Case Study

Higher Mastery Predicting Course Outcomes

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Nursing Fundamentals | Fall 2011

SUMMARY OF FINDINGS

- **Final prepU Mastery Level could statistically significantly predict the total number of points a student (in the usage group of 800 questions or below) received in the course.**
- **Usage of prepU leads to demonstrated ability to correctly answer more difficult questions; mastery of the content improves.**

Course

Nursing fundamentals (Nursing 101) is a course for first year nursing students. During fall 2011, 71 students attended and used the *Taylor, Fundamentals of Nursing* textbook along with prepU.

Course Grading Policies and Assessment

Course grades were determined by:
- ■ Five mid-course exams and one final for 90% of theory grade
- ■ Ten points earned via quizzes (paper/pencil and prep-U with at least 3 mastery level)
- ■ Grades were assigned as follows: below 75 F, 75-80 C, 81-90 B, 91-100 A.

Motivation for Using prepU

prepU satisfies the following teaching and learning goals in this course:

- ■ Increase student preparation for lecture (e.g. reading before lecture, more regular study)
- ■ Assessment of student understanding
- ■ Student remediation of topics not understood after covered lecture
- ■ Increase student knowledge of course material

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- Formative assessment for student
- Formative assessment for the instructor to help address misconceptions
- Prepare students for formalized testing
- Remediation and helping to identify concepts that students interpret correctly.

prepU Implementation

prepU was implemented during the fall semester in the following way:

a) Two mastery level quizzes with a mastery level target 3 (given during the beginning of the course)
b) In addition, students were encouraged to study independently and create their own quizzes in prepU for each chapter assigned for class reading.

Students used prepU throughout the course and some used it more than was have expected.

Results

Usage data from the 71 students is shown in Table 1. Of the 71 students enrolled in the course, 100% of them took quizzes in prepU, with an average of 127.3 quizzes and 91,664 total questions answered.

Table 1: Student Usage

Overall Usage Data Nursing Fundamentals (101) Fall 2011	
Number of Students	71
Students who've taken a quiz:	71 (100%)
Quizzes taken:	9,041
Average number of quizzes: (among those who've taken quizzes)	127.3
Questions answered:	91,664
Average number of questions: (among those who've taken quizzes)	1,291

Final Course Grades

Of the 71 students who began the course, 67 completed all requirements. Of those 67 students, 37 received a B grade (between 81-90 points), 27 a C (between 75-80 points), and 3 students received an F (below 75 points) (see Table 2).

Table 2: Class Grade Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	3	4.5	4.5	4.5
	C	27	40.3	40.3	44.8
	B	37	55.2	55.2	100.0
	Total	67	100.0	100.0	

Overall Usage Statistics of Students with a Passing Grade in the Course

Overall usage between the spring and the fall group increased dramatically (see Table 3 below). The average number of questions answered by the students in the course increased around 78% from 51, 838 to 91, 664.

Table 3: Comparison of Spring and Fall 2011 PrepU Usage

Semester	Average # Questions	Average # Quizzes	Total # Questions
Spring	785	71.7	51,838
Fall	1,291	127.3	91, 664

Usage Statistics of Students with a Passing Grade in the Course

Usage data were captured for each of the grade-level groups who passed the course (N = 64). Tables 4 and 5 show the average number of quizzes, questions answered, and overall mastery level of each of these two groups.

Table 4: Usage Statistics of Students with Grade B in the Course

	N	Minimum	Maximum	Mean	Std. Deviation
Overall Number of Logins	37	6	97	35.22	21.618
Total Number of Quizzes	37	17	326	112.24	71.264
Total Number of Questions	37	193	3441	1175.57	718.580
Final Overall Mastery	37	2	7	3.95	1.109
Valid N (listwise)	37				

Table 5: Usage Statistics of Students with Grade C in the Course

	N	Minimum	Maximum	Mean	Std. Deviation
Overall Number of Logins	27	6	106	46.63	26.747
Total Number of Quizzes	27	19	265	141.59	73.903
Total Number of Questions	27	132	2870	1410.33	773.550
Final Overall Mastery	27	2	6	3.80	.895
Valid N (listwise)	27				

Correlational Analyses

Prior results (Houser, Spring 2011 study) indicated that although there was a significant positive correlation between usage and final adjusted course grade, the effect seemed to decrease after a certain average number of questions were answered. During the spring semester, this number was ~800 questions. These findings suggest that that practicing and quizzing in prepU has an impact on students and can influence course outcomes to a point, but there may be a threshold above which the effect levels out. Based on these prior findings, data were analyzed for students whose usage fell within the range previously seen as having the most impact on student outcomes (see Table 6 for descriptives for this group).

Table 6: Summary of Usage and Outcomes

	Mean	Std. Deviation	N
Adjusted Final Course Points	82.00	3.524	20
Final Overall Mastery	3.11	.611	20
Final Exam Points	12.42	.769	20
Overall Number of Logins	16.65	7.583	20
Total Number of Quizzes	49.05	21.050	20
Total Number of Questions	475.20	191.369	20

Students in this group had an average of 82 points for the course overall (corresponding to a B grade) and ranged from 76-87 points. Of this group, 60% received a B grade and 40% a C grade (no Fs in this group). Average mastery was 3.11 with a range of 2-5. Correlational analyses revealed significant positive correlations between the average number of questions answered and final course points, r (20) = .37, p < .05, and final exam score, r (20) = .38, p < .05.

Regression Analysis

Mastery Level and Final Exam Points: A linear regression established that final PrepU mastery level could statistically significantly predict the (weighted) total number of points a student (in the usage group of 800 questions of below)

received in the course, $F(1, 18) = 4.819$, p < .05, and final prepU mastery level accounted for 16.7% of the explained variability in final points. This is indicative of a medium effect size, according to Cohen's (1988) classification. The regression equation was: predicted final exam points = 10.379 + 4.202 x (Log10_final mastery level).

The predicted final weighted number of points can be calculated by inserting different mastery levels into the regression equation. For example, a student with a mastery level of 6, would be predicted to receive 13.65 weighted final exam points (see Table 7 for a complete list of predicted total points based on this analysis). Mastery levels were transformed into log10 to better fit the regression parameters of normality.

Table 7: Predicted HESI Final Exam based on Mastery Level

ML	Final weighted Points
1	10.38
2	11.64
3	12.38
4	12.91
5	13.32
6	13.65
7	13.93
8	14.17

Within prepU Correlations

An analysis of the average number of questions answered by students (receiving a grade C or higher, N = 64) and their prepU mastery level revealed a significant, positive correlation between number of questions and final mastery level, r (64) = .75, p < .01. As expected, number of quizzes and number of logins was also positively correlated to number of questions answered.

Additional Instructor Comments

Professor Houser is a nursing instructor at Central Carolina Technical College. She has been using PrepU as an integrated part of her courses for over a year. Additional comments from Professor Houser regarding prepU usage in her Fundamentals course are below:

Q: What effect did using prep-U have on your students?
 "They report it helps them learn the material."

Q: Were there any unanticipated outcomes of using prepU in your course?
• *"One unexpected outcome was that one student was unsuccessful but put many hours into studying—seems to be poor test taker as could verbalize information."*
• *"I did have some students who worked very hard but still did not do well in class and not really sure why."*

Conclusion

prepU was used in Nursing Fundamentals 101 both as an independent study tool for students and also as an integrated part of the course (with results from two quizzes making up a portion of the final grade). This current study followed one completed with the spring cohort of the same course in which we found a positive relationship between the number of questions answered within prepU and final exam score.

Given the previous findings (from the Spring 2011 study), it was not surprising to see usage for students in this course to increase. The findings in spring were certainly compelling and perhaps served to motivate students in this group to use prepU more. There are, of course, many unknowns in a study such as this one. Individual differences between students play a large role in student performance and there is no pretest data against which to measure growth or change. In addition, as any instructor will tell you, there will always be students who achieve a high grade without seeming to put in much effort and those who apply themselves with serious effort who somehow don't make the grade. Many educational interventions seek to focus on those students somewhere in-between the two extremes; in other words, those who are perhaps within reach of achieving something more, if only they had some more motivation, or some extra help. The evidence suggests that prepU is particularly advantageous to these students. These results, along with others, indicate that prepU's benefit is optimal for the "average" user—not just the users who are answering far above the average number of questions one might expect them to answer.

These data are extremely encouraging and will prove useful when discussing the potential benefits of practicing and mastering course content within prepU.

Appendix A

Additional Comparisons of Different Student Usage Groups

Usage and Final Course Outcomes

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Overall Number of Logins	Below 800	20	16.65	7.583	1.696	6	32
	Above 801	43	49.77	21.246	3.240	24	106
	Total	63	39.25	23.767	2.994	6	106
Total Number of Quizzes	Below 800	20	49.05	21.050	4.707	17	102
	Above 801	43	157.88	61.999	9.455	66	326
	Total	63	123.33	73.127	9.213	17	326
Total Number of Questions	Below 800	20	475.20	191.369	42.791	132	797
	Above 801	43	1596.05	543.227	82.841	845	2870
	Total	63	1240.22	698.377	87.987	132	2870
Final Overall Mastery	Below 800	20	3.11	.611	.137	2	5
	Above 801	43	4.17	.865	.132	3	7
	Total	63	3.83	.930	.117	2	7
Final Exam Points	Below 800	20	12.42	.769	.172	11	14
	Above 801	43	12.22	.572	.087	11	14
	Total	63	12.28	.642	.081	11	14
Adjusted Final Points	Below 800	20	82.00	3.524	.788	76	87
	Above 801	43	81.09	3.524	.537	75	88
	Total	63	81.38	3.521	.444	75	88
Class Grade	Below 800	20	2.6500	.48936	.10942	2.00	3.00
	Above 801	43	2.5349	.50468	.07696	2.00	3.00
	Total	63	2.5714	.49885	.06285	2.00	3.00

Results of a one-way analysis of variance revealed significant differences between the two groups on the first four usage variables. This is as we would expect as the groups were created based on usage. More interesting to note is the lack of significant difference in course outcome depending on the usage group. The below 800 question group had a slightly higher number of course points and also higher overall average grades—although neither of these differences was significant.