Online Course Evaluation and Analysis

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Abstract

This paper describes an online course evaluation system based on web programming language, PHP and MySQL database. The system offers many advantages over traditional paper-based evaluation system, such as, fast feedback time, protection of students' identity, and elimination of bias of students' response with their grades. The system is in operation at the College of Engineering, Temple University since Fall of 2002. Students can assess faculty teaching performance anytime during the semester, and the results are immediately prompted back to the instructor. This allows the instructor to make changes in the course material or in teaching technique before the semester is over. This paper also introduces a technique for analyzing web-based raw data, and correlating it with students' expected class performance so as to remove any bias. The course evaluation system can be quickly modified, and implemented by an instructor for any course.

1. Introduction

Effective teaching is always an intriguing topic to educational professionals. The education climate has been drastically changed in last decade with more foreign-accent speaking instructors and foreign students integrated into American university campuses [1]. These diversities flourish academic environment, but effective learning becomes difficult to be evaluated and measured due to differences in students' cultural backgrounds. There are students whose cultural backgrounds are to trust instructors in absolute authority, and definite correctness in the classrooms.

Intelligent and remote education systems [2] based on web provide an alternative learning approach to encourage students speak about their opinions. Students can also gather enormous amount of resources and information at their luxury time from CD-ROM, or through websites. Elder students felt these learning preferences more acceptable rather than sitting in a classroom with younger students [2]. However, intellectual stimulations in traditional classroom education can be irreplaceable using these smart and web-based education systems. It is critical for educators to obtain course evaluation to determine how successful and effective a course is taught in the classroom.

Teaching evaluation is as important to instructors as to their students, and is equally critical as students' ability to grasp knowledge. American Board Engineering and Technology (ABET) accreditation guidelines recommend engineering education evaluation as a three-loop process [3]: i) process of teachers evaluating students, ii) process of students evaluating teachers, and iii) process of employers evaluating students. These three-way evaluations provide a full feedback to determine how effectively a student can apply the material learned into real world applications. As a college teaching profession, processes (i) and (ii) are easily assessed by the faculty members in an ABET accreditation program.

Most universities can determine the outcome of process (ii), because students are available in the school. This evaluation process is direct, and is conducted in possibly two ways: 1) paper-based evaluation, and 2) web-based evaluation. The paper-based evaluation is often conducted at the end of the semester; the method is time consuming with slow feedback of response. In addition, questionnaires are often outdated with rapidly changing student population and instructional technologies. Furthermore, the results are often too late for faculty member to make appropriate changes in the classroom.

The web-based course evaluation is more adaptable to changing student population and technologies, along with the additional advantage of instant feedback. However, reference [4] disagreed that a web-based survey could improve faculty members' teaching styles. The author's argument was that a course survey cannot affect faculty teaching style, but teaching workshop and other measures may be the solution. At the same token, this argument is also applied to the paper-based evaluation system. The web-base survey is advantageous since appropriate course-specific questions can also be quickly added in the questionnaire. These benefits of using an online course survey are apparent: fast feedback cycle (sending students' comments as email), and ease of statistical analysis.

Students' responses from a course evaluation can be statistically analyzed to determine how effective an instructor is/was in a course. However, improper analysis can hurt an instructor reputation if the responses are biased, especially in a smaller sized survey. Faculty members are sometimes unfairly criticized by the administration based on inappropriate or improper analysis of survey data. Faculty members also often times tend to inflate students' grades, because they are afraid that bad grades may make students respond unfavorably in a course evaluation. The students do not often learn what they should have learned, rather they learn mostly for an acceptable grade. The education goal is sometimes compromised due to this problem so that course survey does not help.

This paper comprises of two parts of discussions for our college-wide online course evaluation system: Section 2 describes the on-line course evaluation process that has been implemented at College of Engineering, Temple University, and Section 3 is devoted to a new data analysis methodology to remove biasness with students' grades. Concluding remarks and a plan for future work are given in Section 4.

2. Online Course Evaluation System

Online survey systems are usually developed using Common Gate Interface (CGI) programs, written in C or Perl. Our on-line course evaluation has been developed using the php Easy Survey Package (phpESP version 1.4) [5]. The system is written in php, which is a server-side scripting language. The system has a standardized PHP programming interface to a survey database using MySQL database server.

The phpESP system is written in open source, and can also support [5] a large number of respondents, as high as, 4000+. This number is more than sufficient for a typical course or program offered at any university. With the current enrollment in the College of Engineering, the phpESP based course evaluation system was a good choice.

2.1 phpESP Course Survey Architecture

The architecture of the online course evaluation system is shown in figure 1.

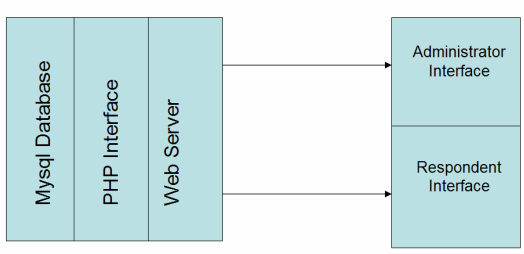

Figure 1. System Architecture

The survey setup at the server side includes:

1. MySQL database – to store all questionnaire and respondent tables.
2. PHP interface – to extract information from MySQL database and generate HTML pages.
3. Web Server – to transport PHP generated HTML page to client side.

The client side is interfaced with either the administrator or the student respondents. There are two client graphic user interfaces:

1. Administrator interface – creates course evaluation template, display evaluation results, achieve evaluation, and analyze evaluation.
2. Respondent interface – contains a simple login screen, and course evaluation form.

The original software, phpESP is written in php integrated with MySQL database server. The original tables have questionnaires, survey administrator, and respondents. To extend the system, we include two more customized tables:

1. A table containing class registration, and student's information, and
2. A table containing student's survey registration information (whether the student can respond to a particular course survey).

The survey respondent table has to be coincided in with the record shown in the classes and student information table. A default survey template has also been created that allows the instructor to create a course survey page quickly, and then modify it as appropriate.

2.2 Administration Interface

The administrator has two responsibilities, namely, creating the survey questionnaire for each course, and publish the survey result.

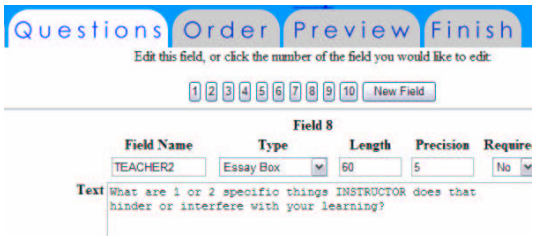

Figure 2. Course Survey Template

The survey forms are created using a course survey template (as shown in figure 2). The template has common questionnaire for all courses. Once the template is created, any course survey form can be generated which has the professor's name and section number. The questions for the survey may be generated by the instructor or by the administrative personnel, and may include general questions about the instructor's teaching style as well as course-specific questions. This process is fully automated.

The course survey result can be viewed any time, even after only one student completes the survey. In fact, it shows how many students completed the survey. Figure 3 illustrates part of the survey result that has rated the professor at 4.5 out of 5. The students can also freely write any comments about the instructor or the course, and the comments can be emailed to the faculty members.

The course survey can be printed or emailed to the professor who teaches the class, or to the university administration. The turn-around time is virtually instantaneous.

2 out of 13 students have completed this course survey

ELECTRIC DEVICES & SYS I

ECE0063 Section 042 - [redacted]

Directions: To assist your professor in improving this course, please respond to the following questions in the provided forms. The re:
evaluation will not be made available to the instructor until after your grades have been submitted. Please respond frankly to the ite
to ask for help. Please respond by giving a numerical score to each question between 1 and 5 where: 1 = strongly disagree; 2 = disagre
agree; 5 = strongly agree

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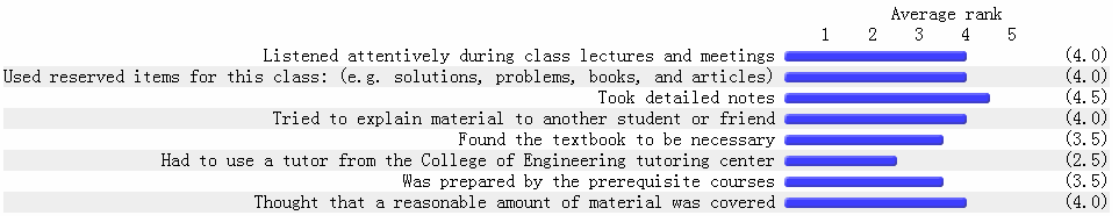
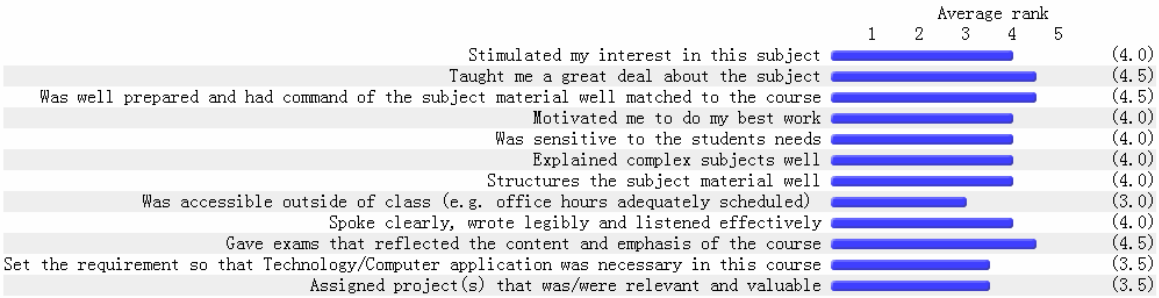
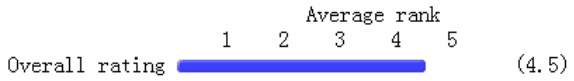
1. In this course: I



2. In the course, the professor:



3. I would rate my instructor's overall effectiveness as a university professor as outstanding



4. Please add any comments you may have pertaining to the course

#	Response

5. What are the 1 or 2 specific things INSTRUCTOR does that help you learn in this course?

#	Response
1	1.great class enviroment 2.answering all students' questions.
1	She does a lot of examples and they are very similar to the exams

6. What are 1 or 2 specific things INSTRUCTOR does that hinder or interfere with your learning?

#	Response
1	none

7. Please give INSTRUCTOR 1 or 2 specific practical suggestions on ways that he can help you improve your learn

#	Response
1	give more small quizes and tests.

Figure 3. Survey Result Screen

2.3 Student Interface

To complete an online survey, a student has to go through a registration process to get a system-generated random password. The password is emailed to the student's official email address. The student can login to the course survey by supplying a username, last six digits of social society number, and the random password as shown in the figure 4.

Login Screen

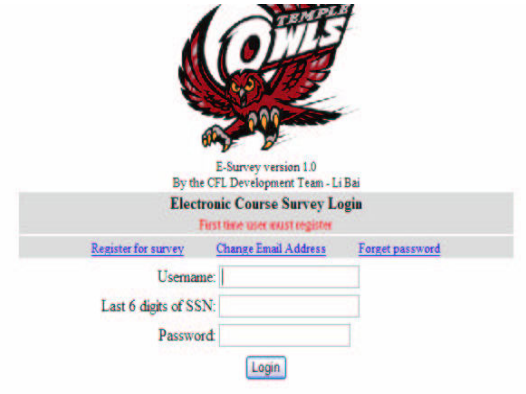


Figure 4. Student Survey Login Screen

If the student is authenticated, the course survey screen is displayed as shown in the figure 5 below. (Identities of the student and faculty members are hidden purposely).

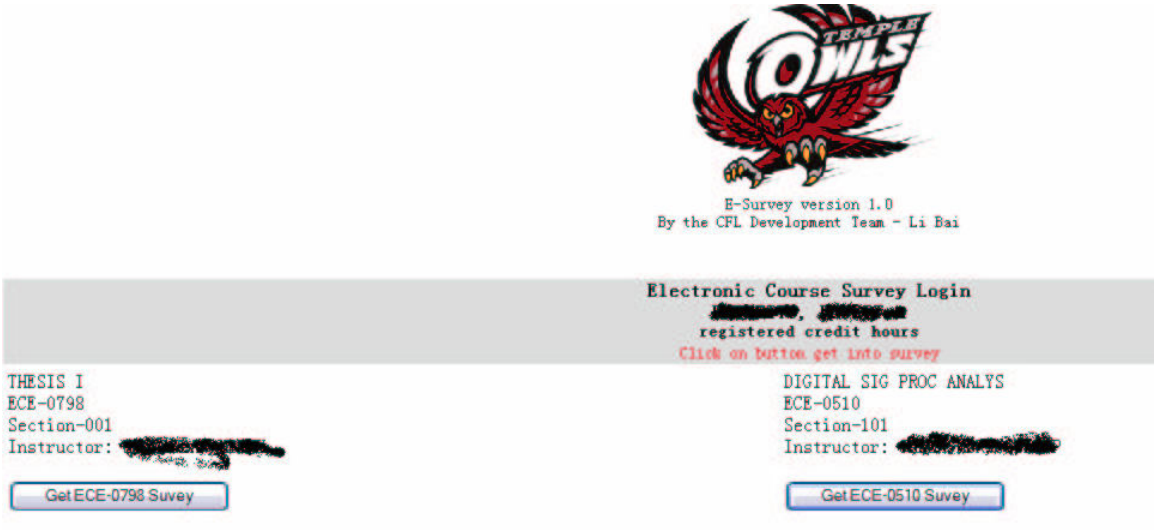
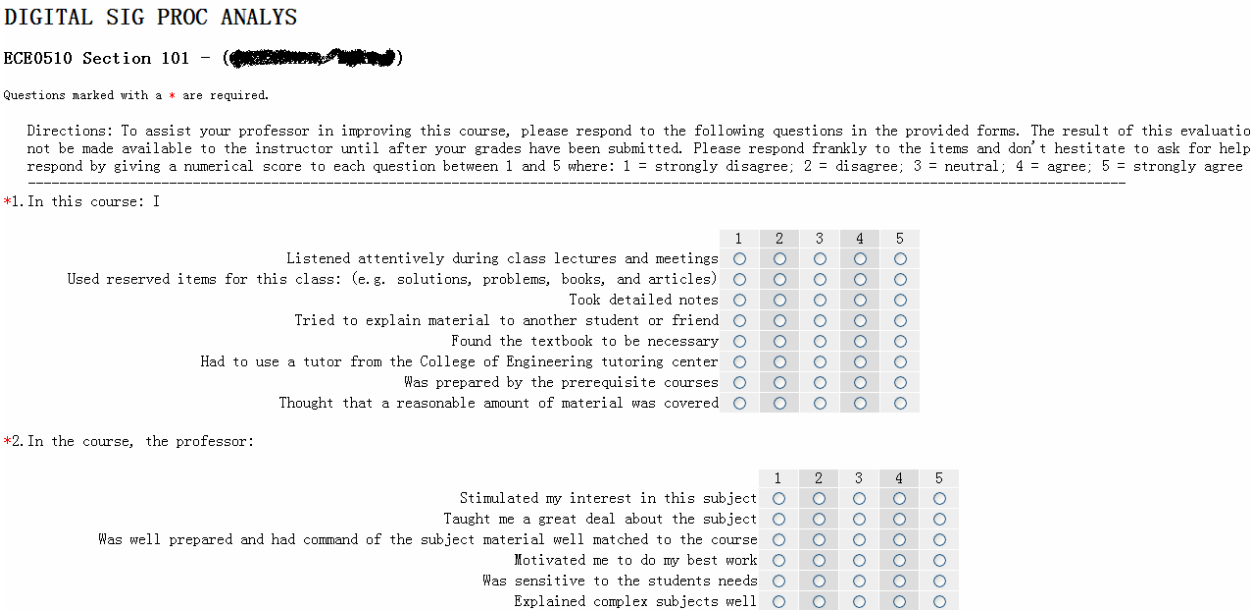


Figure 5. Student Course Survey Selection

The current student has two course surveys to be completed. If the student clicks on the button, the course survey forms will be displayed. In this particular example, ECE-0510 course survey has been selected; the partial screen of the course survey questionnaire is shown in figure 6.



DIGITAL SIG PROC ANALYS

ECE0510 Section 101 - ([redacted])

Questions marked with a * are required.

Directions: To assist your professor in improving this course, please respond to the following questions in the provided forms. The result of this evaluatio not be made available to the instructor until after your grades have been submitted. Please respond frankly to the items and don't hestitate to ask for help respond by giving a numerical score to each question between 1 and 5 where: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

*1. In this course: I

	1	2	3	4	5
Listened attentively during class lectures and meetings	○	○	○	○	○
Used reserved items for this class: (e.g. solutions, problems, books, and articles)	○	○	○	○	○
Took detailed notes	○	○	○	○	○
Tried to explain material to another student or friend	○	○	○	○	○
Found the textbook to be necessary	○	○	○	○	○
Had to use a tutor from the College of Engineering tutoring center	○	○	○	○	○
Was prepared by the prerequisite courses	○	○	○	○	○
Thought that a reasonable amount of material was covered	○	○	○	○	○

*2. In the course, the professor:

	1	2	3	4	5
Stimulated my interest in this subject	○	○	○	○	○
Taught me a great deal about the subject	○	○	○	○	○
Was well prepared and had command of the subject material well matched to the course	○	○	○	○	○
Motivated me to do my best work	○	○	○	○	○
Was sensitive to the students needs	○	○	○	○	○
Explained complex subjects well	○	○	○	○	○

Figure 6. Student Course Survey

The respondent completes the survey by clicking the radio buttons on the right side of the screen. Once the survey is completed and submitted, the student cannot do the same survey again. This provides an accurate count of the surveys completed so that result is accurate.

3. Analysis of Raw Data and Student Grades

Interpretation of course evaluation is often ambiguous and biased with students' course performance. In figure 3, the overall rating of the professor is 4.5 out of 5. This score is used to evaluate instructor's teaching performance. This evaluation is in one dimension with respect to only the students' response, but not with respect to the students' course performance. It is commonly believed that students' responses are often related to their class performance; students who perform better usually rate the instructor highly whereas students who perform poorly rate the instructor also poorly. Clearly a simple one-dimensional analysis of taking the average of students' responses wouldn't provide a true picture of the instructor's teaching performance.

In this paper, a new method is introduced to determine the effectiveness of an instructor in two dimensions: professors' ratings evaluated by students, and students' grades (or expected grades) evaluated by the professor. A course survey was conducted for a group of sophomore year electrical engineering students for three courses that they have taken recently. One of the questions students have been asked in the course survey form is the anticipated grade in the course. They were asked to rate the professor on a scale of 5 with 5 being the best and 1 being the worst. Figures 7, 8, and 9 show the results of the survey for the three courses.

For course EE 1, the mean and variance of professor's rating are Mean(R) = 2.2105, Variance = 0.95, which are not quite favorable for the instructor. However, it may be the result from the

biasness of students respect to their grades. If the professor's rating is plotted with respect to the students' grades in the course as shown in figure 7,

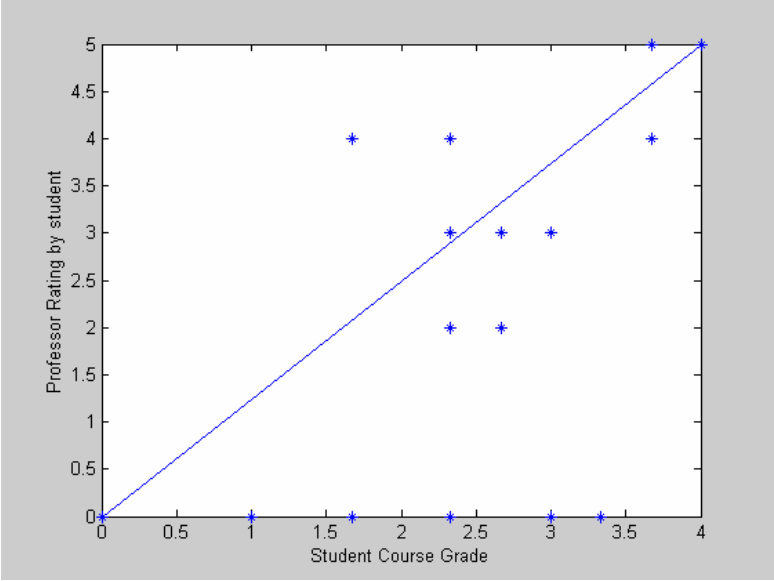


Figure 7. Professor's Rating vs. Course GPA (Course EE 1)

we can observe that there are several students gave the professor a zero rating, which have resulted in the low mean rating for the professor. However, the average students (Grade=2-3) have shown the good ratings (above anti-diagonal line) as well as the bad ratings (below anti-diagonal line). It indicates that the professor is not a bad instructor. Several students also rated the professor as very bad, which may be due to their lack of background for taking the course, or complexity of the course material.

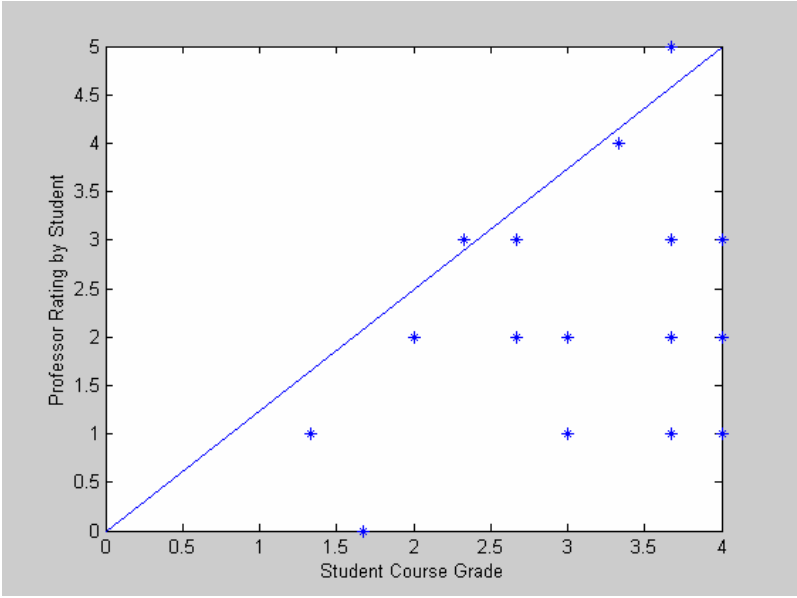


Figure 8. Professor's Rating vs. Course GPA (Course EE 2)

The figure 8 shows another professor's class, and the average of professor rating is 2.1875 and variance 1.63. Although this professor's rating is similar with the previous professor's rating, we observe that there are more samples below the anti-diagonal line. This indicates that students did not like the course even when they expected to receive better grades. It can be concluded that overall performance of the professor in this course has been poor. Also, the average students (Grade=2-3) show more negative responses (below the anti-diagonal line) than the positive responses.

It is also interesting to compare the professor's rating in the courses EE1 and EE2. Since the mean rating for both the courses are about the same, the university administration might put both the professors in the same category, possibly as bad professors. However, our analysis shows that the professor EE2 is actually a much better professor than the professor of EE1.

Figure 9 shows the course review for another course with 18 students. The average score of the instructor is 3.5 and the variance 2.62. If we plot the students' responses against their grades, we observe that average students (Grade=2-3) have shown the good rating as well as bad rating symmetric around the anti-diagonal line. It indicates that the instructor is actually a good professor.

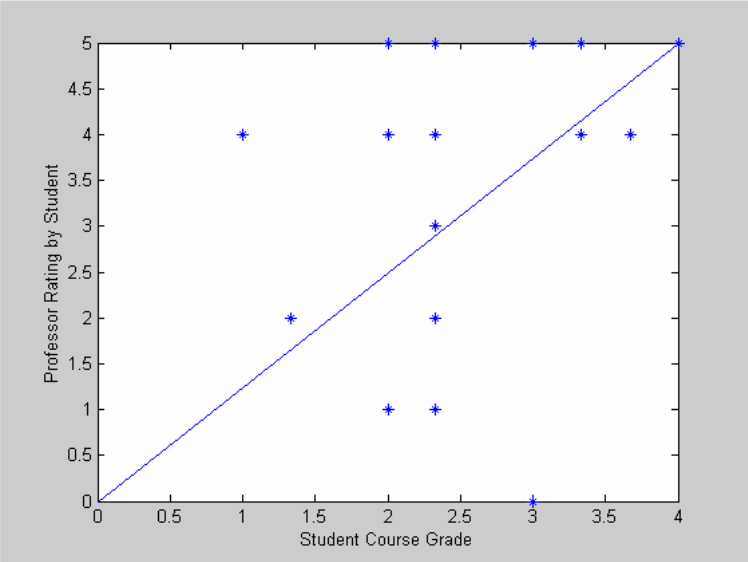


Figure 9. Professor's Rating vs. Course GPA (EE 3)

The figure 10 is the plot for another course taught in the electrical and computer engineering department in Spring 2003 semester. In this figure, the faculty member has most of response on the upper right corner. It indicates that the students did very well in the class, and they seem to like course. Most importantly, most points are on the anti-diagonal line. It shows that students did not show much biasness in this course survey. However, the good grades may be result for the good survey rating for this particular professor. The average students (grades =2-3) have shown their ratings below the anti-diagonal line. The average rating of this professor is the

highest among all four classes, but the figure can not explain whether the professor inflated the grades, or the professor taught well so that students performed well.

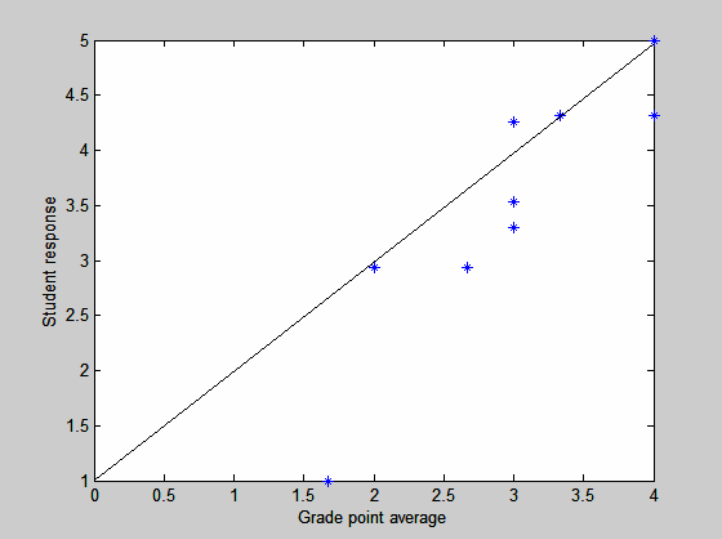


Figure 10. Rating vs. Student Grades (Sample class 4)

In this study the surveys were conducted after the semester was over. It is expected that the survey results would have been about the same if surveys were conducted during the semester for the professor's rating and the student's anticipated grade for the course.

4. Conclusion and Future Work

We designed and launched an online easy-to-use course survey in the College of Engineering at Temple University. It provides instantaneous feedback to the instructor about the course as well as the instructor. Most importantly, we developed a method to identify the biasness that may occur in students' course evaluation. This technique introduces a two dimensional analysis process that may be more appropriate for course evaluation. In this analysis, we could not answer how many samples are needed to well represent the course survey for a class. We assumed that number of respondents has to be greater than half of class size.

There are many things that could be interpreted from the analyzed result. We can draw the conclusion that a good instructor cannot be evaluated with one dimensional data. We can use the average students' response as a reference to see whether the professor has a positive effect to some average students. The survey results may also show if the students are interested in the subject area covered in the course. Other inferences are needed to be studied and understood in future work using a large sample data.

This analysis can also help us to understand how well the course has been taught by the instructor. In this tool, we can design some criteria to determine the teaching effectiveness. This method removes the fear that the faculty members have to give better grades to students in order to get good course evaluation result.

5. Reference

[1] Cliff I. Davidson and Susan A. Ambrose. *The Professor's Handbook*. Anker Publishing Company, Inc. Boston, MA. ISBN 1-882982-01-0, 1994.

[2] Abi Aghayere. *A Web-based Distance-Learning Course in Structural Analysis*, Proceeding of the 2003 American Society Engineering Education Annual Conference & Exposition, 2003.

[3] *Standard Process 00 – Three Loop Assessment / Evaluation Structure*, Available on-line: http://ceaspub.eas.asu.edu/mae-ec2000/PDF_documents/ standard_processes/sp00.pdf, accessed August, 2003.

[4] Michael Theall. Electronic Course Evaluation Is Not Necessarily the Solution. The Technology Source, November/December 2000, Michigan Virtual University. Available on-line: http://ts.mivu.org/default.asp?show=article&id=823, accessed August 2003.

[5] James Flemer. *phpESP on SourceForge.net*. Available on-line: http://sourceforge.net/projects/phpesp/, accessed August 2003.

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