

Evaluating the Effects of WebAssign on Student Achievement and Engagement in  
an Advanced Placement Physics B Classroom

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A Special Project

Presented to

Dr. Gretta Merwin

Heritage University

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In Partial Fulfillment  
of the Requirement for the Degree of  
Master of Education

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## FACULTY APPROVAL

Evaluating the Effects of WebAssign on Student Achievement and Engagement in  
an Advanced Placement Physics B Classroom

Approved for the Faculty

Dr. Kretta Merwin, Faculty Advisor

June 28, 2010, Date

## ABSTRACT

Through the use of post-tests, as well as a student survey, the researcher intended to discover if WebAssign, a web-based homework program, increased student achievement and engagement when compared with the use of textbook assignments. Results of post-test scores for the eight chapters were used to evaluate the effectiveness of the WebAssign program. Half the chapters were completed in conjunction with WebAssign, and the other half were completed using the textbook only. Also, students were provided a survey at the end of the eight chapters to rate perceived student achievement and engagement with WebAssign versus the textbook. Test results and survey responses revealed WebAssign did not notably improve student achievement or engagement over using the textbook only.

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## CHAPTER 1

### Introduction

#### Background for the Project

Student achievement and engagement were important aspects of high school education, particularly in Advanced Placement courses. Students in Advanced Placement Physics B were required to learn a significant amount of information in a short amount of time. Advanced Placement Physics B was a college-level course taught in high school. Students received college credit based on the results of an end-of-the-year exam administered in May. Many Advanced Placement Physics B teachers used WebAssign, an internet-based computer program, to increase student retention and engagement. The researcher used the results of eight post-tests and a five-point Likert scale survey to determine whether the WebAssign program improved student achievement and engagement in an Advanced Placement Physics B classroom.

#### Statement of the Problem

Many Advanced Placement Physics B teachers used WebAssign to increase student achievement and engagement. A study needed to be conducted to determine if WebAssign actually improved student achievement and interest in the Advanced Placement Physics B assignments.

### Purpose of the Project

Through the use of post-tests, as well as a student survey, the researcher intended to discover if WebAssign increased student achievement and engagement when compared with the use of textbook assignments. The researcher used the results of the study to evaluate whether or not WebAssign benefited Advanced Placement Physics B students.

### Delimitations

The study was conducted in the fall of 2009 in an Advanced Placement Physics B class at a small urban high school in southeastern Washington. The school had a population of 1,726 students with a nearly equal distribution of boys and girls. The school ethnicity was as follows: 79.5 percent Caucasian, 13.5 percent Hispanic, 3.2 percent Black, 0.2 percent Pacific Islander, 2.6 percent Asian, and 0.5 percent Native American/Alaskan Native. Approximately 18.3 percent of the students at the school received free or reduced lunch and the special education population was 8.6 percent. The migrant population was 2.8 percent, and the transitional bilingual population was 2.2 percent. The school employed 79 teachers and the average years of teacher experience were 16.4 years. Only 59.5 percent of the teachers had a master's degree and 94.6 percent of the classes were taught by teachers meeting No Child Left Behind highly qualified definition (Office of Superintendent of Public Instruction, 2008).

The Advanced Placement Physics B class involved in the case study consisted of 20 students; most had previously completed Honors Physics. The course instructor majored in Physics in college and taught Advanced Placement Physics B, Honors Physics, and Conceptual Physics for three years prior to the study. Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. Half the chapters were completed in conjunction with WebAssign, and the other half were completed using the textbook only. In addition to test scores, students were provided a survey at the end of the eight chapters to rate perceived achievement and engagement with WebAssign versus the textbook.

### Assumptions

The researcher used a college-level textbook for the Advanced Placement Physics B course. Students were accepted into the course based on mathematical ability. Students entering Advanced Placement Physics B were required to be in second year Algebra or higher. Students who had not previously taken Honors Physics were expected to keep up with the other students by utilizing additional support. The researcher assumed the difficulty level for the chapters using the textbook only and the chapters using WebAssign were equivalent in difficulty. The researcher assigned equivalent quantities of homework in each chapter. Each test consisted of 15 multiple-choice questions and free-response questions.

### Research Question

In an Advanced Placement Physics B classroom, will WebAssign increase student achievement when compared to the use of a traditional textbook for completing homework? Additionally, will the use of WebAssign increase student engagement in an Advanced Placement Physics B classroom?

### Significance of the Project

If the results of the study showed that WebAssign was effective at increasing student achievement, the study would have encouraged the school to continue with the WebAssign program in the Advanced Placement Physics B classroom. Other classes at the school and other schools in the district would be encouraged to try WebAssign. If the results of the study showed that WebAssign was not effective in increasing student achievement, the school would need to re-evaluate the use of WebAssign in the Advanced Placement Physics B classroom.

### Procedure

Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. The first four chapters were completed in conjunction with WebAssign, and the next four chapters were completed using the textbook only. During the first four chapters, students took notes during class and worked in groups of four, using the notes, calculators, and white boards to work problems similar to the

WebAssign homework. Students had individual passwords to log-in to WebAssign using the internet. Students did not have class time to complete the homework and usually used home computers to access WebAssign. Students were given two days to complete the homework, thus students were able to get assistance in class on difficult problems prior to the assignment deadline. Students had five attempts per questions and were given immediate feedback as to the correctness of the solution provided. A discussion board was set up for each chapter and students posted questions and solution strategies. At the end of each chapter, students were given a chapter post-test which consisted of 15 multiple-choice questions and 2-3 free-response questions, compiled from past AP exams and AP review books. During the next four chapters, students took notes during class and then worked on homework problems in class in groups of four. Students completed the homework using the course textbook. Students were able to ask the teacher for help during class. The homework was due the next day and the teacher answered questions prior to grading the assignment in class. At the end of each chapter, students were again given a chapter post-test. At the end of the eighth chapter post-test, students completed a five-point Likert scale survey which was created by the researcher and consisted of ten statements and a section for additional comments. Results from the post-tests and surveys were analyzed and used to determine the effectiveness of the WebAssign program on student achievement and engagement.

### Definition of Terms

College Board. College Board was a non-profit organization that sponsored many tests, education services, and materials connected with college preparation, college admission process, and college credit.

Likert scale. A Likert scale was a rating scale designed to measure respondents' level of agreement with statements by quantifying subjective information.

WebAssign. WebAssign was an online homework program developed by North Carolina State University which worked in conjunction with published mathematics and science textbooks.

### Acronym

AP. Advanced Placement.

## CHAPTER 2

### Review of Selected Literature

#### Introduction

AP Physics B students were required to receive college-level instruction, using a college-level textbook, and perform college-level labs. Teachers were required to use college-level textbooks in the AP Physics B course. A list of acceptable textbooks was provided in the College Board Physics Course Description publication. The researcher used the *Giancoli Physics, 5<sup>th</sup> edition*. The textbook was published by Prentice Hall in 2002. The 6<sup>th</sup> edition of the textbook was published in July of 2008; however, no significant changes were made in the newer edition. The *Giancoli Physics, 5<sup>th</sup> edition* problems were available through WebAssign and were used in conjunction with the textbook.

#### Description of AP and AP Physics B Requirements

For the past 50 years, College Board worked with colleges, universities, and high schools to provide students with college-level coursework while still in high school (College Board, 2009). In the AP classes, students received prescribed college-level instruction and utilized college-level textbooks. In May, students took rigorous AP exams in one or more of the 30 AP courses offered and received a score between 1 and 5. Scores of 3 and above were considered passing; a score of 5 counted as an A, a score of 4 was an A- to a B, and a score of 3 was a B- to

a C. Over 3,600 colleges and universities worldwide offered college credit based on AP exam scores.

AP Physics B was algebra-based, and the course covered mechanics, fluid mechanics, thermal physics, electricity, magnetism, waves, optics, atomic, and nuclear physics. Students were required to complete a minimum of 12 college-level labs throughout the course. Teachers were not provided with a set list of AP level labs; thus, labs were based on teacher selection.

The AP Physics B exam consisted of one 90-minute multiple-choice session and one 90-minute free-response session. The multiple-choice session had 70 questions and students were provided with only a constant sheet. No equations or calculators were allowed. The free-response session had approximately seven questions. Students were provided a constant sheet and an equations sheet for the free-response session. Students were also allowed to use scientific calculators on the free-response portion of the AP Physics B exam.

#### Description of WebAssign

WebAssign was developed at North Carolina State University in conjunction with Advanced Instructional Systems in 1997 (WebAssign, 2009). The program was created to provide students with immediate feedback on homework, quizzes, and tests. WebAssign contained homework questions that coincided with textbook questions; however, the program also allowed teachers to create new



questions. Initially, only a limited number of textbooks were compatible with WebAssign. However, the number of compatible textbooks increased to 452 in a little over a decade. WebAssign was geared toward science and mathematics courses. Since WebAssign was compatible with many different textbooks, high school teachers and college professors used the program in conjunction with the course textbook. Homework and tests were for professors to grade with WebAssign. Each student was provided immediate feedback on the correctness of the solution the student provided. The immediate feedback encouraged students to rework the missed problems in search of the correct answer. The communication board, which was available through WebAssign, provided students with the opportunity to ask for help from classmates or the course instructor.

#### Description of Likert Scale

The Likert scale was developed by Rensis Likert in 1932 to measure a respondent's level of agreement with statements in order to quantify subjective information. The original Likert scale was a five-point scale where individuals selected a number between 1 and 5 which corresponded with the individual's agreement with each statement. The standard response choices were "Strongly Agree," "Agree," "Undecided," "Disagree," and "Strongly Disagree." In order to quantify the results, each statement was assigned a number between 1 and 5.

Typically a rating of 1 corresponded with an unfavorable response and a rating of 5 corresponded with a favorable response (International Encyclopedia of Social Sciences, 2008). Likert scales had been adapted over time and varied greatly based on the intended purpose of the survey.

#### WebAssign Studies With No Improvement in Student Achievement

Past research on WebAssign versus the conventional paper method has shown mixed results. Research conducted by Rhett Allain and Troy Williams (2006) showed that online homework had no significant effect on student understanding or retention when compared with the traditional paper method. The study involved four sections of an introductory astronomy class. Each section contained between 40 and 90 students. Three instructors were involved in the study. One instructor, professor A, taught two sections of introductory astronomy. In one section the instructor used WebAssign to grade homework, and in the other section homework was not graded at all. The other two professors, professor B and professor C, each taught one section of introductory astronomy. Each teacher used WebAssign for half the year and then non-graded homework for the second half of the year. Professor B began with WebAssign and finished with the non-graded homework. Professor C began with the non-graded homework and ended with WebAssign. An astronomy diagnostic pre-test and post-test were given to the students in each class and the results were analyzed based on the normalized

matched gain for each class. Overall, the data showed that the WebAssign students did not achieve any significant gain. Additionally, four tests and a final were given in each course. The average scores for each test were compared for each of the four sections. Again, no significant difference was noted. As a result of the study the researchers concluded that although students spent more time on the online homework, students did not score any higher on the tests than when homework was completed in the traditional method and was not graded.

In an article published in *The Physics Teacher*, researchers Scott Bonham, Robert Beichner, and Duane Deardorff (2001) conducted a study which involved two sections of introductory calculus-based physics and two sections of introductory algebra-based physics. There were approximately 110 students in each of the introductory calculus-based physics courses and approximately 60 students in each of the introductory algebra-based physics courses. Each of the introductory calculus-based physics courses was taught back to back by the same instructor who maintained consistency between each of the courses. The introductory algebra-based physics courses were taught by a different instructor than the introductory calculus-based physics courses; however, the same instructor taught both of the introductory algebra-based courses. Again the instructor maintained consistency between the two courses. Each teacher used WebAssign for one section and the traditional paper method for the other section.

Students who used WebAssign were provided with the same or similar questions as the students who used the traditional method to submit homework. The work of the WebAssign students was graded by WebAssign. The work of the students who submitted written homework assignments was graded by a teacher's assistant. The study indicated that students who used Web-Assign performed slightly better than students who submitted homework via paper. In the introductory calculus-based physics course, students who used WebAssign averaged a 78 percent on tests compared to 75 percent for students who used the paper method. The homework average was 88 percent to 72 percent in favor of WebAssign. The laboratory score was nearly equal at 85 percent and 84 percent, respectively. In the introductory algebra-based physics class, the test average was 82 percent for WebAssign students and 77 percent for students who used the paper method. The average quiz and homework scores were nearly equal; however, WebAssign led each category by one to three percent. Students who used the paper method did average a three percent higher laboratory score than students who used WebAssign. The study concluded that students who used WebAssign did not score significantly higher than students who used the traditional paper method to submit work. The surveys clearly showed, however, students preferred to submit homework through WebAssign rather than the

traditional paper method. While WebAssign did not have a significant impact on student achievement, WebAssign increased student interest and engagement.

#### WebAssign Studies With Improvement in Student Achievement

Conversely, research conducted by H.W. Six, G. Ströhlein, and J. Voss (2001) compared the benefits of WebAssign to the conventional paper method of homework submission and showed students did benefit from WebAssign and the immediate feedback the program provided. The study involved 1,042 students enrolled in an introductory computer-science programming course. The course was selected due to the large enrollment number and the variety of assessments required. Half the information tested was about programming and the other half was about theory. Approximately 35 percent of the students enrolled in the course used WebAssign. The other 65 percent of the students mailed the work into the instructor or grader and waited for the work to be graded and returned. Students were required to achieve 50 percent mastery of programming and 50 percent mastery of theory prior to admittance into the final. The study showed 92.5 percent of students in the WebAssign group passed the programming component of the course and were allowed to move onto the theory portion. In the conventional group, only 80.4 percent passed. In the WebAssign group, 71.1 percent of original students passed the programming and theory portions of the course and were admitted into the final. The percent of students in the

conventional group that were admitted into the final was 69.4 percent. In the WebAssign group, 72.1 percent of students passed the final compared with only 63.2 percent in the traditional group. Additionally, students in the WebAssign group scored higher on both the programming and theory tasks on the final. The researchers concluded WebAssign did have a positive impact on student learning when compared with traditional methods, particularly for the programming tasks. The success of WebAssign was attributed to the quick feedback students were provided.

In the article, "The Influence of Web-Based Homework on Quantitative Problem-Solving in a University Physics Class," the author, Andrea M. Pascarella (2004), analyzed the effects online homework assignments had on students' problem-solving skills when compared with the traditional written method. The study was conducted in 2001 and involved two sections of introductory calculus-based physics courses. One section used the web-based homework assessment while the other groups submitted homework the traditional way. There were 265 students in the web-based group and 250 students in the traditional group. Students who used the web-based program received immediate feedback on homework assignments. Students in the web-based group were able to resubmit answers. Students in the traditional homework group were not able to submit answers and did not receive feedback until after the assignment had been turned in and graded. Students participated in problem-solving interviews which were videotaped and later analyzed.

Students were classified as “thinkers” and “guessers.” At midterm the two groups switched and the students were reevaluated. The researcher found the web-based program promoted guessing. Students who were originally thinkers became guessers after using the web-based assessment program. Students who were originally guessers became thinkers. While not all students switched titles, the number of students who switched categories was significant. The researcher concluded that the web-based program encouraged student guessing. The researcher also noted students who used the traditional method were more thoughtful and thorough.

#### WebAssign Studies With Improvement in Student Engagement

In the article, “WebAssign: A Better Homework Delivery Tool,” the author, John C. Dutton (2001), described the need and benefits of the WebAssign program. The author taught business statistics at the College of Management and used WebAssign because the program provided students with immediate feedback, encouraged students to rework incorrect answers, and reduced the quantity of papers to be graded. The author provided a thorough history of WebAssign, how the program was used, and the drawbacks of the WebAssign program. The author explained how WebAssign was used in the business statistics classes the author taught. Finally, the author provided the results of a short question survey that evaluated students’ opinion of the WebAssign program.

Nearly 2,500 students completed the survey and the results indicated that 95 percent of the students surveyed were comfortable with WebAssign, 94 percent found the program easy to use, 71 percent of students believed WebAssign was more beneficial than traditional homework methods, and 77 percent of the students felt WebAssign helped the students to learn the class material. While the results were strictly qualitative, the survey showed that students found WebAssign to be easy to use and believed the program was beneficial and aided in retention of the material.

In the article, "Textbooks and Tests That Talk Back," the author, Lisa Guernsey (1999), used a series of quotes and general observations to gather information about professors' and students' attitudes toward WebAssign. One student found the program rather impressive while another student stated WebAssign was a vital component of learning. The student learned to expect and value immediate feedback. Students were able to resubmit answers until the correct answer was achieved. The ability to resubmit answers was a quality valued by many students. Professors also highly supported WebAssign and felt the program increased student interest. Professors were not concerned that students did not get the answers correct initially. Professors valued the fact that students were persistent and continued to solve problems. While one student expressed a longing for the traditional textbook problems, the same student also



acknowledged a general support of the WebAssign program. Overall, most students and professors valued WebAssign and felt the program was a vital component in student learning.

### Summary

Research showed that while some courses obtained improved student achievement through the use of WebAssign, others did not. Overall, students who used WebAssign did as well or better than students who used the traditional paper method to submit work. What was notable was all studies that involved qualitative student surveys indicated a majority of the students preferred WebAssign to traditional homework methods. As a whole, students found WebAssign easy to use and valued the immediate feedback the program provided. Instructors enjoyed the reduced time required to grade the assignments and/or the cost required to employ a teacher's assistant to grade the student work.

## CHAPTER 3

### Methodology and Treatment of Data

#### Introduction

Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. Half the chapters were completed in conjunction with WebAssign, and the other half were completed using the textbook only. In addition to post-test scores, students were provided a survey at the end of the eight chapters to rate perceived achievement and engagement with WebAssign versus the textbook. The researcher compared post-test scores from the WebAssign chapters with the textbook chapters to determine if WebAssign improved student achievement. Also, the researcher used the results of the survey to determine whether WebAssign increased students' perceived achievement and engagement.

#### Methodology

The researcher used experimental and qualitative research methods in order to analyze the effectiveness of WebAssign at improving student achievement and engagement. The eight post-test scores were analyzed qualitatively to assess student achievement; however, since WebAssign was a manipulated variable which was being evaluated, the methodology was classified as experimental. The

five-point Likert scale survey utilized qualitative methodology. The average ratings for each statement were used to evaluate perceived student achievement and engagement (Gay, Mills, & Airasian, 2009).

### Participants

The study was conducted in the fall of 2009 in an Advanced Placement Physics B class at a small urban high school in southeastern Washington. The school had a population of 1,726 students with a nearly equal distribution of boys and girls. The school ethnicity was as follows: 79.5 percent Caucasian, 13.5 percent Hispanic, 3.2 percent Black, 0.2 percent Pacific Islander, 2.6 percent Asian, and 0.5 percent Native American/Alaskan Native. Approximately 18.3 percent of the students at the school received free or reduced lunch and the special education population was 8.6 percent. The migrant population was 2.8 percent, and the transitional bilingual population was 2.2 percent. The school employed 79 teachers and the average years of teacher experience were 16.4 years. Only 59.5 percent of the teachers had a master's degree and 94.6 percent of the classes were taught by teachers meeting No Child Left Behind highly qualified definition (Office of Superintendent of Public Instruction, 2008).

The Advanced Placement Physics B class involved in the case study consisted of 20 students. The course utilized the Advanced Placement Physics B curriculum as identified by College Board. Of the students enrolled in the Advanced

Placement B course, 16 had previously taken Honors Physics, while 4 were taking Physics for the first time. The students ranged in age from 15-18 years old. The students self-reported the following ethnicities: 75 percent Caucasian, 15 percent Asian, 5 percent Black, and 5 percent Hispanic. Languages spoken in the class were English, Spanish, and Chinese. The course instructor majored in Physics in college and taught Advanced Placement Physics B, Honors Physics, and Conceptual Physics for three years prior to the study.

### Instruments

The researcher used a series of eight researcher-created post-tests and a survey in order to evaluate student achievement and engagement. The post-tests consisted of 15 multiple-choice questions and 2-3 free-response questions, which were compiled from past AP exams and AP review books. The five-point Likert scale survey was created by the researcher and consisted of ten statements and a section for additional comments.

### Design

The eight post-tests were a cross between a counterbalanced design and a one-shot case study. A counterbalanced design utilized at least two groups where “all groups receive all treatments but in a different order” (Gay, Mills, & Airasian, 2009, p. 260). Results of post-tests were used to evaluate the effectiveness of the treatment. In a one-shot case study, a single group was used and exposed to the

treatment. A post-test was used to evaluate the effectiveness of the treatment. The researcher was only able to use one group of students, thus combining the two designs in order to compare post-test scores with and without the use of the WebAssign program. The five-point Likert scale was a cross-sectional survey which utilized structured items. The survey was conducted at the end of the eight post-tests to evaluate perceived student achievement and engagement. Since the survey used a five-point Likert scale rating system, the statements were classified as structured items (Gay, Mills, & Airasian, 2009, pp. 177-178). The results of both the post-tests and surveys were analyzed qualitatively, rather than quantitatively.

#### Procedure

Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. The first four chapters were completed in conjunction with WebAssign, and the next four chapters were completed using the textbook only. During the first four chapters, students took notes during class and worked in groups of four, using the notes, calculators, and white boards to work problems similar to the WebAssign homework. Students had individual passwords to log-in to WebAssign using the internet. Students did not have class time to complete the

homework and usually used home computers to access WebAssign. Students were given two days to complete the homework, thus students were able to get assistance in class on difficult problems prior to the assignment deadline. Students had five attempts per questions and were given immediate feedback as to the correctness of the solution provided. A discussion board was set-up for each chapter and students posted questions and solution strategies. At the end of each chapter, students were given a chapter post-test which consisted of 15 multiple-choice questions and 2-3 free-response questions, compiled from past AP exams and AP review books. During the next four chapters, students took notes during class and then worked on homework problems in class in groups of four. Students completed the homework using the course textbook. Students were able to ask the teacher for help during class. The homework was due the next day and the teacher answered questions prior to grading the assignment in class. At the end of each chapter, students were again given a chapter post-test. At the end of the eighth chapter post-test, students completed a five-point Likert scale survey which was created by the researcher and consisted of ten statements and a section for additional comments. Results from the post-tests and surveys were analyzed and used to determine the effectiveness of the WebAssign program on student achievement and engagement.

### Treatment of the Data

The researcher calculated the average score for each of the eight chapter post-tests. Average post-test score results were compared qualitatively and used to determine whether WebAssign or the textbook provided higher test scores. Additionally, the researcher found the average rating for each statement on the five-point Likert scale survey. Scores with an average above three were deemed to be in favor of WebAssign and scores below three were deemed to be in favor of the textbook. Charts were used to show the frequency of each response and contributed to the analysis of the data.

### Summary

The researcher evaluated the effectiveness of the WebAssign program on student achievement and engagement through the use of eight post-tests and a five-point Likert scale survey. The study, conducted in the fall of 2009, consisted of 20 students in an AP Physics B course. After each chapter, students completed a post-test which consisted of 15 multiple-choice questions and 2-3 free-response questions. Students used WebAssign to submit the homework for the first four chapters and completed the second set of four chapters with the textbook only. Students took notes and had the opportunity to ask for teacher assistance throughout each chapter. At the end of the eighth chapter, students completed a

five-point Likert scale survey to evaluate perceived student achievement and engagement. The results of the data were analyzed qualitatively to determine the effectiveness of the WebAssign program.



## CHAPTER 4

### Analysis of the Data

#### Introduction

Through the use of post-tests, as well as a student survey, the researcher intended to discover if WebAssign increased student achievement and engagement when compared with the use of textbook assignments. The researcher used the results of the study to evaluate whether or not WebAssign benefited Advanced Placement Physics B students.

#### Description of the Environment

The study was conducted in the fall of 2009 in an Advanced Placement Physics B class at a small urban high school in southeastern Washington. The Advanced Placement Physics B class involved in the case study consisted of 20 students. The course utilized the Advanced Placement Physics B curriculum as identified by College Board. Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. Half the chapters were completed in conjunction with WebAssign, and the other half were completed using the textbook only. The post-tests consisted of 15 multiple-choice questions and 2-3 free-response questions, which were compiled from past AP exams and AP review books. In

addition to post-test scores, students were provided a survey at the end of the eight chapters to rate perceived achievement and engagement with WebAssign versus the textbook. The five-point Likert scale survey was created by the researcher and consisted of ten statements and a section for additional comments.

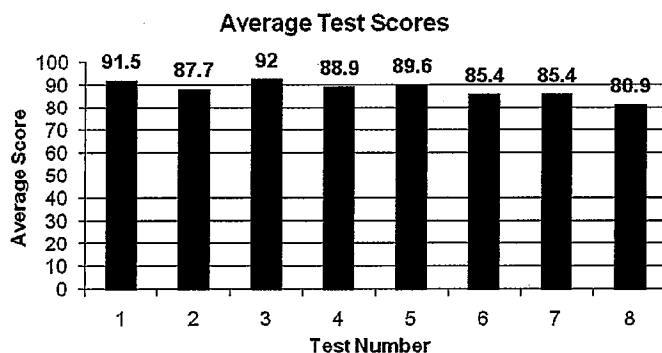
### Research Question

In an Advanced Placement Physics B classroom, will WebAssign increase student achievement when compared to the use of a traditional textbook for completing homework? Additionally, will the use of WebAssign increase student engagement in an Advanced Placement Physics B classroom?

### Results of the Study

Figure 1 summarized the average scores for each of the eight tests used as part of the study. The first four tests utilized the WebAssign program in conjunction with the *Giancoli Physics, 5<sup>th</sup> edition* textbook while the second four tests employed the textbook only.

**Figure 1: Average Test Score Results**



Figures 2 through 12 summarized the results of the five-point Likert survey which progressed from 1, strongly disagree, to 5, strongly agree. Figure 2 showed student responses on the ease of access completing homework using WebAssign versus using the textbook. The average rating was 2.9.

**Figure 2: Survey Statement 1**

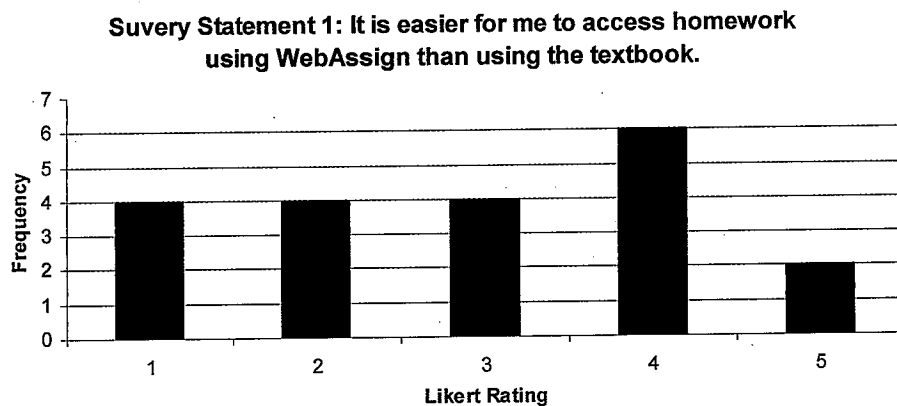


Figure 3 showed student responses on the rate of homework completion using WebAssign versus using the textbook. The average rating for was 2.9.

**Figure 3: Survey Statement 2**

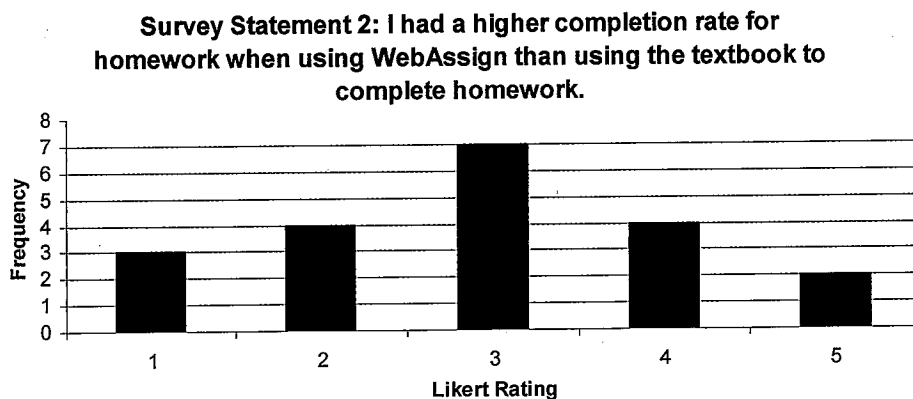


Figure 4 showed student responses to the on-time completion of homework using WebAssign versus using the textbook. The average rating was 3.55.

**Figure 4: Survey Statement 3**

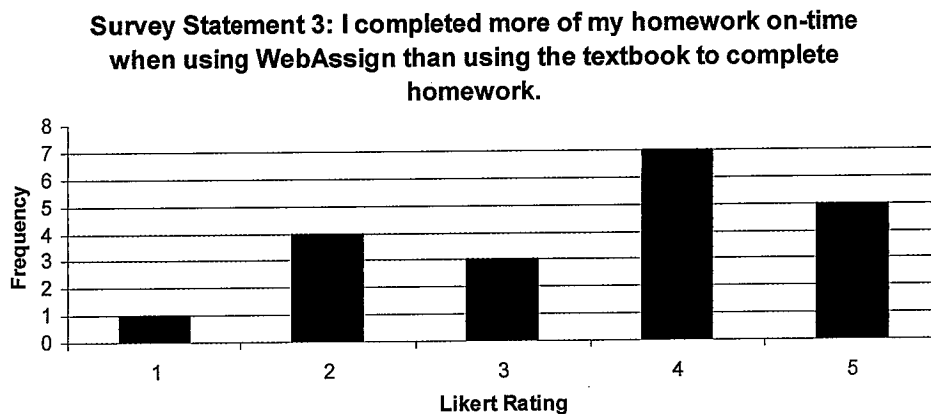


Figure 5 showed student responses to the ability to get help from classmates using WebAssign versus using the textbook. The average rating was 2.1.

**Figure 5: Survey Statement 4**

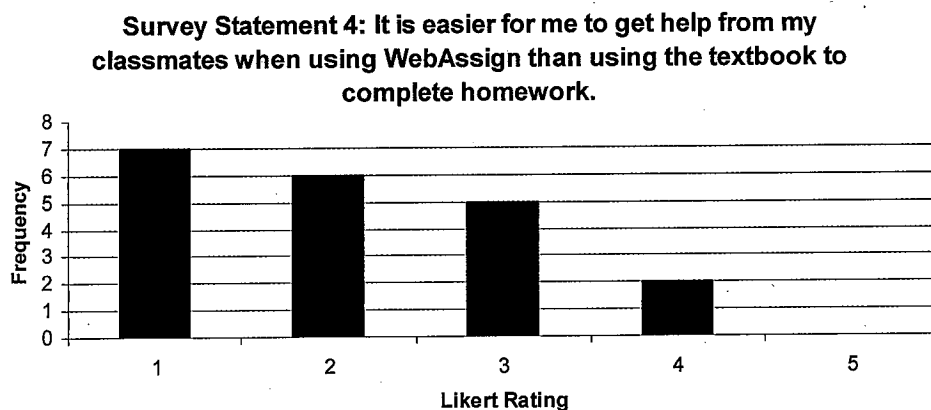


Figure 6 showed student responses to the ability to get help from the teacher using WebAssign versus using the textbook. The average rating was 1.9.

**Figure 6: Survey Statement 5**

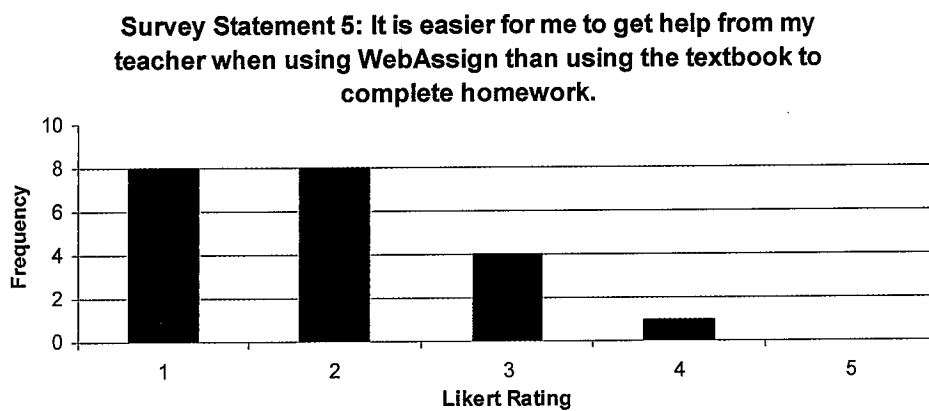


Figure 7 showed the student responses to performing better on homework using WebAssign versus using the textbook. The average rating was 2.9.

**Figure 6: Survey Statement 6**

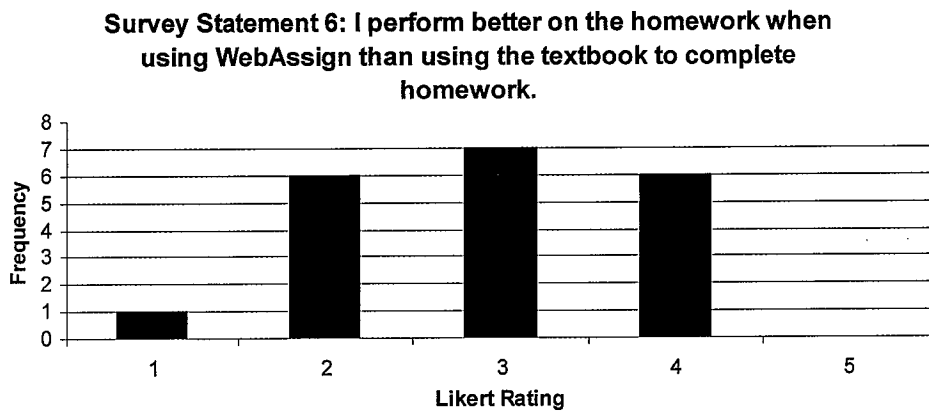


Figure 8 showed student responses to performing better on tests using WebAssign versus using the textbook. The average rating was 2.75.

**Figure 8: Survey Statement 7**

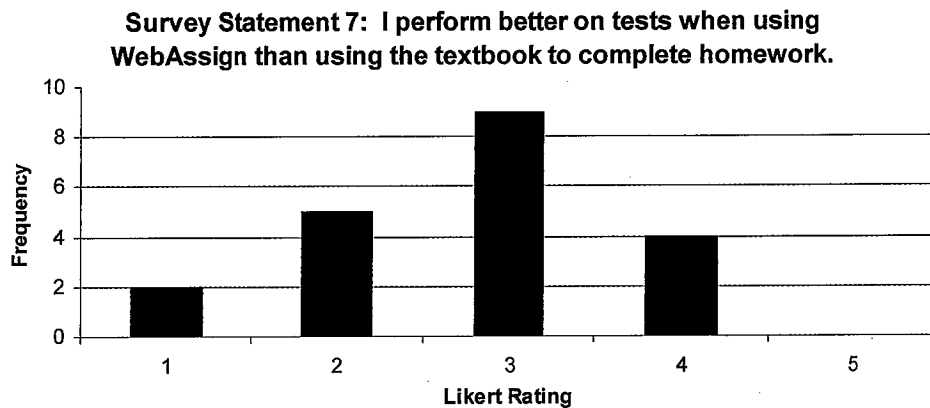


Figure 9 showed student responses to the ability of students to review and study for a test using WebAssign versus using the textbook. The average rating was 2.4.

**Figure 9: Survey Statement 8**

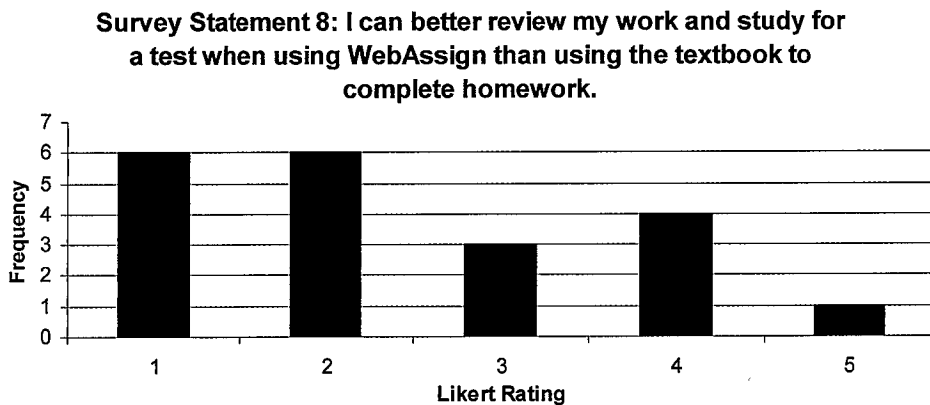


Figure 10 showed student responses to the ability to get feedback on homework using WebAssign versus using the textbook. The average rating was 2.5.

**Figure 10: Survey Statement 9**

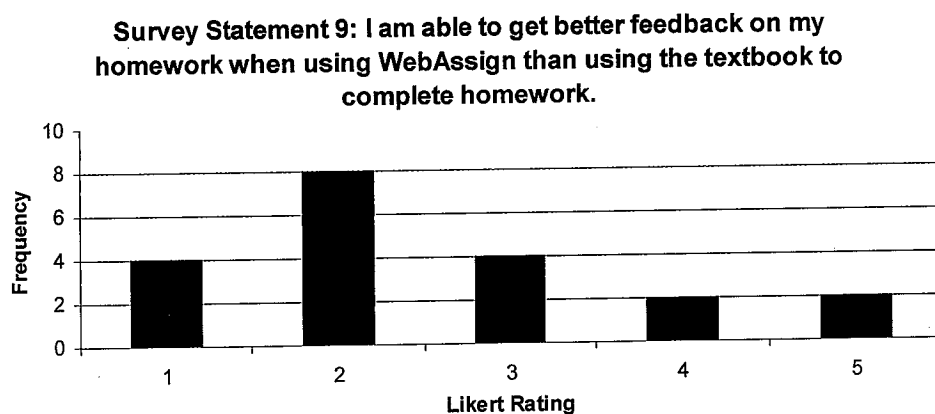


Figure 11 showed student responses to the enjoyment of completing homework using WebAssign versus using the textbook. The average rating was 3.

**Figure 11: Survey Statement 10**

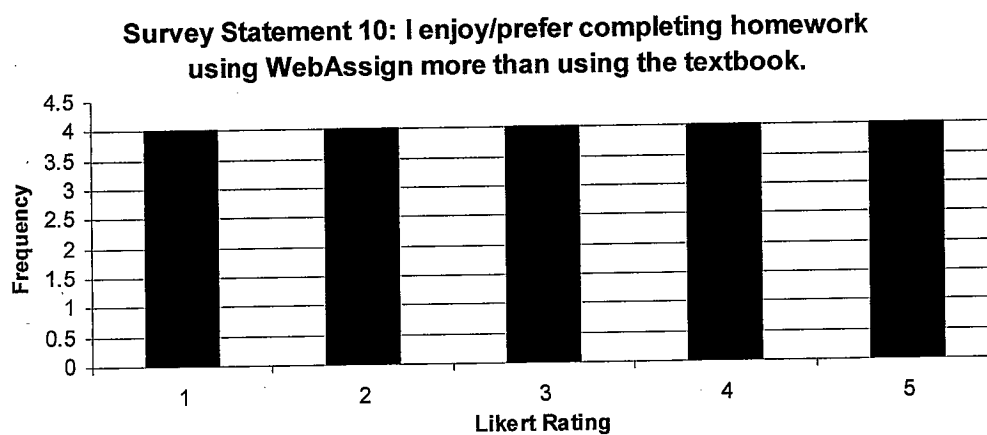
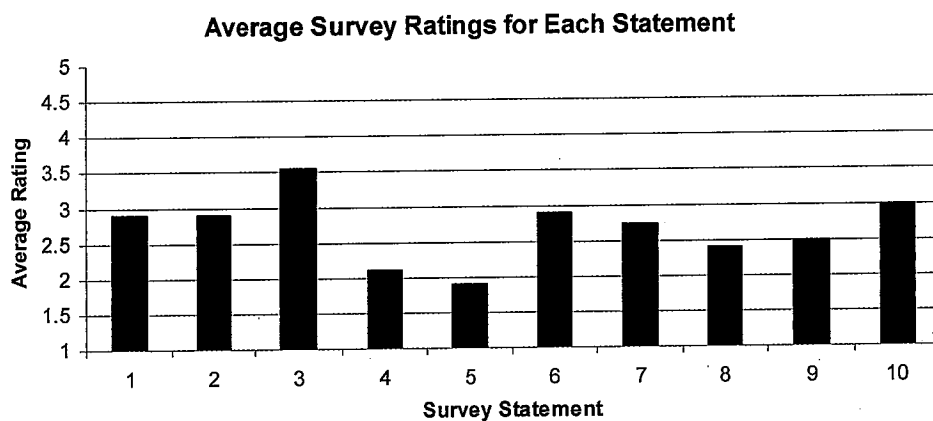


Figure 12 showed the average rating for each statement. All statements except for statement 3 fell at or below the halfway mark of 3.

**Figure 12: Average Survey Ratings for Each Statement**



### Findings

The averages of the post-test scores from the eight chapters used in the study revealed no significant difference in test scores with WebAssign versus with the textbook only. Overall, test scores from post-tests where WebAssign was used in conjunction with the textbook were slightly higher; however, the difference was only slight. All average tests scores fell between 80 and 92 percent while a minor trend showed average post-test scores decreasing as the year progressed.

Aside from statement 3, regarding the on-time completion of assignments, results from the student survey revealed that students did not feel WebAssign was more beneficial to achievement or engagement when compared with the textbook alone. Students did not feel homework was easier to access and completion rate



did not improve when using WebAssign versus using the textbook. As a result, the average response for statement 1 and 2 was 2.9, where 3 represented an undecided response. The responses revealed a slight preference against WebAssign in favor of the textbook alone. Again, with an average rating of 3.55, students felt more homework was completed on time using WebAssign. The researcher attributed the increase in on-time completion to the extra day students had to complete WebAssign homework versus the textbook alone. Student responses to statements 4 and 5 showed students felt help was not easier to get from the teacher or fellow classmates when using WebAssign versus using the textbook alone. With a rating of 2.1 for the ability to get help from classmates and a rating of 1.9 for the ability to get help from the teacher, students disagreed with the statements indicating help was easier to get using WebAssign versus using the textbook. Results from statements 6 and 7 revealed students did not feel achievement on homework or tests was increased from the use of WebAssign versus the textbook. Achievement on homework using WebAssign averaged 2.9 while achievement on tests using WebAssign averaged 2.75. Both scores were near the rating of undecided; however, test achievement with the use of WebAssign was slightly lower than homework achievement. Students felt WebAssign was less of an asset to achievement on tests than to achievement on homework. Statement 8 averaged a 2.4 rating so students felt WebAssign did not

help students to review for tests over using the textbook alone. Three-fourths of the class rated the ability of WebAssign to help review for tests a 3 or lower. Students also did not believe WebAssign provided better feedback on homework than using the textbook alone. As a result, statement 9 received an average rating of 2.5 with a rating of 2 being the most common response. Statement 10, regarding student preference and enjoyment of using WebAssign over the textbook, received an average rating of 3. The number of votes were equally distributed between ratings, thus students did not have a preference between WebAssign and the textbook regarding preference. Overall, WebAssign scored less than the textbook alone on all but one of the survey statements.

From the results of the post-tests and student surveys, the researcher concluded that WebAssign did not have a notable effect on student achievement or engagement. While post-test scores with WebAssign were slightly higher than without WebAssign, the difference was not substantial. The survey results showed students did not believe WebAssign aided in achievement or engagement over the textbook alone.

### Discussion

The outcome of the post-test scores yielded similar results as research conducted by Rhett Allain and Troy Williams (2006) in multiple introductory astronomy classes and by Scott Bonham, Robert Beichner, and Duane Deardorff

(2001) in two sections of introductory calculus-based physics and two sections of introductory algebra-based physics. Both studies noted WebAssign did not notably improve student achievement. The research conducted by Allain and Williams (2006) looked for significant growth between pre-tests and post-tests and the study conducted by Bohnhan, Beichner, and Deardorff (2001) used the results of homework, test, lab, and quiz scores.

In the area of perceived student achievement and engagement, the results of the five-point Likert survey were inconsistent with research conducted by John. C. Dutton (2001) in a business statistics class. The Likert survey given by the researcher found that a majority of the students preferred the textbook over WebAssign while research conducted by Dutton revealed that 94 percent of students found WebAssign easy to use and 77 percent believed the program was beneficial and aided in retention of the material. Case studies reviewed for reference were all performed in colleges and universities while the study conducted by the researcher took place in a high school setting.

### Summary

The results of the average post-test scores did not reveal a significant increase in student achievement with WebAssign versus the textbook alone. Scores from tests that utilized WebAssign were only slightly higher than scores where WebAssign was not used. Additionally, the five-point Likert survey given at the

end after the eighth chapter post-test revealed that students did not believe WebAssign improved student achievement or engagement. While students did believe that WebAssign helped to complete homework on time, students felt it did not improve their achievement or ability to prepare for tests. Students believed that homework and test scores were not higher than usual, and students were not more inclined to complete homework when using WebAssign. Also, students were better able to get help from classmates and the teacher when completing the homework with the textbook only. Thus, the survey showed students felt WebAssign did not improve student achievement or engagement.

## CHAPTER 5

### Summary, Conclusions and Recommendations

#### Introduction

Through the use of post-tests, as well as a student survey, the researcher intended to discover if WebAssign increased student achievement and engagement when compared with the use of textbook assignments. The researcher used the results of the study to evaluate whether or not WebAssign benefited Advanced Placement Physics B students.

#### Summary

The study was conducted in the fall of 2009 in an Advanced Placement Physics B class at a small urban high school in southeastern Washington. The Advanced Placement Physics B class involved in the case study consisted of 20 students; most had previously completed Honors Physics. Participants in the study used the *Giancoli Physics, 5<sup>th</sup> edition* textbook in conjunction with the WebAssign program. Results of post-test scores for the eight chapters studied were used to evaluate the effectiveness of the WebAssign program. Half the chapters were completed in conjunction with WebAssign, and the other half were completed using the textbook only.

The post-tests consisted of 15 multiple-choice questions and 2-3 free-response questions, which were compiled from past AP exams and AP review books. The researcher calculated the average score for each of the eight chapter post-tests.

Average post-test score results were compared qualitatively and used to determine whether WebAssign or the textbook provided higher test scores.

In addition to test scores, students were provided a survey at the end of the eight chapters to rate perceived achievement and engagement with WebAssign versus the textbook. The five-point Likert scale survey was created by the researcher and consisted of ten statements and a section for additional comments. The researcher found the average rating for each statement on the five-point Likert scale survey. Scores with an average above three were deemed to be in favor of WebAssign and scores below three were deemed to be in favor of the textbook.

Research of other case studies involving WebAssign or similar programs revealed that students performed as well or better with the internet or computer-based programs versus the textbook alone. Additionally, research showed most students preferred the immediate feedback received from WebAssign or similar programs. Results from the case study conducted by the researcher revealed that the use of WebAssign did not result in a significant increase in student achievement. The average post-test scores for WebAssign chapters were only slightly higher than post-test scores for chapters which used the textbook only. Also, the Likert survey revealed that students did not believe WebAssign improved student achievement or engagement. Students felt feedback received during class from the teacher and classmates was more valuable than the feedback

received from WebAssign. Students were better able to get help from the teacher and classmates when using the textbook in class versus using WebAssign. Therefore, WebAssign did not have a significant impact on student achievement or engagement.

### Conclusions

Upon analyzing the results of the eight post-test score averages, the researcher noted that WebAssign did not improve student achievement significantly. Average test scores from chapters using WebAssign were only slightly higher in general than average tests scores from textbook-only chapters. Research conducted by Rhett Allain and Troy Williams (2006) also showed that online homework had no significant effect on student understanding or retention when compared with the traditional paper method in an introductory astronomy class. The research conducted by Allain and Williams (2006) utilized pre-test and post-test scores. Students using WebAssign did not show any significant gain when compared with the traditional paper method. The results also agreed with studies conducted by researchers Scott Bonham, Robert Beichner, and Duane Deardorff (2001) involving two sections of introductory calculus-based physics and two sections of introductory algebra-based physics. Researchers noted that students who used WebAssign averaged 78 percent on tests compared to 75 percent for students who used the paper method. The homework average was 88 percent to 72 percent in favor of WebAssign. The laboratory score was nearly

equal at 85 percent and 84 percent, respectively. Thus, WebAssign only showed a slight edge over the traditional paper method. The results of the eight chapter AP Physics B study conducted by the researcher agreed with the work of Bohnhan, Beichner, and Deardorff and showed students only achieved slightly higher scores when using WebAssign. The slight difference was deemed insignificant in both studies.

The results of the five-point Likert survey did not yield the same results as research conducted by John. C. Dutton. A survey conducted by John C. Dutton in a business statistics class using WebAssign showed that 94 percents of students found WebAssign to be easy to use and 77 percent believed the program was beneficial and aided in retention of the material (2001). In contrast to the Dutton study, the researcher used a Likert survey and noted scores below 3 to be in favor of the textbook-only method and scores greater than 3 to be in favor of the WebAssign program. In general, students were either undecided about the benefits of WebAssign on achievement and engagement or were in favor of the textbook-only method.

### Recommendations

The effectiveness of the WebAssign program would be better evaluated through the use of quantitative, rather than qualitative, data. Assuming that each chapter and chapter post-test were equally challenging, and the class supports were equally effective, analyzing the growth between pre-tests and post-tests



would have better assisted in assessing student learning. Acknowledging the potential for differentiated difficulty between chapter and chapter tests, a two year study would be even more effective. Students would be given the same in-class instruction, supports, and tests with the use of WebAssign being the only differentiating factor. Since all other variables would be controlled and WebAssign would be the only manipulated variable, the resulting comparison between WebAssign and the textbook-only method would be more valid.

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## APPENDIX

### AP Physics Survey WebAssign Online Homework Versus Traditional Textbook Homework

Instructions: Please respond to the each statement by bolding the number which best represents your view using the following rating scale;

1-Strongly Disagree    2-Disagree    3-Undecided    4-Agree    5-Strongly Agree

1. It is easier for me to access homework using WebAssign than using the textbook.	1	2	3	4	5
2. I had a higher completion rate for homework when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
3. I completed more of my homework on-time when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
4. It is easier for me to get help from my classmates when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
5. It is easier for me to get help from my teacher when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
6. I perform better on the homework when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
7. I perform better on tests when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
8. I can better review my work and study for a test when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
9. I am able to get better feedback on my homework when using WebAssign than using the textbook to complete homework.	1	2	3	4	5
10. I enjoy/prefer completing homework using WebAssign more than using the textbook.	1	2	3	4	5

Additional Comments: