tutor programs, we find that comparing them is like comparing apples and oranges, for each is very different, have different interfaces and have different modes of presentations, and different features.

Feature	MyMathLab	eGrade	Hawkes Learning
Tutor or testing	Homework tutor	Combination, instructor sets	Two parts, practice (not recorded) and test certification.
Web based	Yes, requires plugin downloads	Yes	No, on CD
Multi-platform	No, PC only	Yes	No, PC only
Instructor chooses problems	Yes	Yes	No, preset problems, sections only can be selected
Automatically records grades	Yes	Yes	No, student uploads a file
Instructor sets due dates	Yes	Yes	Yes
Late penalty	NO	No	Yes, instructor sets penalty
Allows student to do step by step solution	Yes	No	Yes in practice mode only
Shows answer/solution	Yes	Yes, instructor can set	Yes in practice mode only
Immediate feedback after each problem	Yes	Yes	No, in certification mode only at the end
Allows multiple attempts for each problem	Yes	Yes, instructor sets	Only in practice mode, in certification mode one attempt only and for each test "three strikes" and you start over"
Allows multiple forms of answer	No	Yes on some problems	No
Provides video tutor	Yes for some problems	No	No, only shows step by step examples in practice mode.

Getting Student Feedback

An end of the semester survey was given to students in the various classes to compare their responses to the various tutor programs. It must be noted that the Hawkes Learning systems is a testing program and thus is more punitive than the other two programs. Students need to “certify” for each text section. They are given opportunities to practice, however this is not for a grade. The program requires an 80% correct response on a 10-12 point quiz. If a student does not achieve this level he must begin again. Students find this very time consuming. Also when eGrade was introduced in the fall of 2005, an error in the program was found and use was suspended for two weeks. Students were given an opportunity to vote for either going back to using eGrade or to do extra written homework and they voted to go back to eGrade. However, frustration with the way students had to enter answers caused some problems. This was fixed in the second semester. On a mid semester survey of student using eGrade in the spring term, responses were more positive on average +0.3 points. The use of this survey is to examine trends and not to necessarily compare programs, as the type of students in each course is very different and student math backgrounds may effect their response on the survey. In general we see that students feel that the tutors provide valuable practice and can be used to clarify concepts, but does not increase their love for mathematics.

The attitude survey:

SD: Strongly Disagree **D:** Disagree **N:** Neutral **A:** Agree **SA:** Strongly Agree

Computer Tutorial Systems:

1) make a valuable contribution to learning mathematics.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	10.1%	15.7%	32.6%	36.0%	5.6%	A	3.112
MyMathLab	91	4.4%	5.5%	17.6%	50.5%	22.0%	A	3.802
Hawkes	33	12.1%	12.1%	30.3%	30.3%	15.2%	N,A	3.242

2) should be used in the teaching of math courses.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	9.0%	19.1%	37.1%	29.2%	5.6%	N	3.034
MyMathLab	91	3.3%	11.0%	26.4%	35.2%	24.2%	A	3.659
Hawkes	33	36.4%	18.2%	18.2%	21.2%	6.1%	A	2.424

3) help to make math courses interesting.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	16.9%	37.1%	37.1%	7.9%	1.1%	D,N	2.393
MyMathLab	91	6.6%	13.2%	29.7%	42.9%	7.7%	A	3.319
Hawkes	33	42.4%	21.2%	21.2%	9.1%	6.1%	D,N	2.152

4) provide a meaningful learning experience.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	12.4%	28.1%	36.0%	22.5%	1.1%	N	2.719
MyMathLab	91	6.6%	13.2%	29.7%	42.9%	7.7%	A	3.319
Hawkes	33	18.2%	21.2%	27.3%	24.2%	9.1%	N	2.848

5) help clarify difficult math concepts.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	12.4%	21.3%	19.1%	40.4%	6.7%	A	3.079
MyMathLab	91	4.4%	5.5%	11.0%	53.8%	25.3%	A	3.901
Hawkes	33	33.3 %	15.2%	27.3%	15.2%	9.1%	N	2.515

6) provide opportunities for practicing new skills.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	6.7%	11.2%	27.0%	49.4%	5.6%	A	3.360
MyMathLab	91	1.1%	4.4%	18.7%	53.8%	22.0%	A	3.912
Hawkes	33	12.1%	3.0%	45.5%	24.2%	15.2%	N	3.273

7) help broaden students' knowledge of mathematics.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	11.2%	22.5%	44.9%	18.0%	3.4%	N	2.798
MyMathLab	91	2.2%	11.0%	33.0%	49.5%	4.4%	A	3.429
Hawkes	33	15.2%	9.1%	45.5%	18.2%	12.1%	N	3.030

8) require a reasonable amount of effort to use.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	13.5%	15.7%	18.0%	37.1%	15.7%	A	3.258
MyMathLab	91	2.2%	13.2%	16.5%	44.0%	24.2%	A	3.747
Hawkes	33	39.4%	3.0%	9.1%	18.2%	30.3%	SD	2.970

9) help students improve their problem-solving abilities.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	6.7%	20.2%	46.1%	25.8%	1.1%	N	2.944
MyMathLab	91	1.1%	11.0%	35.2%	45.1%	7.7%	A	3.473
Hawkes	33	12.1%	21.2%	36.4%	15.2%	15.2%	N	3.000

10) help increase students' interest in mathematics.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	33.7%	41.6%	20.2%	3.4%	1.1%	N	1.966
MyMathLab	91	26.4%	28.6%	36.3%	8.8%	0.0%	N	2.275
Hawkes	33	51.5%	18.2%	21.2%	6.1%	3.0%	SD	1.909

11) help students identify important math concepts.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	10.1%	13.5%	36.0%	39.3%	1.1%	A	3.079
MyMathLab	91	2.2%	9.9%	28.6%	50.5%	8.8%	A	3.538
Hawkes	33	18.2%	15.2%	39.4%	24.2%	3.0%	N	2.788

12) help students improve their critical thinking.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	9.0%	22.5%	46.1%	21.3%	1.1%	N	2.831
MyMathLab	89	3.4%	16.9%	36.0%	41.6%	2.2%	A	3.225
Hawkes	33	21.2%	21.2%	39.4%	15.2%	3.0%	N	2.576

13) help students gain confidence in doing mathematics.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	14.6%	24.7%	34.8%	24.7%	1.1%	N	2.730
MyMathLab	89	6.7%	15.7%	32.6%	40.4%	4.5%	A	3.202
Hawkes	33	21.2%	27.3%	27.3%	15.2%	9.1%	D,N	2.636

14) help students develop better study skills.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	89	15.7%	25.8%	32.6%	24.7%	1.1%	N	2.697
MyMathLab	89	3.4%	23.6%	37.1%	33.7%	2.2%	N	3.079
Hawkes	33	18.2%	9.1%	21.2%	39.4%	12.1%	A	3.182

15) help students identify areas of mathematical weakness.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	88	5.7%	11.4%	25.0%	52.3%	5.7%	A	3.409
MyMathLab	89	2.2%	6.7%	31.5%	52.8%	6.7%	A	3.551
Hawkes	33	18.2%	29.1%	21.2%	39.4%	12.1%	A	3.182

16) increases students tenacity to solve problems.

	Number	SD	D	N	A	SA	Mode	Mean
Egrade	83	14.5%	21.7%	33.7%	27.7%	2.4%	A	2.819
MyMathLab	86	4.7%	19.8%	30.2%	39.5%	5.8%	A	3.551
Hawkes	30	23.3%	10.0%	20.0%	33.3%	13.3%	A	3.033

What students dislike.

From a free response questionnaire given at the end of semester, this is what the students had to say that was the worst part about using either MyMathLab or eGrade:

Question 2 Worst part about using the tutor	MyMathLab	Egrade
Too much time involved	32	16
Doesn't accept equivalent forms	26	61
Frustrating/Stressful	4	

Troubles logging in/doesn't run/freezes	18	23
Unnecessary	3	
Mistyping	1	
Explanations are confusing/not helpful	10	
All of it	2	2
Problems too difficult	1	1
Allows for Random Guessing	3	1
Easy to forget to do	1	10
Monotonous/tedious/repetitive	2	10
Too much work on top of written HW		12
Don't have a computer, so inconvenient		5
Graphics not working		5

What students would change?

Question 3 Suggestions	MyMathLab	Egrade
No Response/ None	36	27
Make it so there are fewer problems to do at once	12	15
Clearer/Better Explanations	4	11
E-mail reminders that it's due	1	5
More problem types, levels	4	1
Making typing in fractions easier/Accept Equivalent Answers	13	28
Not Counting towards grade/extra credit	6	11
Partial credit for multi-step problems	3	
All due at the end of the semester so can do on own time	4	
Develop a Mac version too	3	
Use Computer or book only, not both	3	12
Making program easier to operate		14
More examples		3

In conclusion

This author is convinced that using computer tutors does help students practice math homework and gives immediate feedback. By assigning homework tutor problems that are due before the next lecture, students are constantly practicing problems and keeping up with the syllabus, rather than waiting until the night before homework is due to finish their homework. They get credit for doing the tutor homework as well as written homework. Students in College Algebra and Applied College Algebra have an 85% pass rate. Students in the lower level Algebra part 1, come in with very poor math skills, have a higher frustration level, but still have a 75% pass rate. Students like less punitive programs that allow them to make mistakes and have multiple attempts at solving the problems. Students like to see step-by-step solutions and worked out examples. They also want to enter their answers in multiple forms. Many students complain that they have the right answer but not in the form the program wants. This really frustrates them. The best thing we can do is find out exactly what the students have to say and communicate this to the creators of these programs. As an instructor, work the problems as students do, to really get to know the program. Then work constantly with the tech support people and tell them about features that are wanted and needed in the program. And last but not least, as always further research is need to prove or disprove success of the use of tutor programs. Research mathematicians need to have opinions that are based on research not conjecture. We all need to bring factual information to our colleagues and to the mathematics community at large.