WORK IN PROGRESS

Using *Mastering Engineering* Software-Based Homework System in Statics and Circuits Classes

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Abstract

Mastering Engineering is a web-based, homework management system, created by Pearson Publishing Company. It is currently available in 4 engineering courses and 2 science courses. Engineering Courses currently covered by the Mastering Engineering software include (1) *Statics, (2) Dynamics, (3) Mechanics of Materials, and (4) Electrical Circuits.* This paper will examine the pros and cons of using this software, from a community college perspective, including opinions from both instructors and the students in their respective classes. There will also be some short discussion on possible future uses of software applications like Mastering Engineering.

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A. The Role of Assigning Homework in my Teaching Career

As a community college Engineering instructor my work duties require a wide variety of responsibilities, including teaching up to five different course preparations in one semester. In my 28 years of teaching engineering at the community college level, my approach to assigning, collecting and grading homework in the *Statics* and *Circuits* classes has evolved. When I first started my teaching career, I would typically assign about 10-15 textbook problems every week, collect them on a weekly basis, grade most, if not all, of them by hand (typically with the assistance of a solutions manual, if available). Grading and recording homework, and providing

solutions in a secure manner was a time-consuming activity, and unlike teaching the same course in many university settings, at the community college I had no access to receiving help in grading from graduate students or other people similarly qualified.

Over time, I ended up grading fewer homework problems each successive year, though I would still provide student access to all solutions, either by physically posting solutions on a bulletin board or by posting electronic solutions on a student-accessible website like Blackboard or Moodle. In recent years, this has evolved to where I would still collect the homework, but only check it to see that the student made an attempt to solve the problem, and continue to provide students with solutions to each of the problems that I had assigned. Beginning in Fall Semester 2011, I tried using *Mastering Engineering* for *Statics* for the 1st time, based on a presentation I had seen in the summer of 2011. In the current Spring 2013 semester, I am now using *Mastering Engineering* for the 4th time: twice in *Statics* (Fall 2011, Fall 2012) and now twice in *Circuits* (Spring 2012, Spring 2013). This report summarizes briefly how *Mastering Engineering* works, and also includes both my assessment, and my students' assessments, of the effectiveness of using this web-based homework management system. In my situation, the fact that I no longer personally grade each student's homework, nor spend time recording each student's homework score, has been a significant time savings to me, particularly in large classes.

In both *Statics* and *Circuits*, the homework portion of each course, which now comes completely from the *Mastering Engineering* website, is worth 20% and 15% of the total course grade. In addition, I require a written journal, which should include work completed in answer the Mastering Engineering homework questions, and in both classes it is worth between 3-5% of the overall grade (see **Part G., My Recommendations**)

A summary of student comments from my first semester using *Mastering Engineering* (for *Statics*) can be found in Appendix K. The following semester (Spring Semester 2012) I used *Mastering Engineering* for *Circuits*, and I have just completed using *Mastering Engineering* for *Statics* for the 2nd time this past Fall Semester 2012. In each of these classes, the class size has averaged about 28 students per class. In terms of my determining how many problems to assign, I have varied the number of problems per assignment, from about 10 problems on some assignments, up to 25 problems per assignment on others. I recall hearing that Pearson recommended assigning 10-15 problems per assignment, though I personally will assign more problems per assignment if I feel that (a) the problems are shorter, and/or (b) I believe that students need additional practice to master the material.

B. Mastering Engineering Overview

Mastering Engineering is a product, created by Pearson Publishing Corporation, to be used by college faculty and students in a variety of disciplines, mainly within engineering and the sciences. Engineering disciplines currently available in Mastering Engineering include the following:

- Statics
- Electrical Circuits
- Mechanics of Materials

- Dynamics

Other subjects to be added to this list include Materials Science.

On Pearson's *Mastering Engineering* home page, the *Mastering* homework system is advertised the following way: *"used by over a million students, the Mastering platform is the most effective and widely used online tutorial, homework, and assessment system for the sciences and engineering*." Pearson Publishing is also involved with on-line homework management systems in Mathematics courses, although the software I currently use in teaching Intermediate Algebra--*My Math Lab* ---has a different user (and instructor) interface than that found in Mastering Engineering. This paper will solely focus on the Mastering Engineering system.

C. How Mastering Engineering Works

Homework assignments are created by the instructor, on the Mastering Engineering website (website access to the instructor's site is password protected). When a "course" is created on Mastering Engineering, a course number is assigned (for example, in my Spring 2013 Introduction to Circuits Analysis course, the course number was MELEVELENGR44).

Figure 1: *Mastering Engineering Log in Home Page*

All students enrolled in the class are required to sign-up for the Mastering Engineering website. Access to Mastering Engineering is not free; student options for gaining access to the Mastering Engineering site include the following:

1. Students purchasing web-access to Mastering Engineering separately, through the Mastering Engineering website. In the current Spring Semester 2013, this access costs students approximately $60/semester for access Mastering Engineering-Circuits.

2. Students can purchase either a hardbound or an electronic textbook bundled with web-access to Mastering Engineering through the Pearson website.

3. If the instructor elects to do so, Pearson also offers the opportunity to bundle a custom-published hardbound textbook, bundled with the Mastering Engineering software. For example, in Spring 2013 I have this option available to students for the Circuits class. I am using only the first 11 chapters of the Nilsson-Riedel Circuits textbook (vs. the entire 18 chapters found in the hardbound textbook). The custom-published textbook (containing 11 chapters of Nilsson-Riedel Circuits, and identical to the chapters found in the full-length textbook), bundled with Mastering Engineering, costs approximately $110 to Las Positas College students during Spring 2013.

As is also true in a "traditional" approach to assigning/collecting/grading homework, in Mastering Engineering the instructor will assign homework problems, determine due dates, determine whether late assignments will be accepted and, if so, how much deduction will apply to late-submitted assignments. The instructor interface for some of these tasks is shown in Figures 2 and 3.

D. Grading in Mastering Engineering

Mastering Engineering keeps a running score of student grades on all homework questions. At any time within the semester, the instructor can select the Gradebook course link (see **Figure 4**) to view a gradesheet (see **Figure 5**) which shows student scores on all homework problems assigned. There are also several filtering options that allow the instructor to see specific portions of the Gradebook.

Figure 4: *Course Home Links*

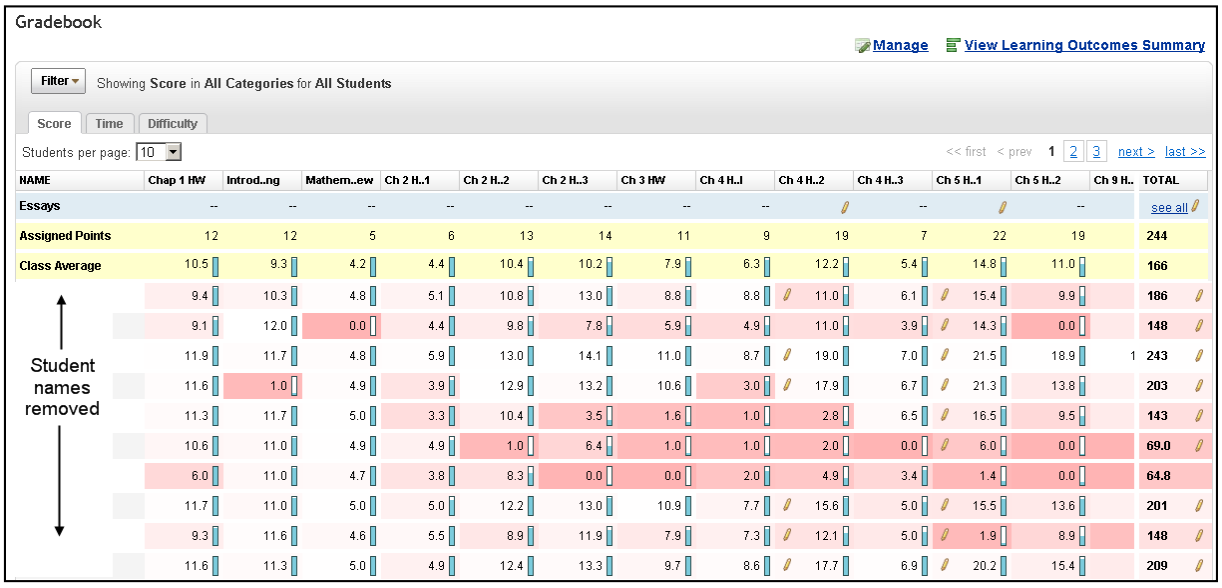


Figure 5: *Example Gradebook, showing individual and total homework grades*

E. Types of Problems Available in Mastering Engineering

Mastering Engineering is designed to have two different types of problems for students to solve. **(1)** ***End-Of-Chapter questions*** are identical to those found in the most current edition of the hardbound textbook. If students purchase the hardbound textbook bundled with the Mastering Engineering access, they can still potentially work on homework problems without access to a computer. The other type of homework problem, **(2)** ***Tutorials***, are problems which are not available in the hardbound edition of the textbook, and have been marketed to both students and instructors as one of the value-added features to Mastering Engineering (see **Figure 6**). These are typically much longer than end-of-section problems, with multiple parts, and are designed to be more conceptual than end-of-section problems. An example of a Tutorial question from Statics is shown in Figure 6. Tutorial Problems also include a **Hints** feature, where a student can receive additional information to help solve the problem (see **Figure 7**)

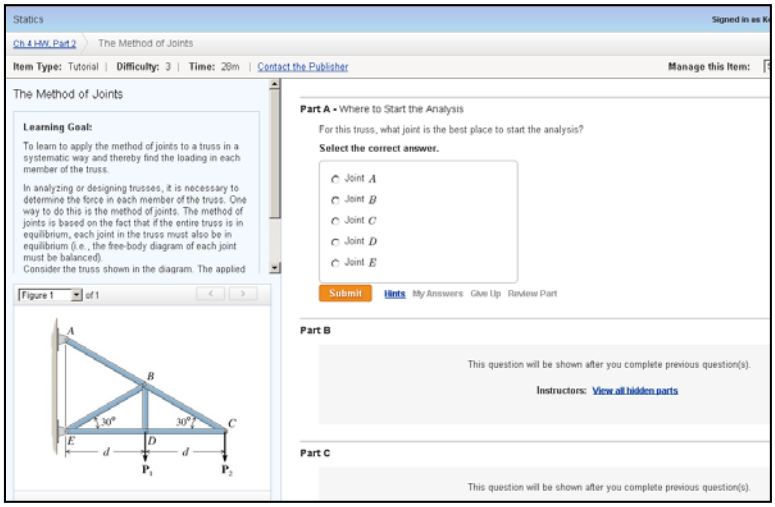


Figure 6: Example of Tutorial Problem on Method of Joints, from Statics. Tutorial Problems are not duplicated in the textbook, and typically involve multiple parts, and are intended to build towards a better understanding of a topic.

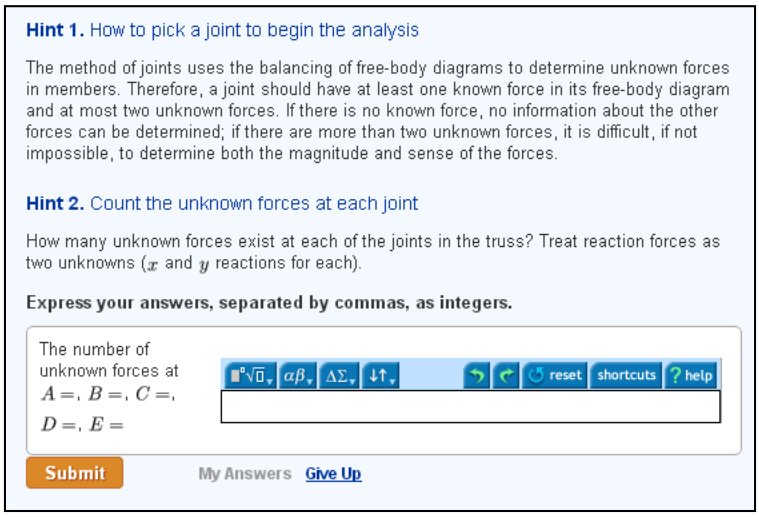
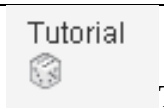
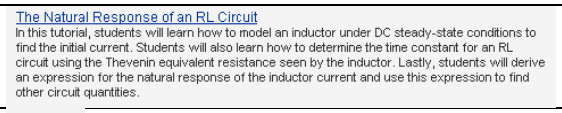


Figure 7: Tutorial Hint from a Method of Joints Problem, from *Statics*

In addition to selecting specific problems, the instructor will also be able to view the following items, for each problem. Usage statistics are based on how have previous students have scored on the same problem. Each problem includes an (a) Item Type, (b) Title, (c) Time, (d) Difficulty, and (e) Usage Statistics. An example from an RL Circuit Tutorial is shown below:

Item Type	 The icon below Tutorial indicates that problems are *randomizable*	Tutorials are longer problems, and are not available in the textbook
Title		A description of the problem or tutorial
Time		How long, on average, students have taken to complete problem
Difficulty		Mastering Engineering's Difficulty Rating
Usage Statistics		Green % who answered question correctly Red % who requested the answer (i.e., gave up) Orange Measure of wrong answers per student Yellow Measure of number of requested hints

F. Importing / Exporting Courses / Other Resources

This feature allows an instructor to either (a) share courses that they create, with other instructors, and/or (b) re-use a course used in a previous year or semester. **Figure 8** shows the link from a Statics course, including the option of creating a course, which would lead to a dialogue box shown in **Figure 9**. As the only Engineering instructor at my college, I have only used this 2nd option, though I can see how the first option might be very helpful at colleges with multiple sections of a statics or circuits (or other *Mastering Engineering*-supported) courses. If I elect to use a course from a previous semester, I will still have the option to edit the specific problems that I had assigned before. In any case, I will still have to update due dates for all homework

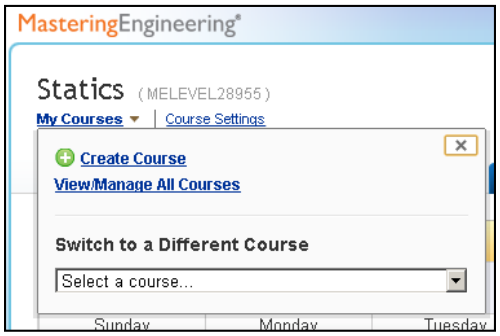


Figure 8: Create or View a Course

problems. **Figure 10** below shows a page used to Manage different courses within Mastering Engineering.

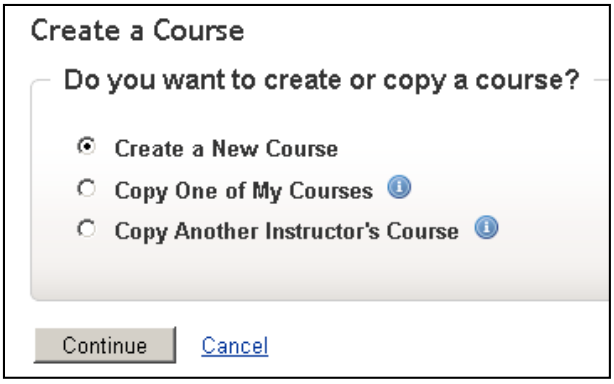


Figure 9: Create a Course Dialogue Box

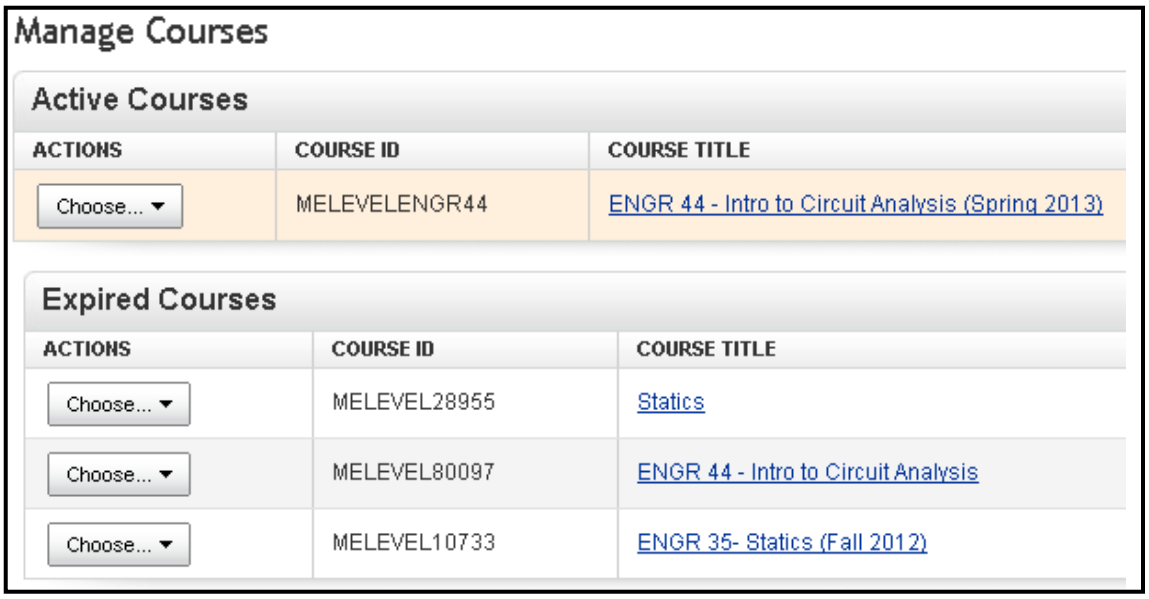


Figure 10: Manage Courses Link: Includes Active and Expired courses

Other resources for Instructors include (1) on-line Solutions Manuals, (2) pre-made lecture Powerpoint files, and (3) access to an on-line electronic version of the textbook (see **Figures 11, 12 and 13** below)

Figure 11: Links to Other Instructor Resources

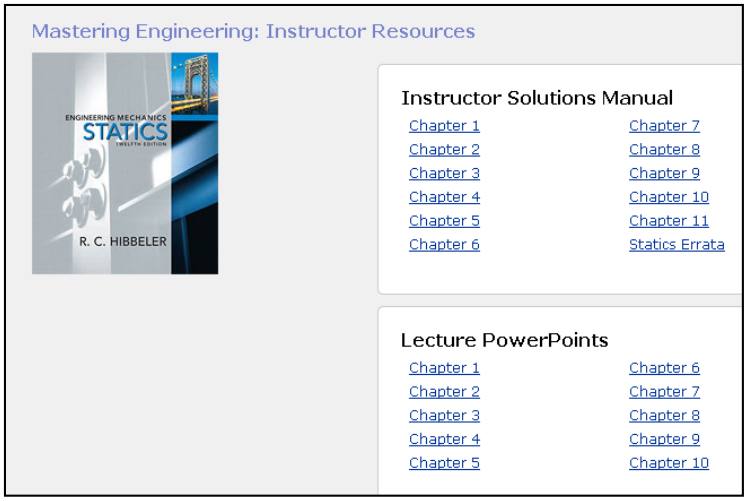


Figure 12: Link to Solutions Manual and Lecture PowerPoints

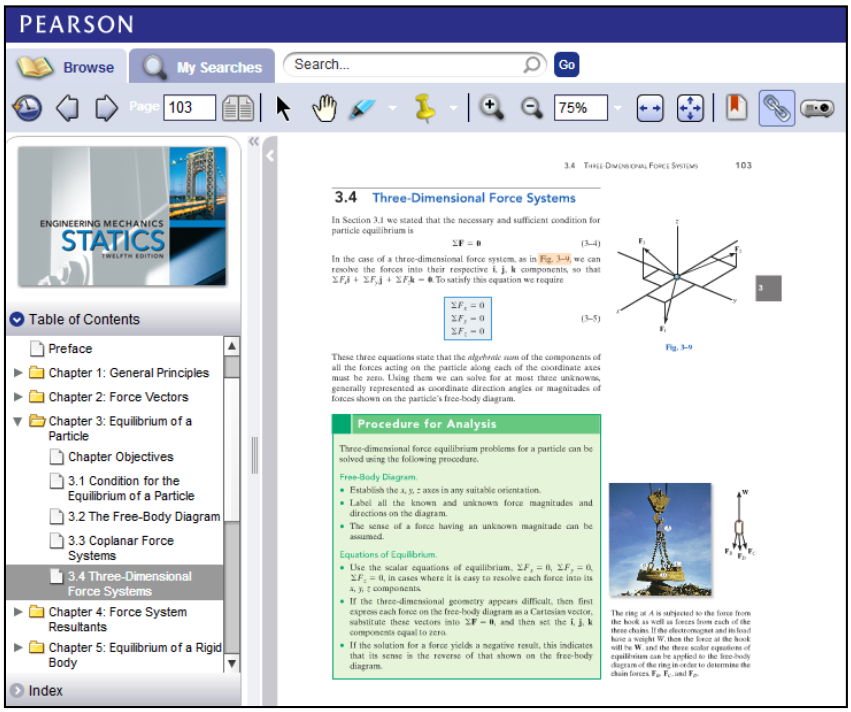


Figure 13: Link to Electronic Version of Textbook

G. Customizing *Mastering Engineering* to include Instructor's Course Materials

Mastering Engineering does provide a way for instructors to both (a) Upload and record course materials (See Figure 14), and (b) assign their own problems (See Figure 15). In my time using *Mastering Engineering*, I have not yet used either of these features.

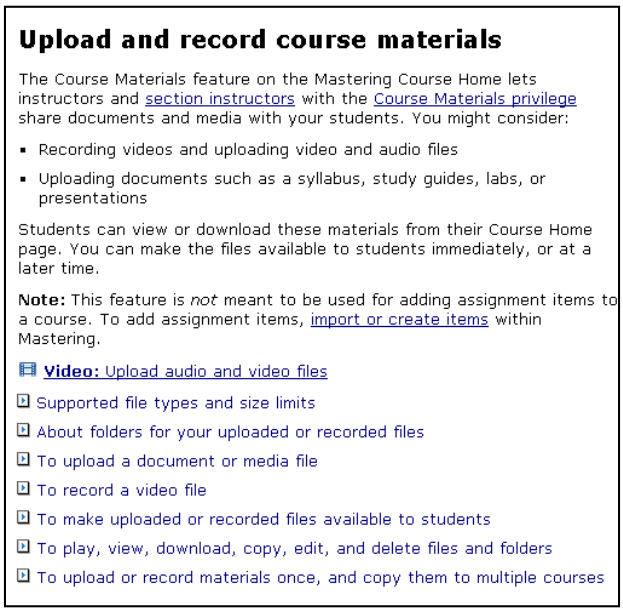


Figure 14: Mastering Engineering Help File on Uploading Course Materials

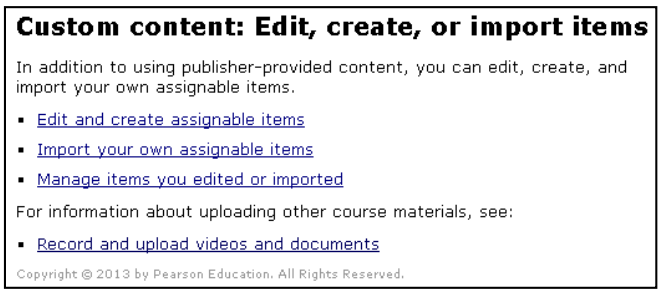


Figure 15: Mastering Engineering Help File on Adding Your Own Problems

H. My Recommendations for instructors who will use Mastering Engineering

1. Consider assigning a written journal as part of the Mastering Engineering homework, and make it a percentage of the entire homework grade. This reinforces some of the traditional homework practices that I encourage students to maintain (e.g., drawing free-body-diagrams in Statics).

2. Learn and become knowledgeable about the various settings (e.g., late penalties for homework) that Mastering Engineering provides.

3. Be aware that some students may be quite insistent on their dislike of this approach to completing homework (see Appendix K for student comments).

I. Upsides to Mastering Engineering: Instructor and Student Perspectives

1. Frees up a significant amount of paperwork on the instructor's part.

2. Provides students immediate feedback on whether homework solutions are correct, and also has the potential to provide immediate assistance to students working on homework problems.

3. Keeps all grades in a secure location on the Mastering Engineering website, which an instructor can access at any time.

4. Provides the facility to align the goals of homework with Student Learning Outcomes (SLOs).

J. Downsides to Mastering Engineering: Instructor and Student Perspectives

1. Software is 1st or 2nd generation. Students have complained that correct solutions are not always recognized by the software as being correct. An example of one type of inconsistency is shown in Appendix L, where the input (mine, in this case) was not recognized as being correct, even though it appears to be correct.

2. It is unclear whether the actual learning outcomes are an improvement when compared to using a traditional approach to engineering homework. In the courses where I have used Mastering Engineering, I have not observed any significant difference in student performance, when comparing students who completed homework through Mastering Engineering vs. a traditional paper-and-pencil approach. To accurately measure learning outcome differences between using Mastering Engineering vs. using the traditional pencil-and-paper approach would be very challenging.

3. Graphics-based problems. I was advised by another community college instructor to avoid assigning these types of problems. My brief exposure to solving these types of problems has confirmed the advice that I had received.

4. Assignment of computer-based homework problems may discourage students from solving homework problems using the traditional approach of pencil on paper, including appropriate diagrams (e.g., free-body diagrams in Statics). To address this issue, I typically require that students use journals to record their problem solving, collect the journals 2 or 3 times per semester, and incorporate the journal's grade as part of their overall homework grade. This aspect is my first recommendation in Part G.

5. There is no "used-software" market for this product, and, as a result, students have really only one option for accessing the Mastering Engineering software—through the publisher. I have found that, in today's textbook market, many students have been

accustomed to using a variety of internet sources to buy textbooks. Options for students to obtain Mastering Engineering through another vendor are very limited.

K. Possible Future Trends

If the trend in offering distance-education courses (including hybrid courses) continues, then Mastering Engineering and other software systems of its type will likely increase in use. As an instructor who has ample experience in the older, more traditional approaches to teaching Statics and Circuits, I feel that it has potential to potentially improve upon the "old way", provided it is used and managed carefully.

Appendix L: Summary of Student Comments re: Mastering Engineering in *Circuits*

Course: ENGR 44, *Introduction to Circuit Analysis*, 4 units, Spring 2012, Las Positas College, Livermore, CA, Instructor: Keith Level

Note: ME represents Mastering Engineering, MP represents Mastering Physics, M by itself or combined with other words will represent any of the different Mastering software programs.

All students were presented with all of the following questions; although each student's name is kept anonymous, each lower case letter, in each answer, represents the same student (this is done to provide some continuity between answers to the various questions).

1. Summarize any use of "Mastering"-types of homework software prior to this semester, and include your overall opinion of its merits / problems (prior to Spring 2012)

a. Used ME for Statics, Used MP for 3 Physics Classes
b. Physics Heat/Light: straightforward, just a bit time consuming
   Statics: Not so great graphical problems
c. I used Aplia for Economics which was a lot easier to use and well thought out than M softwares that I have used
d. It is a good way to have immediate check for correct answer. But, I believe it is very time consuming to change and keep track of the unit prefix, such as μ, m, M, G
e. MP: It was pretty good
f. ME, MP, MChem
g. Decent stuff, the hints on why you got a problem wrong can really help.
h. Used MP before
i. Used MP in Physics 4A-C
j. Very finicky about units, ie, will be marked wrong for 5 nF when the answer is given as 5×10^{-9}
k. I used MP for 2 semesters. It was difficult to get used to at first, but eventually I learned to appreciate the benefits of having to spend 2 hours on one problem
l. M-type homework that I have done prior to this semester have the same problems I have in this semester. The way it is designed to help student learning on the subject is very weak compared to a software I have to use of Chem 1A, "sapling"
m.
n. I have used M for two semesters of physics. Both experiences have been awful.
o. I have used MP and ME so far. I liked using it because I thought that it was a better way to study than just using the textbook.
p. I don't like it at all.
q. It is a great idea, just need to fix up glitches.
r. MP was done well, all the answers were correct and what you needed to find was clear. ME for statics was also pretty clear.
s. MC: Did not have a problem with it. MP: Hard to input values like it wanted it. ME: Graphs and some data entry are confusing.
t. Used M for all 4 of my Physics classes plus my statics engineering class. Up to this class, I would give M a fair grade, but this experience I would rate M as unacceptable.

2. **List some of the positive aspects of Mastering Engineering for Circuits this semester:**

a. Immediate feedback (that isn't perfect)
b. Continuous work
   Lengthy tutorials, need to summarize text?
c. I can go back to every assignment that I have completed and review it. I can also do all the problems from scratch (for no credit)
d. Immediate respond on the correct answer. It forces you to understand the problem, although it could help with more hints in regular problems or example problems.

e. It tells me whether I have the correct answer right away; hints.
f. Immediate feedback; tutorial problems w/hints are generally helpful; orange is my favorite color.
g. Homework is graded very quickly.
h. Immediate feedback on solved problems which helped speed up the learning process

3. **List some of the positive aspects of Mastering Engineering for Circuits this semester: (continued)**

i. Gives instant feedback if answer is right/wrong; Multiple attempts to get correct answer; Don't have to wait for the teacher to return work to know your score;
j. Immediate feedback; Tutorial problems are useful, but very long
k. Having M homework makes it harder to breeze through an assignment, since you have to work so much harder for each little point. You end up spending more time thinking about circuits, which probably increases understanding.
l. It covers all theories we need to learn for basic circuits; The video clips by the author helps a lot.
m. Forces me to do my homework fully. Gives me on the spot grading, which is very helpful.
n. Makes it easy for teachers.
o. Easy access to it. Wherever you have the internet, you can study. Tutorials are very helpful.
p. The hints help and when the feedback box shows up.
q. Most of the hints are helpful. The immediate response is helpful.
r. Some of the hints helped figure out the problems.
s. It tries to help us see what we are doing wrong and it gives us hints to get the answer correctly.
t. Immediate feedback on all problem answers. Hints on tutorials.

4. **List some of the negative aspects of Mastering Engineering for Circuits this semester:**

a. Rounding / significant figures errors
   Entering the answers in the way ME wants it gets frequently frustrating
   Entering plotted graphs never match with the key
b. Inconsistent units for answers (preferred standard units or Sci Notation), SI units
   Do not truncate too much each step of a problem
      i. Only truncate for sig figs for final answers
   Lack of circuit building diagrams
c. All the questions are not of equal difficulty, but are usually worth same points (usually 1 pt), even though some of them have multiple parts
   Tutorials are a lot longer and usually tougher than regular problems
   If the answer is slightly wrong, most of the time no error shows up, especially with problems that are based on a circuit diagram.
d. The instructions are not always clear. It should provide hints on the regular problems, not only the tutorials. Keeping track on the prefix, such as μ, m, M, G
e. Rounding errors; When they tell you they are using (ms) for time; Some of the hints are very pointless and don't held at all; Graphs.
f. Feedback is not always helpful—difficulty and time ratings are inaccurate; Inputted .785 instead of pi/4, marked incorrect with comment "check your signs"; drawing vectors is terrible; drawing graphs is terrible; some problems have errors.
g. Some problems have incorrect answers; sometimes the software says your answer is incorrect when it isn't
h. Graphing was very difficult, not much room for error.
i. Some correct answer are not accepted by M; At times it won't accept an answer if its not in ms (e.g., e^{-5000t} vs e^{-5t})
j. Easy to forget (at least for me); Typing in solution can be painfully slow / difficult.
k. I have no problem with spending a long time working on a problem until I understand it completely. However, if I spend that long on a problem and then find out that the first answer I entered was correct after all, I become extremely frustrated. This happened more than once with ME, but never with MP. When emotion over the software is stronger than frustration over learning the material, then it is not an effective tool.

l. Have to spend more time on unit issue (ie, time is in milliseconds in one problem and in microseconds in another) for the right answer than actually solving the concept of the problem; graphs problems are very time consuming to get right.
m. Tutorials are outrageously long. Spend sometimes an hour per tutorial. I know it is to learn but an hour reading a computer screen is very, very difficult. If majority of students use TI-83-84 calculators fix your problems to match their rounding. In circuits software the time should stay in seconds, not milli- or micro-. S.o unnecessary
n. Being asked to give your answers in milliseconds every problem sucks. All of our answers come out in seconds. There is not point making us move decimals. All tutorials created by M suck. Completely removing the tutorials would greatly improve my experience. There are typos on every assignment. Units in general are always finicky. Most of the hints suck.
o. It sometimes requires too precise answers.
p. The feedback box doesn't always have helpful hints.
q. The graphing problems are too glitchy. Significant figures and units are inconsistent. Tutorials have too many parts A-Z excessive.
r. Answers were wrong. Some of the hints only gave you info that was given in the question. And the sig figs and what must find, not very clear.
s. Some problems ask for very specific formats when we input them on the computer and even if the answer is correct, we get marked down for it.
t. Required answering time value functions in different prefixes for equations (milli, micro, etc.). Cannot trust M if my answer is wrong—far too many mistakes on this version of M. 5 or 6 Plus mistakes. Entering functions on graphs is too time consuming and difficult. Some of the tutorials are too long. By the end of the problem you just want to be done, which does not stimulate learning. Possibly make tutorials worth more points.

5. Overall, do you believe using Mastering Engineering for managing the homework in Circuits to be better than the traditional way (paper solutions, collected /graded /returned)? Explain your answer.

a. Overall, no. ME's issues doesn't help students focus on the actual subject
b. A bit, because it involves online use to access different parts of the material
Switch picture diagrams per question; speeds up
c. No, I do not believe ME to be better, mainly because the teacher does not have to grade the assignment personally, which usually results in teacher not knowing how lengthy the problems are.
d. Yes, it is because it is easier to get immediate respond on answers and scores.
e. Yes
f. I haven't done this specific class using the traditional method, would recommend traditional method because ME doesn't give solution to incorrect problems.
g. Yes and No; I like how the grading is easier and faster for M, but wrong answers and unclear instructions on their end can be quite frustrating. Pros = Cons.
h. Yes, its faster feedback
i. Yes, switch up was nice experience.
j. No, with traditional HW, the professor can show you where you made a mistake (since all the work for the problem is right there AND if it's a small error, it's easier to fix)
k. No. If it were a more reliable program, then perhaps. The way it is now, dedicated students get frustrated, and not-so-dedicated students either blow it off or copy from the solutions manual.
l. Not sure but improving the design of ME will be better, in my opinion
m. Yes, only because of the way I get instant feedback, however useful that feedback may be.
n. No, never in a million years. Traditional paper solutions would have made my experience in this class much more pleasant.
o. I think so because we don't have to carry heavy textbooks anymore.
p. It's both good and bad. I like having hands on HW help from the teacher.
q. More thorough grading. Quick response.
r. I think paper would be easier, since it has you show circuits and label your own circuit and voltage directions it would help more.

s. I find it hard to complete my assignments because it feels very time consuming, I feel like I like the traditional way a lot better.
t. I do like the immediate feedback aspect of M and not having to wait for the work to be returned. Do homework with M does take more time, usually. More time spent analyzing incorrect problems.

6. You are hired as an advisor to an Engineering Instructor, who has decided to use Mastering Engineering software, but needs guidance on how to use it most effectively. What do you recommend?

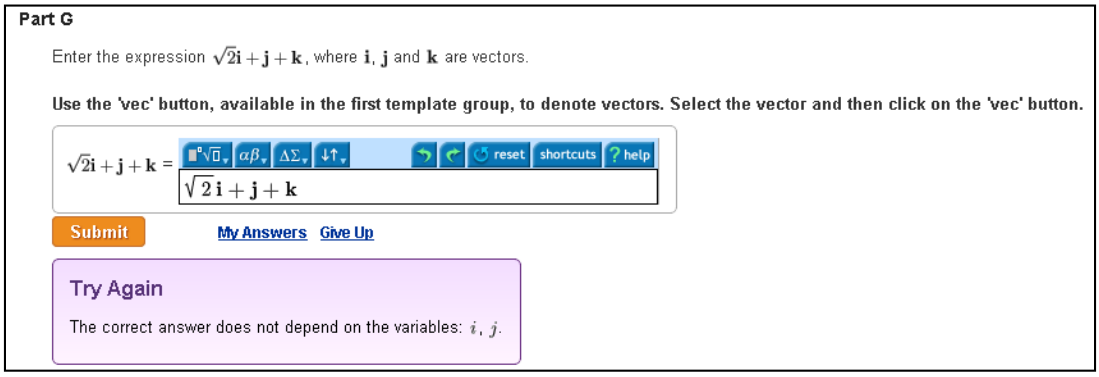
a. Don't use ME in the first place!
b. "Improve" graphical or vector analysis
Circuit analysis programs
c. I recommend the Instructor to complete every assignment himself/herself to realize what level of difficulty they are and if they're appropriate for all students.
d. Not assign too many problems, because they are very time consuming.
e. Tell students to buy solutions manual, it is very useful to understand how to do problems
f. No.
g. Give your students multiple tries on each problem, and don't take off too many points for each attempt. This way students aren't afraid to try if they're not sure about an answer. Give more problem sets with less problems per set.
h. I would recommend still giving partial credit even after the due date so students are still encouraged to learn the material.
i. Remove unhelpful / repeated units
j. Use the problems from the book, don't use the tutorial ones; Don't mark off points for wrong answers, only count correct ones.
k. The problems take a long time, so don't assign material that you don't intend to test. Don't take off credit for using hints—they're not usually as helpful as advertised.
l. The software that designing on the website "sapling" learning.com, I had used for chemistry class.
m. Not due Fridays at midnight but the time the next class starts. I work Friday nights so it is very rushed. Please check the problems beforehand.
n. Don't use it. If you must use it, never under any circumstances use tutorials. Allow problems to be turned in late for half credit. Do not limit the number of chances you get. Curve everything. Assign less problems.
o. I don't know how to use it more effectively. I just try to go on the website as many times as possible.
p. Minimize amount of graphing problems. Try to change units to be all the same.
q. Minimize tutorials and graphing problems. Require students to record work in a notebook.
r. I like the intro questions, they gave me a basic understanding of what I need to do. I would recommend they do that first if they need help, but not make it mandatory.
s. Walk through the program with the students so that they know how to use graphs and how to input values.
t. Double and triple check the answers before charging students money. Work on the graphing interface to be easier and less intolerant.

7. Other Comments (list on the backside if necessary). Include any HW problems that you believe to have mistakes.

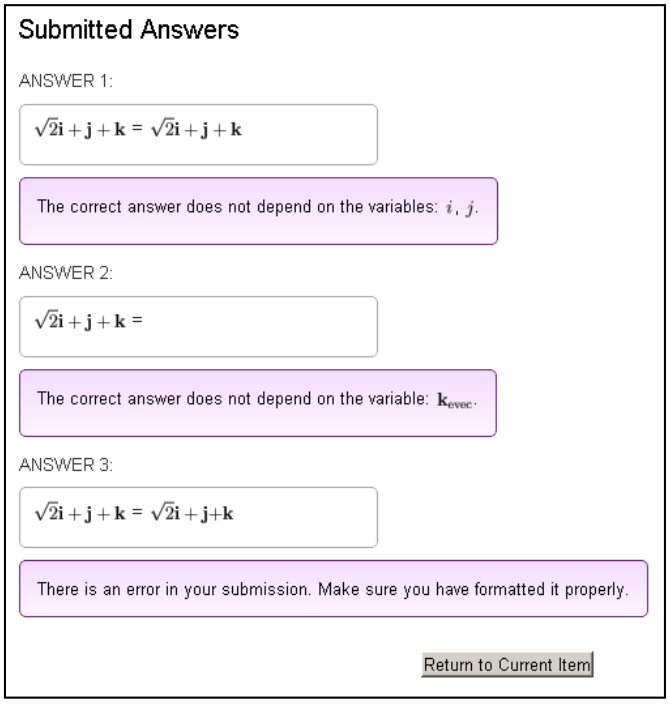
b. Include a circuit analysis program (3rd party) if necessary
Interactive graphs
c. Usually when I partially complete a problem and do not have the time to complete it later on (before the due date), I'm not awarded any points for that particular question.
d.

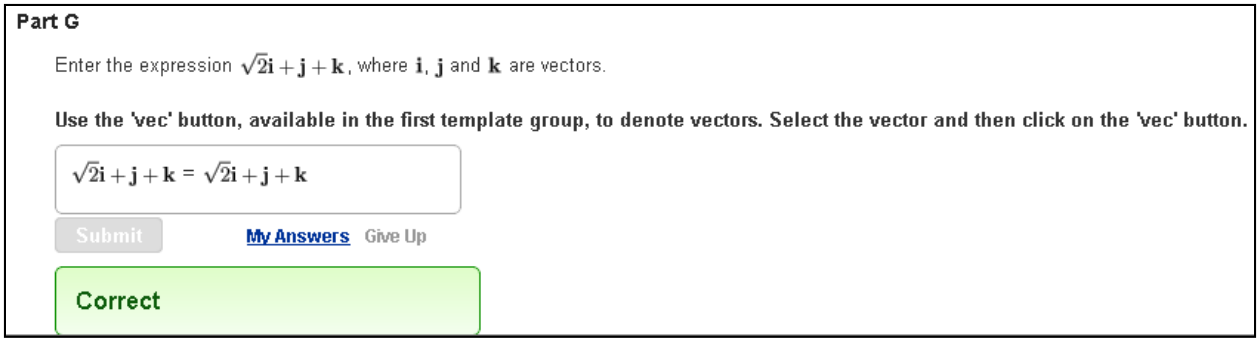
e. I honestly like it overall, but there are just a few more issues than can really piss you off.
f. I hope to be hit by lightning so I do not have to finish M assignments.
g. SHARE AWAY!
h.
i.
j. It's good for immediate feedback, but having answers in the back of the book is just as useful; If M included a solution, the steps from the start to the solved problem (or until the answer is reached) it would have been MUCH more helpful.
k. A classmate said it best: "Under any other circumstances, no one would pay $50 to beta test someone's software for them." Especially when we're busy trying to learn circuits. (1) I wish they would stop messing around with time units. If an equation given in the problem requires time to be in seconds, we should be allowed to enter our answer with time in seconds; (2)In the earlier chapters, M's insistence on using their preferred sign convention in tutorials was more confusing than helpful. It didn't help that the convention they chose seemed backwards compared to the more logical approach we learned in lecture (and in physics). (3) It would be more useful to have hints for the long book problems rather than the tutorials, because the tutorials are already broken up into small parts. (4) That being said, I have found errors in hints as well as final answers. I left comments on the worst ones, but who knows if anyone looks at those? (5) Tutorials are very long and are only worth the same number of points as a normal problem. It does not feel as rewarding to complete a tutorial for just one point, regardless of how much is learned from the problem, when there are 8+ parts to the tutorial.
l.
m. Fix the problem difficulty levels for teachers view.
n. Toward the end of the semester, putting lots of Extra Credit in the M helped. Another problem is that M only gives credit for problems that have all parts either complete or requested. This means, if you only know how to do half of the parts on a problem, you can't get credit for the parts you have done, until you "show answer" on the parts you don't know, so instead of getting half credit on a few problems you didn't quite finish, you get none if you don't "show answer" on the parts you don't know. Also, sometimes I would be working on problems right up until the last minute, and I would finish a problem right at 11:59 and not get credit for it because it was considered late. Due dates need to be more flexible.
o.
p.
q.
r.
s. I have found that some problems using the random number generator have the answer to the original values.
t. Education is about learning and learning requires trust. Trust in the teacher and trust in the material. Trust that the teacher knows the material and will, to the best of their ability, guide the student down the correct path of knowledge. I do not have this trust in this particular ME program. I have used M several times before and did not have anywhere near this level of frustration with the program. While I know to err is human, this product is supposed to be a learning tool, one that is a required purchase, and should not leave the student wondering if the incorrect answer message they receive is because of student error in answering the problem or if M is wrong <u>again</u>. I spend many year diagnosing problems in my previous career so I am no stranger to this process and I believe it is an invaluable skill that everyone should learn, but diagnosing my homework should not have the extra variable of incorrect software in it. I know life is hard and real world does have extra unpredictable variables in it, but I and every other student that has to <u>pay</u> for this program should expect an error free learning tool.

Appendix M: Example of Submitted *Mastering Engineering* Answer which appears to be correct



Example of apparently correct problem submission, interpreted by the software as incorrect. The main issue turned out to be how specifically the vectors were inputted, which ultimately was corrected. From the students' perspective, if an answer looks correct, is marked wrong by the software, should be graded as being correct. The mistake in this instance was inputting the vectors **i**, **j** and **k** without hitting the **vec** button first.





The correct submission to the original problem discussed and shown above.