COURSE SUCCESS

LIPPINCOTT FOR LIFE

Case Study

Higher Mastery Level Indicates Higher Course Grades

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Med Surg I & II | Spring & Fall Semesters

SUMMARY OF FINDINGS

- **No students who achieved a C in the course had a prepU ML above 4.5 and no students who received an A in the course had a ML below 3.51**

Course

The program at University of Mississippi school of Nursing is a 5-semester program. Students take Med Surg I in the spring (their 3rd semester), Med Surg II in the fall (4th semester) and then a seminar/NCLEX prep course in the spring before graduation (5th semester). prepU is used in all three courses. In Med Surg I, students have to achieve a ML of 4 in the assigned chapters in order to pass the course. For Med Surg II, the ML requirement is a 6 and for the NCLEX-seminar, the ML required is 8. Students take quizzes in different chapters, however, so the fact that they already have a ML when they begin a new course does not impact the chapter-specific ML they must achieve.

Course Grading Policies and Assessment

Grades in the course are based on:

- 6 exams (one ever 2-3 weeks) 80% of grade
- prepU mastery level assignments (6)
- Case Studies (5% of grade)
- Comprehensive final exam (15% of grade).

Passing criteria for the course were based on two main areas: the unit tests and the clinical component of the course. Students were required to have an average of 76 or better on all examinations to successfully pass the course. This included all unit exams (not Case Studies). Failure to have at least a 76 average resulted in course failure.

To receive a passing grade in the course, the student must also receive a satisfactory evaluation in clinical performance and in the clinical simulation lab. An unsatisfactory evaluation in clinical performance or clinical simulation lab resulted in failure of the course and a grade of "F" regardless of overall average score in the course.

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prepU Implementation

During the course, all students were given access to prepU and were encouraged to use it to gain extra practice and to help master course concepts. prepU was integrated into the course with mastery level quizzes and students were required to reach at least a mastery level of 4 (in all chapters appropriate for the course). There were six ML quizzes and each focused on the major part of each unit/the big idea. There were no points allotted for using prepU, but in order to pass the course students were required to complete all the requirements.

Results

prepU usage data from 97 students is shown in Table 1. Students answered an average of 719.98 questions, took an average of 74.53 quizzes, and answered a collective total of 69,838questions. The average mastery level attained by the study sample was 3.9 and ranged from 3.2 to 5.6 (*SD* = .35). Low variance in ML across the group is likely explained by course requirements. We often see students not exceeding a given ML target when one is set within a course. In this case, many students reached the target ML ~4 and did not continue to take quizzes.

Table 1: Overall prepU usage and mastery

	N	Min	Max	M	SD
Number of Quizzes	97	28	365	74.53	44.23
Number of Questions	97	285.00	3168.00	719.98	452.77
Mastery Level	97	3.20	5.60	3.90	.35

Note: The data for number of questions and Mastery Level had a degree of positive skewness, so these data were transformed using a Log10 transformation to better fit the normal distribution for subsequent analyses.

Course Outcomes

Course outcome data for the 97 students is presented in Table 2. These data include scores on all six unit exams, a comprehensive final exam along with scores on a math test given early in the semester. Students in the course took six exams, one final, and a math test at the outset of the course.

Table 2: Course outcome data

	N	Min	Max	M	SD
Exam 1	97	64.86	100.00	84.31	6.94
Exam 2	97	51.43	97.14	79.35	8.47
Exam 3	97	71.43	100.00	88.86	6.01
Exam 4	97	74.29	100.00	93.43	4.66
Exam 5	97	68.57	100.00	89.81	6.10
Exam 6	97	74.29	97.14	87.54	5.54
Final Exam	97	69.94	99.00	83.50	6.06
Math Test	97	45.00	100.00	96.06	7.85

Across all unit exams, the average total score was 87.22 (*SD* = 3.78) with no students below the threshold of passing the course (*M* = 76). Thus, all students satisfied the exam requirements for the course and were eligible to receive a passing grade.

Grade groups based on scores from the six unit tests are presented in Table 3. For this course, 10.3% of students earned an A, 73.2% of students a B, and 16.5% of students a C.

Table 3: Grade Group Frequencies

	Frequency	Percent
2.00	16	16.5
3.00	71	73.2
4.00	10	10.3
Total	97	100.0

Analysis of Math Test Score Groups

A math test was given to students at the beginning of the course and we had hoped to use this measure as a baseline measure against which to look at other student outcomes. As can be seen in Table 4, about 64% of the students in the group scored 100% and about 95% scored 80% or higher (with a mean of 96.06).

Table 4: Frequency of math test scores across the class

		Frequency	Percent
	45.00	1	1.0
	72.50	1	1.0
	75.00	1	1.0
	80.00	2	2.1
	85.00	3	3.1
	90.00	12	12.4
	92.50	1	1.0
	95.00	11	11.3
	97.50	3	3.1
	100.00	62	63.9
	Total	97	100.0

Students were divided into two math score groups to determine if score on the entry-level math test was related to either course performance or prepU usage/mastery outcomes. Group 1 included students with math test scores above 91% (*N* = 77), and Group 2 all students who scored 91% or below on the test (*N* = 20).

Comparison of Course Outcomes

An independent samples t-test was used to compare scores on course outcomes for Group 1 and Group 2. Results indicated that for exam 1, those students in Group 1 (who scored above 91% on the math test) had a higher average score ($M = 85.08$, $SD = 6.72$) than those students in Group 2 ($M = 81.35$, $SD = 7.17$), $t\ (95) = 2.185$, $p < .05$. A similar pattern was seen for exam 2 with the average for Group 1 ($M = 80.22$, $SD = 8.51$) significantly higher than Group 2 ($M = 76.00$, $SD = 7.61$), $t\ (95) = 2.019$, $p < .05$, and also the final exam. On the final exam, students in Group 1 scored higher ($M = 84.12$, $SD = 5.87$) than those in Group 2 ($M = 81.16$, $SD = 6.35$), $t\ (95) = 1.965$, $p < .05$. Scores on the other exams were not statistically significantly different between the two groups.

Comparison of prepU Usage and Mastery

An independent samples t-test was used to compare prepU ML and usage for Group 1 and Group 2. In other words, we wanted to determine if there was a difference in usage for these two groups based on their math scores at the outset of the course.

The students in Group 2 took more quizzes than Group 1, but we also see that their usage was much more varied with a SD of 74.14 (see Table 5). Looking at the number of questions answered, students in Group 2 answered on average 812.10, compared to 696.05 for Group 1 (this difference was not significantly different).

Table5 : prepU Usage and Mastery for Group 1 and Group 2

	Math Score Group	N	Mean	Std. Deviation	Std. Error Mean
Num Quiz	1.00	77	69.40	31.12	3.55
	2.00	20	94.25	74.14	16.58
Num Quest	1.00	77	696.05	405.43	46.20
	2.00	20	812.10	605.87	135.48
Mastery Level	1.00	77	3.89	.36	.04
	2.00	20	3.90	.30	.07

Analysis of Grade Groups

The above analyses were repeated using grades as a grouping variable. In this analysis we looked to see if there were differences in prepU ML and usage based on Grade Group (4, 3, or 2). A one-way ANOVA revealed no significant differences on prepU related variables between grade groups (see Table 6).

Table 6: Descriptive statistics for prepU usage and Mastery Variables

		N	M	SD
Num Quiz	C	16	70.94	24.94
	B	71	75.76	46.77
	A	10	71.50	52.67
	Total	97	74.53	44.23
Num Quest	C	16	656.19	305.51
	B	71	712.41	402.11
	A	10	875.80	859.57
	Total	97	719.98	452.77
Mastery Level	C	16	3.89	.22
	B	71	3.88	.33
	A	10	3.96	.60
	Total	97	3.89	.35

We were interested in exploring usage and mastery of course concepts within the different grade groups. Figure 1 shows the ML group for students in each grade group. Students were grouped by grade (A = 4, B = 3, C = 2) and ML grouping 1-5. We present this graph primarily to illustrate that most students within the course achieved between a 3.51 and a 4 in prepU ML (*N* = 77) and in this group the majority of students (*N* = 50) achieved a B in the course. No students who achieved a C in the course had a prepU ML above 4.5 and no students who received an A in the course had a ML below 3.51.

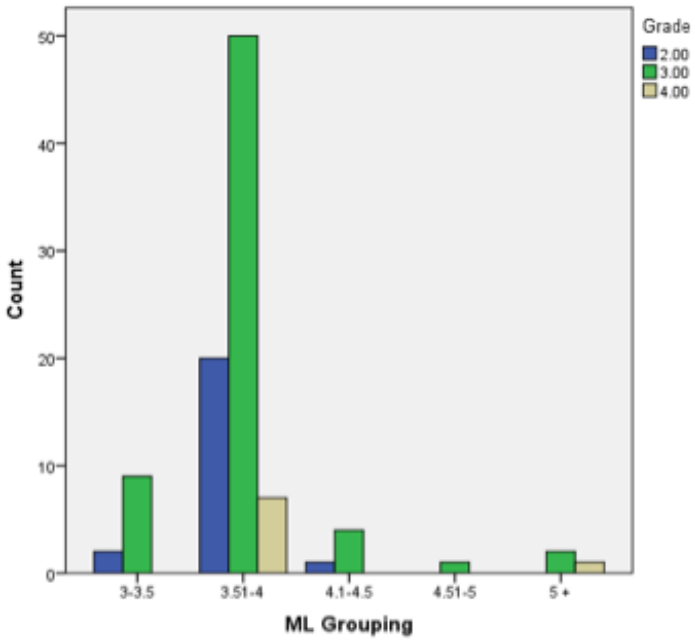

Figure 1: Frequency of students achieving each grade level by ML group

Within-prepU Correlations

A Pearson product-moment correlation coefficient was computed to assess the relationship between the average number of questions answered by students and their prepU mastery level. When considering the complete group, there was a significant, positive correlation between number of questions answered and final mastery level, r (97) = .453, p < .01. Thus, as students practice more in prepU, the difficulty level of the questions they are able to answer correctly increases (see Table 7). This pattern takes into account the nine students who used prepU far above the typical usage (in terms of number of questions).

Table 7: Correlations between prepU usage and mastery

		Mastery Level	Num Quiz	Num Quest
Mastery Level	Pearson Correlation	1	.314**	.453**
	Sig. (2-tailed)		.002	.000
	N	97	97	97
Num Quiz	Pearson Correlation		1	.862**
	Sig. (2-tailed)			.000
	N		97	97
Num Quest	Pearson Correlation			1
	Sig. (2-tailed)			
	N			97

**. Correlation is significant at the 0.01 level (2-tailed).

Only nine students achieved a ML > 4.1 (4 was the required ML in the course) with the highest ML achieved a 5.6. The prepU usage and ML data for these students are shown in Table 8 below.

Table 8 : High ML Group prepU Usage and ML Descriptive Statistics

	N	Min	Max	M	SD
Num Quiz	9	71	365	154.11	88.90
Num Quest	9	905.00	3168.00	1673.00	807.95
Mastery Level	9	4.10	5.60	4.64	.53

Course outcomes for the higher ML group are shown in Table 9 below:

Table 9: Higher ML Descriptive Statistics Course Outcomes

	N	Min	Max	M	SD
Exam 1	9	78.00	96.00	87.21	6.10
Exam 2	9	65.71	97.14	80.00	9.69
Exam 3	9	82.86	97.14	88.89	4.62
Exam 4	9	85.71	100.00	93.02	4.54
Exam 5	9	68.57	97.14	88.89	8.86
Exam 6	9	80.00	94.29	88.57	4.52
Final Exam	9	76.62	91.65	84.41	4.57
Math Test	9	75.00	100.00	96.11	8.58

There were no significant differences between the Higher ML group (*N* =9) and the rest of the students (*N* = 88) on course outcomes. Although the higher ML group had an average ML of 4.64, the cut off between groups was 4.1, and we would not necessarily expect to see large differences with this degree of granularity. In other words, the difference between a student achieving a ML of 4.1 and a ML of 4.6 is not necessarily large and is also dependent on which questions were presented to each student. When answering questions in prepU at a particular ML range, there is variation in the difficulty of questions each student answers and it may be that one student has the opportunity to answer a more difficult set of questions than another student—leading to a slightly higher/lower ML.

In previous analyses we have seen patterns of usage far above what might be expected from a particular group of students. When these outliers are removed, we sometimes see different patterns emerging. In the student group reported here, the mean number of questions answered by students receiving an A in the course was 875.80, and the SD was 859.57. Based on the average number of questions answered by the total student group (*M* = 719.98, *SD* = 452.77), we created a cut-off for number of questions answered. The cut-off was set at the M + 1SD = 1,172 (rounded). Data were subsequently analyzed for this new sub-group. Question Group 1 (*N* = 88) and descriptive data are shown below.

Table 6: Descriptive Statistics: Question Group 1 prepU usage and mastery

	N	Min	Max	M	SD
Num Quiz	88	28	132	64.86	22.35
Num Quest	88	285.00	1162.00	609.73	215.35
Mastery Level	88	3.20	5.20	3.84	.263

This group of students was compared to those who answered above 1,172 questions—Question Group 2 (*N* = 9). An independent samples t-test revealed a significant difference in ML between Question Group 2 (*M* = 4.41, *SD* = 0.62) and Question Group 1 (*M* = 3.84, *SD* = 0.26), $t(95) = -5.26$, $p < .001$. These data reflect the patterns revealed by the correlational analyses (reported above). Although there were differences in ML between these two groups, there were no significant differences in course outcomes (final grades).

Conclusions and Future Use

prepU was used in the third semester Med Surg course as both as an independent study tool for students and as an integrated part of the course (with attainment of a ML of 4 on six assignments used as a course completion requirement). There were, however, no points associated with prepU usage in this course. Within the course, students used prepU with an average of 720 questions answered and an average ML of 3.9. When considering the complete group, there was a significant, positive correlation between number of questions answered and final ML. Thus, as students practice more in prepU, the difficulty level of the questions they are able to answer correctly increases.

All students succeeded in the course and completed all prepU ML assignments required. As a result of the type of prepU implementation, the variation in ML across the class group was low, making it harder to tease out differential impact based on usage/mastery. In other words, when everyone is achieving roughly the same level of mastery and prepU usage is confined to a set of ML assignments, it becomes more difficult to determine if there are differences within the group based on these variables.

In subsequent semesters it will be important to encourage students to continue to quiz and practice within prepU even when they have achieved the target ML set in an assignment. Our prior studies indicate that increased engagement with prepU in terms of answering more questions and increasing content mastery can have a significant, positive impact on course performance.