



Implementation of ORION and its Effect on Student Learning

Dr. Kenneth M Purcell, University of Southern Indiana

Dr. Kenneth M Purcell is an Assistant Professor of Physics at the University of Southern Indiana. His research interests include low temperature/high magnetic field studies of heavy fermion superconducting materials.

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1. Introduction

Over the last 12 months, Wiley has introduced WileyPlus with ORION¹, an adaptive online learning system that is personalized to students needs. After completing a twenty question diagnostic exam to determine their initial proficiency in the chapter subject material, students are presented with multiple choice practice problems of a difficulty determined by their performance on the diagnostic exam. The difficulty of practice problems presented to them as they continue with their practice also adapts to match their level of performance. To guide their studying, students are provided with reports that show performance and study time data broken into specific subject material displayed as a red, yellow or green level and percentage proficiency. The instructor also has access to this information.

This system is very new, making evaluation based on large data sets impossible at this time. Here we present our experience with the system after a semester of use. The use of ORION was made mandatory for students in our first semester calculus based introductory physics course and monitored to award points based upon a level of proficiency being met. Students' conceptual understanding of the subject material was measured using the Force Motion Concept Evaluation administered at the beginning and end of the semester and was compared to that of students who used WileyPlus before the addition of ORION. Performance on a common final exam was also compared. Overall instructor experience and student response will also be discussed.

2. Use of WileyPlus with ORION

WileyPlus has been used in the calculus based introductory physics courses at University of Southern Indiana since 2012 in conjunction with Fundamentals of Physics 10th edition by Halliday, Resnick and Walker. Students are assigned 8-12 End of Chapter problems and 2-4 concept questions per chapter that were graded for credit. Practice problem sets of 80-100 End of Chapter questions relevant to the lecture are also assigned for zero credit. Students are strongly encouraged to utilize the "Read, Practice, Study" section that contains e-text content, animated illustrations, additional sample problems, videos of sample problems being worked out, mini-lectures, concept simulations, Interactive Learningware problems, and a solution manual that includes selected End of Chapter problems. Unfortunately, student use of the resources in the "Read, Practice, Study" section is not reported to the instructor and therefore cannot be used to monitor study habits.

In early 2014, ORION was added to the WileyPlus package offering an excellent way to encourage students to study and a means to monitor their study habits. In order to urge students to take advantage of this new study tool, its use was incorporated into their course grade in Fall 2014. During that semester, students were required to reach 50% proficiency in each of the chapters covered in the course by the date of the final exam and were awarded 25 points (out of a total of 650 points in the course) to do so. This was done so as to encourage them without being overly punitive.

3. Comparison of Student Performance

In our program, we have always been willing to adapt to include any publisher provided resources that we believe can be beneficial to our students, even changing textbooks to explore the resources available. We are motivated to ensure that the course text is a student resource that works in harmony with the material presented in lecture. This required that classroom presentation of material change to fit the flow of the narrative in the text. The metric that has remained constant in the calculus based introductory physics course is the cumulative final exam and this is the metric primarily used to monitor student response to changes in course delivery. This cumulative final exam consists of the same 10 problems ranging in topics from Newtonian mechanics to fluids to thermodynamics. Surprisingly, the class average on this exam has remained relatively stable over the past 4 years.

System	MP	HW	MP	WP	WP + O
Text	HRW	HRW	Knight	HRW	HRW
Avg Final Exam Grade	65% (52 students)	65% (48 students)	66% (47 students)	64% (46 students)	69% (42 students)

Table 1: Final Exam grades for first semester calculus-based introductory physics with online learning system and textbook used. MP = MasteringPhysics. WP = WileyPlus. WP +O = WileyPlus with ORION. HRW = Halliday, Resnick, and Walker. HW = Conventional Homework

Table 1 shows the class average on the cumulative final exam for the calculus based introductory physics course with the number of students enrolled. During one semester (shown in the second column) no online homework system was used and assignments consisted of approximately 6-8 End of Chapter problems turned in weekly and several in class homework problems in which the students we required to work with a partner to solve a homework problem in 10 minutes.

Along with the use of online learning systems, many other variables are involved in the previous 4 years including variation in student population, textbooks, changes in my presentation of material in lecture, and changes in the accompanying laboratory section make it impossible to suggest that online learning systems alone affect student critical thinking skills and conceptual understanding of physics as measured by the common cumulative final exam. Any change in the average grade earned has been negligible through the years. The addition of ORION (shown in the fifth column) to the coursework did accompany a marked improvement in student performance on the final exam. This is promising, but it remains to be seen if this is a result of the use of ORION, or just a fluctuation in student population.

In order to have an additional, but more standard metric of student learning, we have begun administrating the Force-Motion Concept Evaluation² (FMCE) at the beginning and end of the first semester calculus based introductory physics courses in Fall 2013. The FMCE is a survey containing 47 items in a multiple-choice multiple-response format that assesses student conceptual understanding of Newton's Laws of Motion. Students

are given participation credit for completing the survey, but their performance on the survey is not part of their calculated course grade. This may have caused students to not take the survey seriously and this could reflect in their score and the overall average normalized gain of the class. There was, however, a small increase in the overall average normalized gain with the introduction of ORION. The average normalized gain for the Fall 2013 class was 19% and that for the Fall 2014 class was 22%, both from pretest score of approximately 25%. However, this slight increase is negligible and no conclusions can be drawn from only two data points.

4. Conclusions

While there was a slight increase in both of the metrics used to measure student critical thinking skills and conceptual understanding of physics, the small sample size makes any significant conclusions about cause and effects impossible to quantify. While simple to use from an instructor's viewpoint, it must be noted that student opinion of ORION was poor. Of the 42 students that used the system, 5 explicitly commented in student course evaluations about the "buggy" nature of the system. Students who passed the first semester course with a C or better and are continuing in Spring 2015 in the second semester of the sequence overwhelmingly requested that ORION not be made mandatory, noting the lack of feedback with the ORION questions compared to the feedback provided in the Practice Problem sets composed of End of Chapter Problems.

Implementation of ORION also needs to be adapted before further mandatory use of the system is considered. ORION use was too small of a percentage of the course grade to motivate students that would not normally use the system to do so. Anecdotally, it must be noted that there is a strong correlation between the students that spent time throughout the semester logged into ORION and those that came to my office to discuss physics during office hours and the quality of the questions asked by the students improved when compared to past years. Over half (52%) did not reach the target proficiency in more than a third of the chapters covered. It must be noted that the 14 students (33% of students in the course) that met or exceeded the set target proficiency had an average final exam score of 79%. This is a full letter grade higher than the average for the entire class. These results are even better than those presented in the promotion material that provided by Wiley for an Anatomy and Physiology course.³

Increasing the direct impact that ORION use has on the overall course grade may serve to motivate the unmotivated and increase the number of students reaching target proficiency. Also, it should be required that the proficiency goal set be reached by the exam date that covers that section of material, not the final exam. Many students were rushing to reach proficiency during the last week of the course as they had ignored the system all semester.

With this limited experience, use of ORION will be made part of the course grade again in Fall 2015. Student response was not positive, but as Fall 2014 was only the second semester that ORION had been available for use, it is not surprising that it contained bugs. These will, hopefully, be corrected in the near term. This decision is due primarily

to the anecdotal evidence presented, as the more quantitative means showed little to no improvement in student critical thinking skills and conceptual understanding of physics. Even if the quantitative means did show significant improvement, the small sample size makes any significant conclusions about cause and effects impossible to quantify. Professorial “gut feeling” based on conversations with students that used ORION about subject material provides adequate motivation to continue its use with the changes in implementation noted above.

References

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