



Characteristics of Students Who Do Not Do Homework

Dr. Richard M. Bennett, University of Tennessee, Knoxville

Dr. Richard Bennett is a professor of Civil and Environmental Engineering, and the director of Engineering Fundamentals.

Prof. William Schleiter, University of Tennessee, Knoxville

William Schleiter is a senior lecturer.

Dr. Taimi Olsen, Tennessee Teaching and Learning Center

Dr. Taimi Olsen is the associate director of the Tennessee Teaching and Learning Center at the University of Tennessee-Knoxville, and adjunct in the First Year Studies program and the UT English Department. At UT, she oversees staffing, web materials, workshop creation and delivery, and assessment procedures. She has led workshops on classroom management and teaching techniques in the Humanities and Foreign Languages, and University-wide workshops on service learning, visual learning, and—with Dr. Stan Guffey—HSS (Humanities and Social Sciences) workshops on active learning in flexible classrooms. She coordinates University-wide workshops and institutes, such as the New Faculty Teaching Institute, The Summer Teaching Institute, university workshops on Assessment, Experiential Learning, and others. Through a grant opportunity, she published "Engaging Students as Researchers through Internet Use" in The Academic Commons. With Drs. Schumann and Peters, she co-authored "Co-Creation of Value through Teaching and Learning Centers" forthcoming in a New Directions volume.

Dr. Stan Guffey, University of Tennessee Teaching and Learning Center Miss Wenshu Li

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Introduction

All freshman engineering students at the University of Tennessee take a common course, EF 151 Physics for Engineers I, which is a combination of physics and an introduction to engineering. The pass rate for this course in Fall 2011 was 82.8%. The pass rate for students who completed at least 80% of the homework was 96.9%. The pass rate for the 22.5% of the class who did less than 80% of the homework was 33.3%. We are interested in why 22.5% of the students do not complete at least 80% of the homework. The goal of identifying the characteristics of students who do not do homework is to enable appropriate intervention techniques to be developed. This paper presents a work in progress, describing the research process and giving preliminary results.

There is debate over the role of homework, its usefulness, and its role in learning [e.g Vatterott (2009) and a current NSF project reported by Kaw and Yalcin (2010) examining whether collecting homework improves exam performance]. This research does not address that issue, but rather assumes that homework will be assigned and be a part of the grade. For the Fall 2011 EF 151 class with 409 students, the correlation coefficient between the homework grade and final average was 0.91, whereas the correlation coefficient between the first exam grade and the final average was 0.69, indicating the importance of homework, at least in this course.

Homework is worth 21% of the grade in EF 151. Approximately 80% of the homework grade is based on completing online homework problems. A customized web-based homework system is used (Schleter and Bennett, 2006). This system provides individualized homework (Goulet, 2010); each student has different parameters. Some of the features of the online homework system are shown in Figure 1. The remaining 20% of the homework grade is based on portfolio checks. The intent of the EF 151 portfolio is to help students organize all of their materials for the class, and to encourage students to document all of their work in a clear and methodical manner. To this end all students are required to maintain a portfolio of all work in a 3-ring binder. Students are graded based on their overall portfolio, as well as on the format and clarity of individual random written homework problems.

Recently a bonus system (Schilling, 2010) was implemented in the homework system, whereby students receive a 10% bonus homework problems completed at 24 hours or more in advance of the due date. This bonus has resulted in over half of the homework is being completed in the bonus time (Bennett et al, 2012). The positive effects are that the bonus system encourages students to figure things out for themselves, and it discourages procrastination. Improved preparation for lecture and recitation, and reinforcement of learning are also benefits identified by some students in the mid-semester survey.

rbennet2 - On-Line HW 2-5-2

Show all questions in fixed order

1 2 3 4

Previous Next Close

Current time: Sat Feb 19, 09:17:01

Deadlines:
 110% credit: Wed Feb 16, 2011 23:59
 100% credit: Thu Feb 17, 2011 23:59
 75% credit: Sat Feb 19, 2011 23:59
 50% credit: Fri Apr 29, 2011 23:59

[View Discussions about this question](#) [General Instructions](#) [State](#)

Show Solution
 Edit mode [Clear](#) [View all](#) [Setup](#) [Units](#)

Test/Question ID/Problem Set: 278/1132/0

2. 

Dr. Bennett's and Prof. Schleter's daughters both want an iPod dock for Christmas. Since a normal iPod dock isn't geeky enough they each decide to build a custom dock, vacuum tube amplifier, and speaker system. Sparing no expense, Professor Schleter incorporates a 280 watt amplifier, while frugal cheap Dr. Bennett uses a cheap 41 watt amplifier.

Notes/Calcs:

Save Params

Students can type equations or notes here. EF staff can view notes when providing help.

Students can also upload scans or send pix texts of homework for EF staff to view.

Calc
 Calc All
 Calculator help
 JS solution: Get Save
 Manage Note Images

Part	Description	Answer	Chk	History
A.	What is the inte connected to Prof. Schleter's speaker? (W/m ²)		6.89 pts. 83% 0 hints 2% try penalty punish	Clear tries and answer
B.	What is the sound level in decibels at 3.5 m from a speaker connected to Prof. Schleter's amp? (±0.2 db)		6.89 pts. 83% 0 hints 2% try penalty punish	Clear tries and answer

Small penalty for each wrong answer to encourage students to think about answer.

10% bonus for early completion.
 75% credit if late but worked by exam.
 50% credit if worked by end of semester.

Clicking here takes students directly to our discussion board, and filters for only posts on this problem.

Figure 1. Online Homework System

Quantitative Analysis

Table 1 compares homework averages with other parameters. Comparisons are made in terms of correlation, and also averages of those students who had higher than an 80 homework average, and those students with lower than an 80 homework average. The medians of two groups are compared using the two-sided Wilcoxon rank sum test. There is a significant difference between the medians of all the parameters in Table 1, with $p < 0.0001$ in all cases.

The Math ACT score is used as a measure of incoming preparation. The Math ACT score also factors in admission. To be admitted to the college of engineering, students need to have a Success Prediction Index (SPI) of 60, where the SPI is calculated as 10 times the high school GPA plus the Math ACT score. In addition, students must have a minimum Math ACT score of 25 to be admitted to the college of engineering. A Math ACT score of 28 is required to place into Calculus I, which is a co-requisite for EF 151. Some students with Math ACT scores below a 28

can place into Calculus I through Advanced Placement (AP) credit, dual enrollment credit, or passing a math placement test administered by the math department. It is interesting to note the Math ACT average for those students having less than an 80 homework average is only slightly above that required to be in Calculus I.

It has been hypothesized that students are better set up for success if they have more grit, more toughness, and more perseverance (Jaeger et al, 2010). The Fall 2011 students were given the grit survey (Duckworth and Quinn, 2009), with a small amount of extra credit being awarded for completing the survey. The mean overall grit score for the class was 3.54, which is essentially the same as the grit measured for 374 engineering freshman by Jaeger et al (2010) of 3.55. Although the correlation between the homework average and grit score is small, there was a statistically significant difference ($p < 0.0001$) of the grit between the two groups. Those completing more of their homework did possess a higher grit.

The rest of the parameters are related to class performance. The homework average is compared to the overall class average. The exam average is the weighted average of four semester exams and the final exam. Each of the semester exams counts for 11% of the grade and the comprehensive final counts for 20% of the grade. As an improvement incentive, if a student scores higher on the final exam than a semester exam, the semester exam weighting is changed to 8% and the final exam weighting is increased by 3%. This applies to each semester exam, so the final exam can count as much as 32% of the grade if the final exam score is higher than all semester exams.

The format of EF 151 is large 50-minute lectures three days a week and smaller (24-28 students) 75-minute recitations two days a week. The lectures are team taught and use personal response systems (clickers) to increase course engagement. The recitations are led by trained graduate assistants and consist of collaborative problem solving, hands-on activities, demonstrations, and team projects. Students are assigned to teams of four for the recitations, and these teams sit around a table. Team assignments are made based on student performance, and new teams are formed every three weeks.

Lecture participation is measured by the percentage of clicker responses. In other words, students with greater than an 80 homework average answered on the average 86.2% of the clicker questions. Our grading of the clicker questions is 10 points for a correct answer, 7 points for an incorrect answer, and a student receives a 100 on their clicker grade if they obtain 75% of the possible points. The measure used here is not the actual clicker score, but simply the number of responses.

Recitation participation is a combination of an attendance grade taken at each recitation, and also completion of several extra credit surveys and extra credit activities. Students can earn approximately 10% extra credit by completing the surveys, attending three student society meetings (e.g. ASCE, ASME, IEEE, NSBE, SWE), and participating in two community service activities (e.g. Habitat for Humanity, Race for the Cure). Thus, the recitation participation can be as high as 110%, and should be an easy grade, as it just involves showing up.

Table 1 shows that students that are not doing their homework start with a lower Math ACT, have less grit, and are not fully participating in either the lecture or the recitation. This combination is leading to lack of success in the class.

Table 1. Comparison of Parameters to Homework Average

Parameter	Correlation	Average Value	
		< 80 HW Average	>80 HW Average
Math ACT	0.275	28.5	30.1
Total Grit	0.060	3.47	3.57
Average	0.907	53.6	87.6
Exam Average	0.807	51.4	82.4
Lecture Participation	0.680	53.9	86.2
Recitation Participation	0.749	84.7	105.4

Students fill out a background form at the beginning of the semester. As part of the background form, we ask students what their last high school math class was, and the quality of the class. We also ask students about whether they had high school physics, and the quality of the class if they did have physics. These results are summarized in Table 2. For those students having below an 80 homework average, less had high school calculus, and the quality of math instruction was lower. In terms of physics, a higher percentage of students having below an 80 homework average did not have any high school physics, and a lower percentage had AP physics, although some of the students did have AP physics. Students having below an 80 homework average rated the quality of the high school physics instruction lower, although the p-value was 0.054, or right at the typical significance cutoff of 0.05.

Table 2. Math and Physics Background of Students

Parameter	< 80 Average	>80 Average	Significance
HS Math Class Had Calculus	62%	79%	
Quality of Math Class	All: 3.82 Calc: 3.88	All: 4.19 Calc: 4.29	All: p=0.0050 Calc: p=0.0156
HS Physics	AP: 13% None: 29% Other: 58%	AP: 22% None: 19% Other: 59%	
Quality of Physics Class	3.38	3.71	p=0.0541

Qualitative Analysis

Students who were completing less than 80% of their homework in Fall 2012 were invited to participate in a 30-45 minute interview in order for us to better determine why these students were not doing homework. Approximately 100 students were invited to the interview, with 20 agreeing to participate. Instructors for the course were not involved in the interviews, and the interviews were conducted in a neutral location, away from the engineering campus. Initially the

students were asked some demographic questions. The following questions were then used to guide the interview.

- Why did you enroll in this course?
- How do you feel the class is going for you?
- What do you like about the course content? Why?
- What do you dislike about the course content? Why?
- Questions about the homework bonus system
 - Do you know how the homework bonus works? Describe it.
 - Do you think the homework bonus increases your motivation to complete the homework? Why?
 - When do you normally begin to work on your homework once it has been assigned?
- Describe the typical environment in which you do your homework.
- How much time do you spend on a typical homework assignment?
- Describe how easy or difficult it is for you to complete the average homework assignment?
- If you had a difficult homework problem, will you give up completing the homework or spend some time trying to answer it?
- If you had a difficult homework problem, how much time would you spend trying to answer it before you go on the next problem?
- How helpful is the homework in helping you understand the course content?
- Is there anything about the classroom instruction that influences your ability to complete the homework?
- What goals do you have for this class?
- How is doing homework connected to reaching your goals?
- Sometimes, “things happen” in a semester that make it difficult to get tasks accomplished or to focus on studying. Would you say that you have experienced personal circumstances that have interfered with completing homework assignments this semester?
- What are some other types of circumstances that have made it difficult for you to complete your homework?
- When these circumstances happen, what support could we provide to help you in completing homework assignments?
- Do you have questions for us?

The interviews are in the process of being transcribed, after which a detailed content analysis will be conducted. Based on a preliminary analysis, several reasons were identified for why students do not do homework, which are listed below:

- Time management
- Struggling with both this course and other courses
- Work
- Too many credit hours
- Transition problems. Of the four students whose parents did not go to college, two of them reported transition problems, while the other students may have time management problems.

- Family problem which takes time
- Other activities which take time, such as religious activities and band rehearsal
- Do not like physics
- Get frustrated because of their low scores on tests and homework
- EF151 homework is harder and more than other courses
- Easily distracted by others (e.g., some students cannot work because a roommate is watching TV)
- No physics class in the high school. 6 of 20 students had no physics class before EF 151
- Like/use early homework bonus, mostly, and then less during semester
- The process of completing complex HW frustrates them and they cannot get help immediately at a key point (relates to the question below)

Conclusions

Both quantitative and qualitative methods are used to study characteristics of students who do not do homework in a freshman engineering class. Preliminary results are given, and work is continuing to further analyze and drill down into the data. Students who do not do as much homework have not had as good of a high school background, both in terms of courses and quality of courses, have slightly less persistence as measured by a grit test, and are not participating as much in class. The goal of identifying the characteristics of students who do not do homework is to enable appropriate intervention techniques to be developed.

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