

# Using Time-on-Task Measurements to Understand an Introductory Science Class



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# Time on Task



- One of the most valuable resources of any class is the amount of time students spend preparing for the class.
- Time on task has been identified as one of pillars of good practice for general undergraduate education (Chickering and Gamson 1987).
- The National Survey of Student Engagement (N>150,000) laments that students only spend half the expected time preparing for class.

# Measurement



- Surveys asking students to report on a wide variety of out-of-class activities performed to prepare for an introductory university physics class were given after the first and third exam.
- Two versions of the class were investigated.
  - Version 1 (Easier) – Course coverage was strongly thinned so that all important topics could both be addressed in lab and lecture.
  - Version 2(Harder) – Coverage was increased with additional focus on use of calculus.
- Four semesters of each version measured (N=450) for each version.

# The Class



- University Physics II is the second semester calculus-based electricity and magnetism class taken by scientists and engineers at the University of Arkansas.
- Presented with two one-hour lectures and two two-hour labs each week.
- Labs mix inquiry-based methods with traditional physics experiments and problem solving.
- Conceptual learning evaluated by the Conceptual Survey in Electricity and Magnetism.

# Survey Questions



- **What Did You Do?**
  - Do you take lecture notes?
  - How many homework solutions did you review?
- **How did you do it?**
  - How thorough was your first reading of the chapter?
  - When did you first read the chapter?
- **How much time did you spend?**
  - How much time on average do you spend on a homework set?
  - How much time did you spend working practice tests for the exam?

# What Did We Expect?

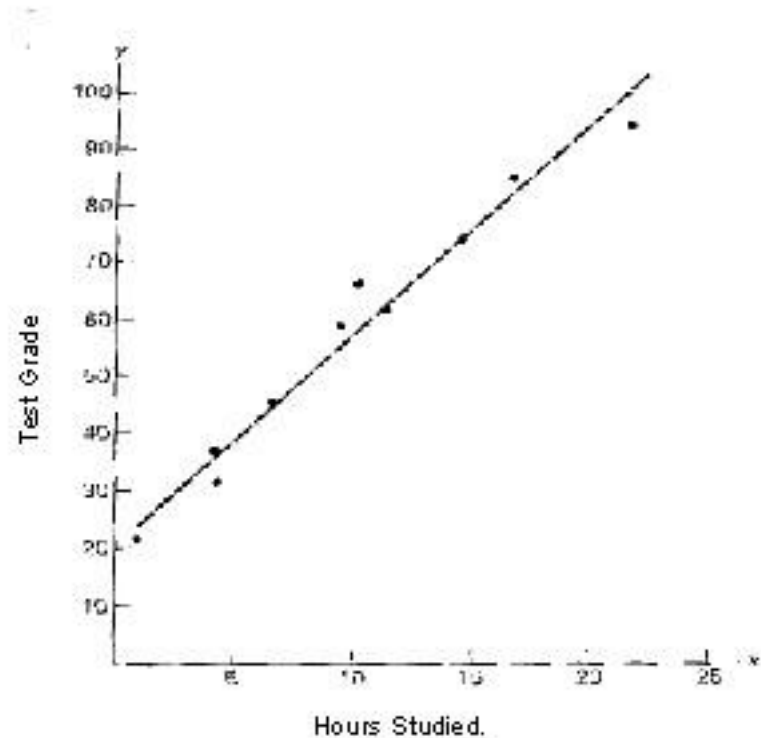


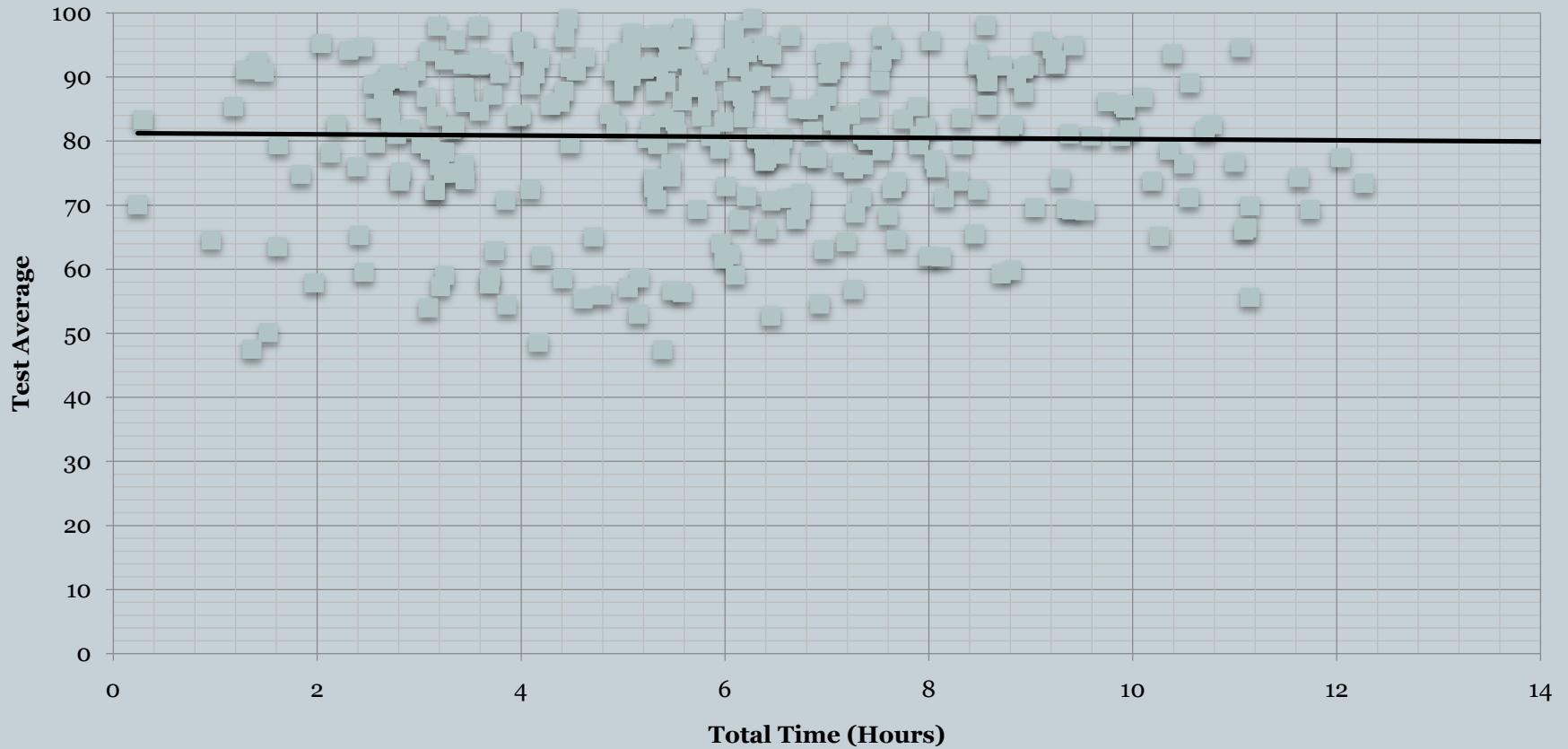
Figure 11.2 Data on test scores and number of hours studied

From David Walpole, 1980.

# Effect of Time Use on Class Performance



## Test Average vs Total Time



# No Significant Correlation



- There is no significant correlation between the total time spent on a class and the outcome measured by the test average.
- While the reason for this certainly varies from student to student, a reasonable explanation for which we strong anecdotal support is that students shift the effort (time) spent on a class not to meet learning goals but in response to how they are doing in the class and other classes.

# Regression



How much of student performance is predictable from behavior?

	$R^2$ - Test Average	$R^2$ - Normalized Gain CSEM
Version 1 – All Variables	0.26	0.19
Version 2 – All Variables	0.41	0.33
Version 1 – Important Variables	0.21	0.14
Version 2 – Important Variables	0.13	0.17

- All Variables – All responses to survey questions.
- Important Variables – Combinations of survey variables that capture features of behavior that are commonly considered signs of good or bad study habits.

Values are for the model that maximized  $R^2_{adj}$ .

# Regression Results



- Student behavior accounts for 26%-41% of the variation in hourly test average.
- The amount of variation explained increased as the class was made more difficult.
- The harder version of the class was better predicted by the details of student behavior and far less so by the variables an instructor associates with good study behavior.

# Student Reaction to Revision



The revision from version 1 to version 2 increased the length of the course reading by 42%.

Activity	Version 1 (Easy)	Version 2 (Hard)	Percent Change
Reading Time per Week	2.0 hours	2.4 hours	20%
Homework Time per Week	2.7 hours	2.6 hours	-4%
Non-exam Time per Week	4.4 hours	4.7 hours	7%
Study Time per Exam	5.6 hours	7.3 hours	30%
Total Time per Week	6.0 hours	6.8 hours	13%

# Student Reaction



- Students on average increased their effort in response to the change in class difficulty.
- The degree of reaction did not keep up with the amount the class changed.
- Almost all of the change occurred during exam preparation, exactly the behavior we wish to discourage.

# Relation to Other Curricular Revision



The amount of additional material was more than the students could react to and will be decreased in the next revision. Compare version 1 and 2 with the revision of Halliday, Resnick, and Walker.

<b>Material</b>	<b>Words</b>
Version 1	98,000
Version 2	140,000
Halliday and Resnick, Version 3	117,000
Halliday, Resnick, and Walker, Version 6	107,000
Halliday, Resnick, and Walker, Version 7	137,000

HRW 3 and 7 estimated from chap. 1-6, HRW 6 estimated from page counts.

# Conclusion



- Student behavior accounts for 26%-41% of the variation in student performance in an introductory class.
- The amount of variation account for changes with class construction.
- Students modify their time use with class difficulty but do not necessarily completely adjust to changes in class difficulty.
- Students modify their behavior within a class in response to their current performance, but this can also be incomplete as the class becomes more difficult.
- For additional information, visit <http://educationalengineering.uark.edu>