Using On-Line Tutoring Systems: Successes, Failures and Lessons Learned

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Almost all mathematics textbooks at the pre-calculus level have a computer tutor/testing program which accompanies the text. Programs vary in form and substance and fall into the categories of electronic tutor or electronic testing program or a combination of the two. This author has spent the last five years using some of these programs including: Math Pro, Math XL, My Math Lab, eGrade, The Learning Equation and Adventure Learning System.

There are many reasons why an instructor would want to use such programs, esoteric reasons such as:

1. Provide students with unlimited mathematical practice.
2. Identify areas of student weakness.
3. Ability to track student progress.
4. Keep students engaged in mathematical problem solving.
5. Provide a nonbiased tool for finding student errors.

However, the main appeal is that a computer program can manage homework assignments and quizzes, which are automatically graded, allowing the teacher (or teaching assistant) to spend less time grading. Instructor opinions of computer tutor/testing programs and student opinions vary considerably. It is this instructor's experience (and that of the instructors in our department) that just because a computer tutor package comes with the text or is available for students to use, does not mean that students use it—in fact unless students are forced to use the program, they will not use it.

Implementation of a computer tutoring/testing program

Successful incorporation of these programs into the curriculum is a rather tricky business, especially if you put the emphasis on "successful". An instructor cannot seriously evaluate a computer program unless all of the students use it. After trying many approaches from voluntary to extra credit to mandatory use, here is what really works:

1. Start small, pilot with a small group first.
2. Ask for a list of schools that use the program and a contact person at the school. Find out how they use the computer tutor/testing program and what they like or dislike about it.
3. Find out what in-service training is being offered and if the software company will train your instructors or Teaching Assistants.
4. All students should be required to use the computer tutor/testing program.
5. A substantial portion of the student grade should come from the computer tutor/testing program; for example 20% or the equivalent of an exam score.
6. Give the computer tutor/testing a different name like "take home quiz" or "supplemental homework", which prominently appears on the syllabus.
7. Make the first few assignments "extra credit", so that students can get used to how the program expects answers to be entered and so that any computer bugs or software incompatibility is found early in the semester. This is very necessary for programs that require downloads.
8. Allow for multiple attempts, thus insuring a good grade.
9. Set a deadline for completion of the assignments. This is especially important with distant learning courses. Some programs allow you to penalize late assignments.
10. Incorporate some written assignments, in addition to the computer, so students can demonstrate correct mathematical writing techniques.
11. Work each computer assignment yourself, so that you can find the quirks of the program, then alert students ahead of time students. Do similar problems in class.
12. Find out the technical support phone number especially for faculty and if possible a contact person. When a crisis arises, and it will, you want to talk with someone immediately not wait to go through email.
13. Make sure students have the technical support phone number and email. Expect to answer many emails early in the term.
14. Never totally believe the sales rep hype. The program is never as good as it is cracked up to be. You will always want the program to do something it cannot.

15. Find out if the gradebook is exportable to a spreadsheet and if it has multiple filters, and multiple formats for recording the grade (i.e. percent and total points or ratio of correct to total).
16. Ask if you can communicate with the student via email inside the gradebook. When you are looking at student progress you often want to email the student immediately.
17. Give your part-time instructors in-service training. They are like students, maybe worse, if you don't require them to use it –they wont. Put the computer tutor on the syllabus
18. Ask the students what they like and dislike about the program.
19. Be flexible, servers will go down, students will miss deadlines, anything that can go wrong will go wrong.
20. Be adventurous, if the program you are using does not work, try something new.

What students have to say.
Students have a mixed reaction to computer tutor/testing programs. In general they dislike typing math answers into a computer and do not like the unforgiving nature of the computer, and feel that the computer takes up too much time, but they think it provides good practice. To get at student attitudes a two part survey was given to the students during the fourth week of the term. Part 1 asked the students to write what was the *best* and *worst* part about the computer tutor/testing system they were using. Table 1 shows the responses from the day section. The evening section was comparable. The Day section had 81 students respond and the evening students had 41 students respond. Some students responded with more than one best part or worse part, therefore the numbers do not add up to 81 responses.

Question 1: "Best part"	Question 2: "Worst part"
Opportunity to Practice: 21	Too much time involved: 27
Step-By-Step solution presentation: 12	Missing a small part of the problem and getting the whole
Being made aware of mistakes/ clarify procedures: 12	problem wrong/ mis-typing: 13
Getting Certified (done): 10	3 strikes & you're out & having to start over): 10
Easy Grade: 9	Doesn't accept equivalent forms: 9
No Best Part: 8	Frustrating/Stressful: 7
Reinforces Lecture Topics/Homework: 5	Troubles logging-on/doesn't run: 4
Helps to learn (non- specific): 5	Unnecessary: 3
No response: 4	Typing-in wrong #s, but knowing the correct: 3
Forces to practice: 3	Explanations are confusing: 2
Using the program to study from: 2	All of it: 2
Builds confidence: 2	No chance to correct answer: 1
Good for review of previously learned math: 2	No chance to see calculation errors: 1
	Tutor problems more difficult than HW problems: 1

Table 1 Results of free response questions for day section

Part two of the survey was a 15 item multiple choice questionnaire. The questions were adapted from the Office of Measurement and Evaluation, Student Evaluation of Teaching Form. The students were asked to respond to the question on a Likert scale of :
A: Strongly Disagree   **B:** Disagree   **C:** Neutral   **D:** Agree   **E:** Strongly Agree
The results were computer graded with scores given to the response: Strongly Disagree=1, Disagree=2, Neutral=3, Agree=4, Strongly Agree=5. A mean score greater than a 3.0 was considered a positive response and a mean less than 3.0 was considered a negative response. The results appear in Table 2. Students strongly feel that the computer tutor/testing program does not help make the course interesting and that it does not help increase students' interest in mathematics. On the other hand they agree that the program requires a reasonable amount of effort to use and that the program provides opportunities for practicing new skills. At the end of the term this author will again give the survey to see if there was an attitude shift over the term.

Summary
Computer tutor testing programs have some good points and some bad points. They are not as simple to implement, as it would seem from the literature from the publishers. First time users would be wise to contact other instructors who have used the product to get advise on how to implement the program successfully.

The survey:

A: Strongly Disagree   B: Disagree   C: Neutral   D: Agree   E: Strongly Agree

Computer Tutorial Systems:
1) make a valuable contribution to learning mathematics.
2) should be used in the teaching of math courses.
3) help to make math courses interesting.
4) provide a meaningful learning experience.
5) help clarify difficult math concepts.
6) provide opportunities for practicing new skills.
7) help broaden students' knowledge of mathematics.
8) require a reasonable amount of effort to use.
9) help students improve their problem-solving abilities.
10) help increase students' interest in mathematics.
11) help students identify important math concepts.
12) help students improve their critical thinking.
13) help students gain confidence in doing mathematics.
14) help students develop better study skills.
15) help students identify areas of mathematical weakness.

Combined N= 128								
Item	SD	D	N	A	SA	MODE	MEAN	Stand. Dev.
1	8	23	39	44	14	A	3.258	1.074
2	18	35	36	27	12	N	2.844	1.187
3	29	53	33	9	4	D	2.266	0.992
4	18	34	38	34	4	D; A	2.781	1.086
5	13	26	25	50	14	A	3.203	1.186
6	6	7	42	59	14	A	3.531	0.930
7	7	21	51	44	5	N	3.148	0.931
8	14	9	10	36	59	SA	3.914	1.346
9	6	22	53	37	10	N	3.180	0.967
10	51	49	25	1	2	SD	1.859	0.867
11	14	21	49	41	3	N	2.984	1.011
12	9	22	59	34	4	N	3.016	0.922
13	25	24	44	30	5	N	2.500	1.135
14*	18	26	46	32	5	N	2.843	1.080
15†	9	15	30	56	16	A	3.437	1.084
T	245 12.8%	387 20.2%	580 30.2%	534 27.8%	171 8.9%	N	2.999	1.162

* 1 missing data point   † 2 data points missing

Table 2 Survey Summary