

Homework Is So 20th Century !

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Abstract

Homework accomplishes little or nothing. The few student who do complete it benefit but the overwhelming majority copy (incorrectly often) their classmates' efforts and think they can build up a cushion to pass the course. There is a better way – announced quizzes. That is, suggest some problems that demonstrate the principles taught in the course then give 10-15 minute quizzes frequently (about thirty (30) times a semester) with increasing point value every week. If the quizzes exactly mirror the “suggested problems” the instructor and the student have a good measure of learning and mastery of the subject material.

The task and the joy of teaching is to transfer knowledge from the teacher to the student. At its best this transfer involves a knowledgeable teacher and an engaged, participative student. Along the way the student should learn how to explore gaining knowledge without the teacher in order to instill life-long learning. The teacher usually also tries to instill a good work ethic as the student learns. For the mathematics and sciences courses this often involves assigning problem sets for the student to apply and practice the tools, techniques, and concepts presented in class and in the reading assignments. At regular intervals the student is tested on her or his ability to identify and categorize problems, select the appropriate tools to solve the problem, and apply the appropriate problem solving steps to actually solve the problem. This testing exercise is designed for assessment and feedback to the student. To encourage the student to prepare for the test, the traditional method of teaching involves assigning homework problems to allow the student to practice on typical problems encountered while applying knowledge gained learning the subject material. The assignment of regular homework also encourages the student to develop a good work ethic and facility with the concepts presented in the classroom. To further these objectives the homework completion is often worked into the grading system. Thus, the submission of completed homework becomes and end unto itself. In each class a minority of the students dutifully attempt the problems and submit them. For most student, however, the homework assignment becomes a game of getting it in with the least effort possible. It is a short term strategy to minimize the effort (time spent solving problems) and to maximize the reward (grade awarded for completing the assignment).

What the instructor is attempting to do is to get the student to engage with the course material. The majority of the student are just trying to gain as many grading points as possible. This exercise is relatively benign if the instructor does not spend valuable and limited time “grading” the homework submitted. One solution is to give each student a unique set of problems for homework. That sounds daunting at first both for constructing the problems and for grading them. With the aid of computers, it is possible to construct a unique set of problems for each student by altering the wording and parameters of each problem. The solutions can also be generated in a relatively automated manner. The likely result of this exercise is fewer student submitting the work – not the desired outcome.

A better solution is to assign a set of representative problems, with the answers (or intermediate answers) but not the solutions, designed to illustrate the facts, concepts, and problem solving techniques presented in the course and then test the students regularly with short quizzes taken from the set of illustrative problems assigned. This gives each student immediate feedback on her or his progress toward mastery of the subject matter. Since the quizzes will be short (5-8 minutes) the instructor can also add some fact gathering questions, e.g. “How much time did you spend reading the assignment?”, “How many of the suggested problems did you attempt?”, “How many of the suggested problems did you complete successfully?” the answers to these supplementary questions give a good window onto how the students in the class are going about gaining mastery of the course material. After the quiz is completed, the solution to the problem should be posted and the student’s score for the quiz should be posted within twenty-four hours of the quiz. Using class management software such as Sakai makes this process easy and confidential. Every week, grades for the class should be published so the students can see their scores and where they fit in the class score.

At this point, both the instructor and the student have an accurate measurement of the student’s grasp and mastery of the material covered in the course to that date.

The percentage of the student’s grade attributable to the quizzes has to be enough for them to pay attention to quiz performance. Ideally, the quizzes should count for around 15-20% of the total grade. Some consideration should be given to making the value of each quiz increase through the weeks occupied by the course. The intent is to get the student’s attention while “keeping the student in the game”.

The technique of suggested homework exercises (unsubmitted and ungraded) followed by regular, frequent quizzes taken from the list of suggested homework exercises is a wrenching concept for the average student today. For the most part they have progressed through an academic system which rewards producing completed assigned homework, regardless of how the homework solutions were obtained. This is the academic game as currently played by the students. Changing their expectations and getting them to engage the subject materials is a hard process that requires constant attention and engagement on the part of the instructor.

There is a two-pronged, retail approach I have been employing for the last four years. The elements are listed below:

I. Present suggested questions and problems each week during the course lectures.

Offer problems with the answers (or intermediate answers), but not the solutions.

II. Administer Quizzes taken from the questions and problems of the previous week.

III. Publish Quiz Solutions and Quiz Grades

The grades are delivered with a complete grading rubric outlining where and why the student lost points on a particular problem. The rubric is developed and published prior to the administration of the quiz.

IV. Offer Extra Credit problems for students to improve their grades on quizzes.

Students are required to meet with the instructor for an office-hours appointment (30 minutes maximum) and explain their extra credit problem solution

V. Administer Mid-Term Exams (2 ea.).

VI. For a limited time, offer “half-back” on the mid-term exams.

Students are required to solve the entire mid-term exam, meet with the instructor for an office-hours appointment (30 minutes maximum) and explain their exam problems solution

VII. Administer a Final Exam with the proviso that passing the final exam means the student passes the course.

Throughout the course, the students are encouraged to meet with the instructor to clear up any difficulties they have with the concepts presented in the course. At first glance this seems to be an infinite time sink for the instructor. It really is not. Last semester, my course, Computer Applications for Construction Management, had an enrollment of fifty-seven freshmen students in three meetings of fifty-minutes on Mondays, Wednesdays, and Fridays. My weekly schedule included about twenty-four (24) 30 minute office-hours appointments available. A typical week included an average of 3.94 appointments each day with a standard deviation of 2.91 appointments. Over a typical thirty-four (34) school day period (from September through most of October) I met with students for a total of thirty-three (33) hours outside class sessions. These meetings included tutoring, extra credit problem presentations, and exam “half-back” sessions. Each meeting was scheduled by the student through the Sakai Sign-up option. The students participating were prepared and self-directed during the meeting. The use of time was very organized with the student getting right to the point of the meeting and zeroing in on particular concepts or techniques giving them problems.

Comparing the time spent holding the one-on-one sessions to the time I used to spend grading homework, there is no contest on the effectiveness. First, I meet only with the students who need to improve their grade because they did poorly on a quiz. The students scoring well on the quiz questions obviously have acquired the required skills and knowledge somehow. They do not need my attention beyond what is covered in class. When I meet with the students for the extra credit problem solutions, I have the opportunity of planting the seed that doing the suggested problems and asking about them in class if they do not understand something is a much easier, less effort way to maintain their grade in the class. The same is true with the office-hours meetings for the half-back exercise on the mid-term exams. Convincing the student that paying attention in class and asking a question as soon as you do not understand something is a surer, quicker way to academic success is an easier sell when they are spending their free time sorting out their grad from a mid-term exam.

Adjust the Scoring

Final – 30% Hour Exam II – 25% Hour Exam I – 20% Quizzes - 25%

Quizzes should be spread evenly and weekly throughout the 14 weeks of a semester

Giving weekly suggested problems or exercises and taking the quiz for that week from the suggested problems/exercises from the previous week is key as is having a practice quiz the first week. You are trying to establish a paradigm that is different from what the students are used to so the sooner you start, the more success you will have. This process also allows the instructor to publish grades weekly to keep the students continuously informed about their progress.

	Quizzes	Hour Exam I	Hour Exam II	Final Exam	% of Course
Week #01	1%				
Week #02	1%				
Week #03	1%				
Week #04	1%				
Week #05	2%	20%			26%
Week #06	2%				
Week #07	2%				
Week #08	2%				
Week #09	2%				
Week #10	2%				
Week #11	2%		25%		63%
Week #12	2%				
Week #13	2%				
Week #14	3%				
Final				30%	100%
	25%	20%	25%	30%	100%

Keep the Student in the Game

Since the object is for the student to master the material, a caveat should be added that any student passing the Final Exam will pass the course since they have demonstrated some mastery of the material. The grade is negotiable but should be a minimum of a D.

Example:

Student grade going into the final – 58% and passing is 60%

Student scores 61% on the Final – final grade is D

Student scores 71% on the Final – final grade is D

Student scores 81% on the Final – final grade is 64.9%

Student scores 91% on the Final – final grade is 67.9%

How effective is it?

I have been steadily shifting to this system in two classes over a period of four consecutive years. The grade distribution data do not indicate that it is any more or less effective than the traditional assigned homework method. Qualitative feedback from the end of course surveys suggests that the students like the combination of frequent, small tests and extra credit opportunities to improve their grades at their own pace. The students are unanimous in appreciating the opportunity to salvage their hour exam scores through the “half-back” system of solving and explain the solution of the original test. The goal is knowledge transfer and the deletion of homework and its replacement by self-preparation and frequent quizzes.

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