

Using Knowledge Surveys to help direct the class

Sheila Horan
Klipsch School of Electrical and Computer Engineering
New Mexico State University
Las Cruces, New Mexico 88003
sheila@nmsu.edu

Abstract

There is no point to continually repeat information that the students already know. In an effort to help identify areas that need more attention in class, a knowledge survey can be given to the students. This survey is a list of questions over the topics that are normally covered in the class, and topics that are pre-requisite to the class. Once the students have taken the survey, the instructor can see where the students are weak, and what they already know (or think they know). The survey can also be broken down into different levels of learning, and be able to see what types of learning are going on with the students. At the end of the semester, the survey can be given again, and students can assess to a finer degree what they have and have not learned. This post survey can then be used to restructure the material for the next class to adjust for areas where students indicate difficulty in understanding. The survey for the introductory circuits class is given as a sample of how this can be used in classes to assess the students and to structure the class.

Introduction

In some classes too much time is spent going over material that is already understood, or not enough time is spent on material that isn't understood. The knowledge survey is a tool that was developed by Ed Nuhfer {1} to help assess content learning and intellectual development. This tool was one of the many tools presented in "Boot Camp for Profs" (a one week summer workshop to help faculty learn about various learning and teaching techniques). The basic idea is to make up a list of questions and problems that covers the entire content of your class, and pass out this questionnaire to your class at the beginning of the semester. If there is content that you expect the students to know, those questions can be included. The students don't work the problems. Instead they respond with one of three selections: A: you feel confident that you can now answer the question sufficiently for graded test purposes, B: you can now answer at least 50% of the question or you know precisely where you could quickly get the information and return (in 20 minutes or less), to provide a complete answer for graded purposes, or C: you are not confident that you could adequately answer the question for graded purposes at this time. Once an instructor knows what the students know (or think they know), specific areas of material can be addressed, reviewed, or skipped over. The questionnaire can be given again at the end of the semester to help assess student learning.

Application

A knowledge survey was developed and used during the fall 2003 semester in EE 111 (Introduction to Electrical and Computer Engineering – DC Circuits). A sample of part of the survey is given below:

This is a knowledge survey. It's purpose is to provide a study guide and to help you monitor your knowledge as you go through the term.

Mark an "A" if you feel confident that you can now answer the question sufficiently for graded test purposes. Mark a "B" if you can now answer at least half of the question, or if you know where you could quickly get the information needed and return in 20 minutes or less to provide a complete answer for graded purposes. Mark a "C" if you are not confident that you could adequately answer the question for graded purposes at this time. Be honest in your assessment of your knowledge.

1	What is the maximum voltage that can be used safely in a ¼ Watt, 100 ohm resistor?	A	B	C
2	What is voltage?	A	B	C
3	What is current?	A	B	C
4	What is resistance?	A	B	C
5	Describe Ohm's law - tell what it is and how to use it.	A	B	C
6	What is voltage division? Describe voltage division, how to find a voltage, and under what circumstances you would use it.	A	B	C

The students were given the survey as part of their first homework assignment. They were given it again, at the end of the semester (as part of the last homework). One way to view the results is to look at the class average response to each question. This can help an instructor decide what to emphasize in the class. The results of the survey at the beginning of the semester (pre-test) and at the end of the semester (post-test) are shown in for both sections of EE 111. Figure 1 shows section 1 results and Figure 2 shows section 2 results.

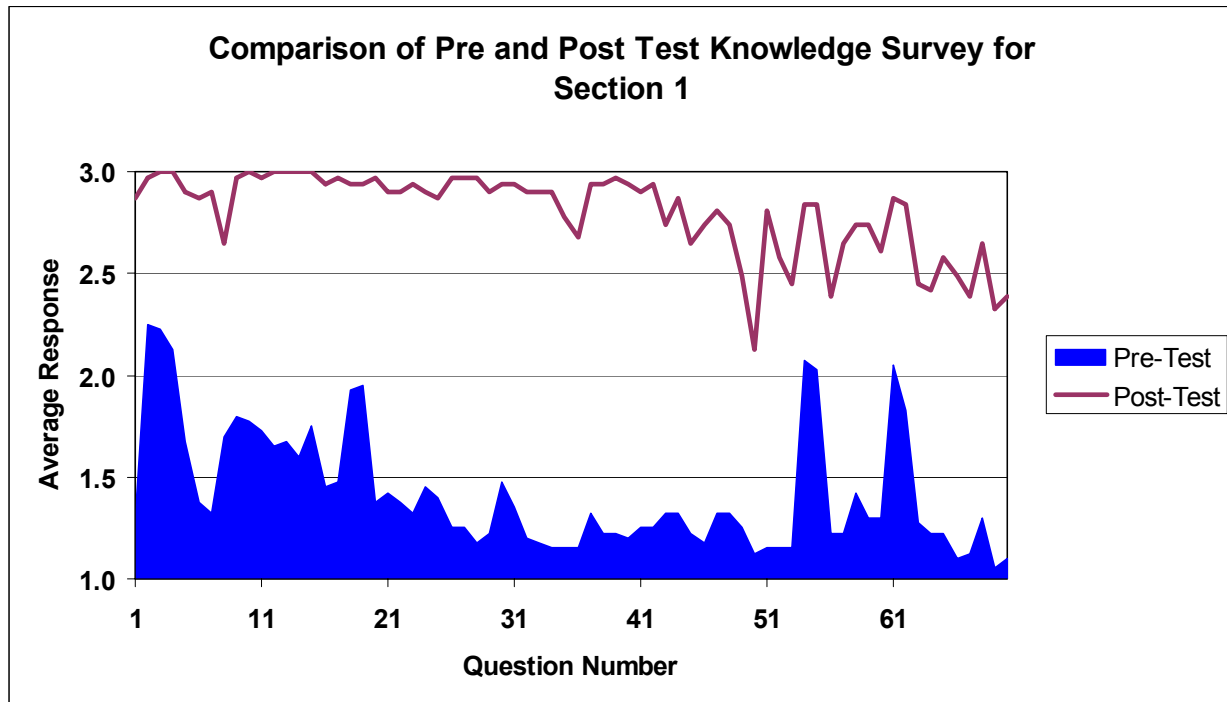


Figure 1: Section 1 results

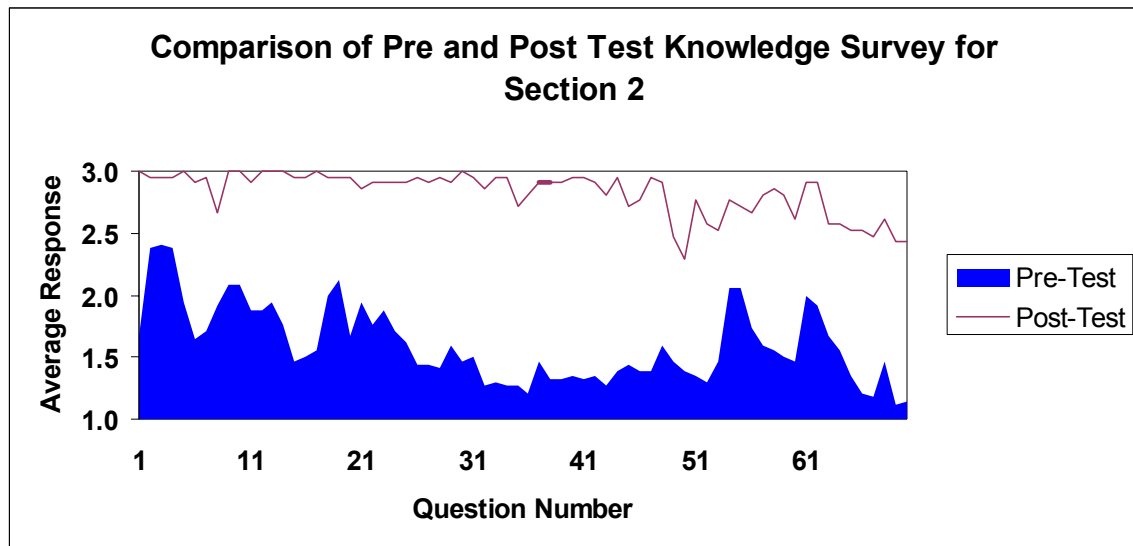


Figure 2. Section 2 results

In both figures, the blue shaded area indicates the pre-test responses – what the students thought they knew coming into the class. The level 1 indicates no knowledge, level 2 indicates that they feel they could do the problem if they could look up information, and the level 3 indicates that they can work the problem right now.

For both sections, there were questions where students felt that they had an idea of the information but would need to look up something in order to do the problem. These would be areas where a brief review may be required. For the most part, most students indicated that they do not know the material (if they did know all of it, they should perhaps try to test out of the class). The red line indicates responses at the end of the semester. In an ideal world and in a well taught class, the red line would indicate a perfect 3 all the way across the plot. Where dips occur indicates areas that may need more emphasis. Looking at both charts, one can see that the plot slopes downward indicating less confidence with material at the end of the semester (Since the questions are listed by concepts/ideas as we progress through the semester). This indicates that more time and emphasis needs to be applied to this area. This same result shows up on the class evaluation that our EE department gives. An earlier dip occurs at question #8, which is “What is conductance?” Since there is a dip here, this indicates that students need to work more with this concept, or more explanation is needed to help them understand the concept. The other low dip occurs at question #50 – “What is the principal of proportionality?” This past semester, the concept of proportionality was included as an aside when we went over superposition and linearity. If I want the students to better understand this concept, I’ll need to spend more time on it in class.

Another way to view to survey is to break it down into the total responses per question and look at it in terms of a histogram for each question. Figure 3 shows this type of plot.

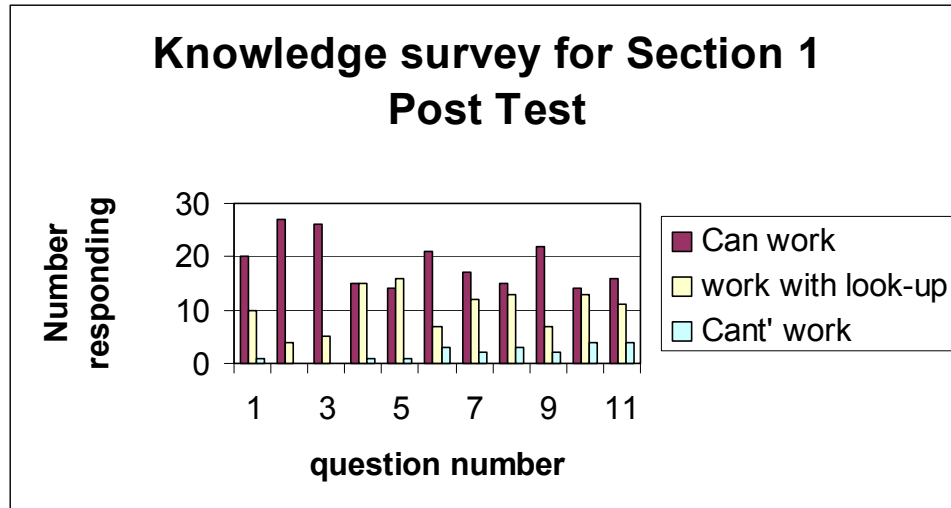


Figure 3. Individual question response

In this type of plot, you can see how many students feel comfortable with the problem. As more students indicate that they can't work the problem, more attention would need to be paid to that content area. If only one or two students need work in that area, they can be directed for further help with tutoring, an office visit, or perhaps some supplementary online help.

The questions on the survey can also be ordered to show cognitive levels (memorization versus critical thinking skills). Once the critical thinking questions are identified, then the plots can be used to see if students are mastering the level of thinking you want them to achieve.

Summary

The knowledge survey has been a tool that can help identify problem content areas in a class, and indicate material that students need review or help with. The survey can help an instructor organize the class material in a more efficient way to benefit the students and the class.

References

1. Edward Nuhfer, "The Knowledge Survey: A tool for All Reasons", Univ. Of Colorado at Denver, and Delores Kniff, United States Air Force Academy, 2003, To Improve the Academy, V 21 pages 59-78.