

Case Study

Engaging Students Using Mastery Level Assignments Leads To Positive Student Outcomes

Senior BSN Students

PassPoint Pilot Testing Sample | Spring 2014

SUMMARY OF FINDINGS

- Students answered an average of 1,009 quiz questions and had an overall average Quiz Mastery Level of 6.4 (range from 2.7-7.6).
- Students took an average of 5 practice exams, and had an overall practice exam Mastery level of 7.62.
- There was a strong, positive correlation between the number of practice exam questions a student answered and overall exam ML.
- With increased usage (both quizzing and practice exams), students were more able to correctly answer more difficult exam questions; mastery of the content improved.
- Students took the HESI E². If they did not achieve > 900, they had the chance to retake. 40% of the students did not score > 900 on the HESI E².
- HESI E² scores were correlated with students' final grade points. Students who passed the HESI on the first attempt had a higher final course percentage than the other two groups and those who failed the HESI both times had the lowest course percentage.
- 96.5% of the students in the sample passed the NCLEX exam (on their first attempt) even though 35 students did not achieve the passing standard on either of two HESI E² attempts.



Participants

Second semester seniors ($N = 87$) enrolled in Nursing 884, a senior-level course in a BSN program.

Nursing 884 Course Requirements

I. HESI Exit Exam

Students take the HESI E² mid-semester. If they score < 900, they take a second Exit HESI during the last week of the semester. Students are not withheld from graduation if they do not achieve > 900. Faculty works with the students to build a solid action plan and they are allowed to graduate. Typically, students take the NCLEX 4-8 weeks after graduation.

II. PassPoint Implementation

During the fall 2013 semester this school used PassPoint NCLEX 10,000. During the spring 2014 semester, the new NCLEX-RN PassPoint (Wolters Kluwer, 2013) was implemented into the course. PassPoint incorporates the features of the PassPoint with some additional ways for students to practice and master content as they prepare for the NCLEX. Practicing in an authentic environment is an effective way to learn and PassPoint provides students the opportunity to take practice quizzes in an adaptive learning environment, as well as take longer NCLEX-style exams. PassPoint also includes remediation links. These links take students to content related to their individual strengths and weaknesses as indicated by their score on the simulated NCLEX or their day-to-day quizzing. The remediation links provide students chance to review concepts which may be causing them difficulties, before taking more quizzes or practice exams.

Participants included students enrolled in the senior-level NCLEX preparation course ($N = 87$). Students were given 32 Mastery Level (ML) assignments across the semester.

A complete list is shown in Appendix A (including the number of students completing each one). For each of the eight client need categories students were assigned four ML assignments—each one with a progressively higher ML target. These assignments were spread throughout the semester.

III. PassPoint Usage: Adaptive quizzing

Overall student usage and final mastery level (ML) is shown in Table 1. Students answered an average of 1,010 questions, took an average of 178 quizzes and achieved an average ML of 6.40. Students logged into PassPoint an average of 49.18 times (with a range of 22-99).

	N	Min	Max	M	SD
Quiz Log Ins	87	22.00	99.00	49.18	16.75
Number of Quizzes	87	74.00	712.00	178.10	73.15
Number of Questions	87	557.00	1785.00	1009.99	252.02
Overall Quiz ML	87	2.70	7.60	6.40	1.00
Quiz Remediation Views	87	0	99	5.25	14.64

Overall range of ML for the class is shown in Figure 1 below. The standard deviation was 1.00 and ML ranged from 2.7-7.6. The median ML was 7 and 40 students achieved this ML. The ML was not normally distributed for this group and so a transformation was performed on the ML data.

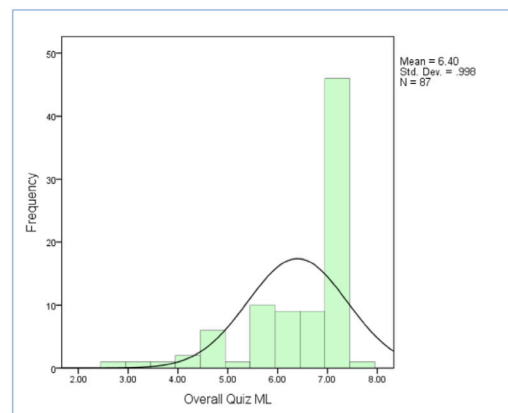


Figure 1: Frequency of ML across the class group

Students had the opportunity to follow remediation links when viewing answer keys. This is a new feature of PassPoint. Of the 87 students in the class, 48 students did not use the remediation links, and of the remaining 39 students, 12 students accessed one link, with the rest spread between 2 and 99 (see Figure 2).

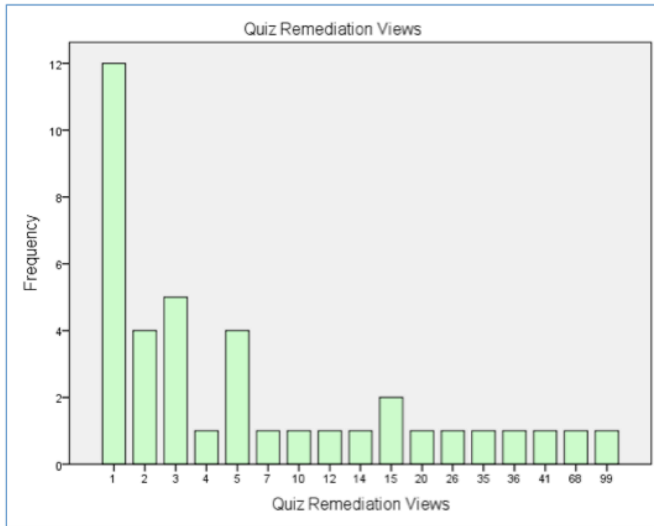


Figure 2: Frequency of Remediation Link Usage

IV. PassPoint Usage: Practice Exams

Table 2 shows usage of the practice exam feature of PassPoint. Students took an average of 4.99 ($SD = .417$) practice exams, and achieved an average exam ML of 7.62 ($SD = .57$). Variance in exam usage and mastery was low, which is expected given that students were assigned five practice exams.

	N	Min	Max	M	SD
Total Number of Practice Exams	87	4	7	4.99	.417
Total Number of Practice Exam Questions	87	525.00	940.00	781.44	58.37
Overall Exam ML	87	4.53	8.00	7.62	.57

As part of the course, students were assigned five practice exams. The breakdown in performance for each exam is shown in Table 3. Of the class sample, 86.2% took exactly 5

practice exams and 5.7% took either 6 or 7 exams. Thus the exam usage did not typically exceed that which was assigned by the instructor (7 students missed one of the assigned exams and took only 4).

	N	Min	Max	M	SD
Exam 1 ML	85	1.10	8.00	7.45	1.18
Exam 2 ML	87	1.60	8.00	7.60	1.00
Exam 3 ML	86	1.00	8.00	7.76	.98
Exam 4 ML	87	2.80	8.00	7.59	.99
Exam 5 ML	87	1.00	8.00	7.44	1.48

V. Course Outcomes and Exit HESI Exams

Students in the course took a final exam as well as (at least) one HESI E² exam. Final grade points and scores on the first HESI E² exam (HESI I) shown in Table 4. The average number of grade points in the class was 89.94 ($SD = 3.75$), and students scored an average of 898.33 ($SD = 88.62$), on the HESI I. Within the class group, 46 (52.9%) students scored below the passing criteria of 900 (requiring them to retake the exam) and 41 scored 900 or above.

	N	Min	Max	M	SD
Final Grade	87	79.41	97.39	89.94	3.75
HESI I	87	691.00	1094.00	898.20	88.62

Figure 3 below shows the frequency of HESI E² score for the class group (first attempt).

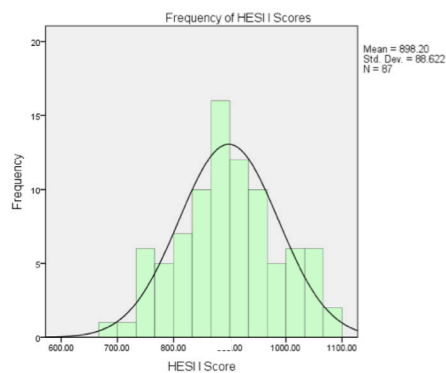


Figure 3: Frequency of HESI I scores (first attempt) across the class group

Fourteen students scored 1,000 or above on the HESI E² and one student scored below 700.

Scores for those taking the exam a second time are shown in Table 5. Forty-six students took the exam a second time. Of these students, 11 passed (scored > 900) and 35 did not achieve the passing standard. All students were permitted to graduate and take the NCLEX, regardless of HESI E² outcome.

	N	Min	Max	M	SD
HESI II	46	645.00	1024.00	845.11	89.49

Figure 4 shows the distribution of HESI II scores for those students taking the exam again (N = 46).

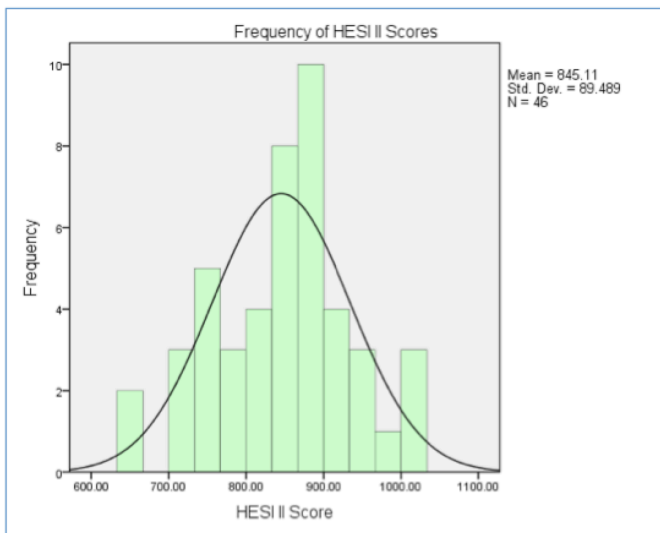


Figure 4: Frequency of HESI II scores (second attempt)

VI. Correlation between HESI I and HESI II

Using a Pearson correlation analysis, we looked at the relationship between HESI I and HESI II scores. There was no correlation between scores on the two exams, $r(46) = .245$, $p > .05$. Of the 46 students who took the HESI II, 52.2% got a lower score on the HESI II and the remaining 47.8% achieved a higher score.

VII. Within PassPoint Correlations

Using a Pearson correlation analysis we explored the relationship between PassPoint usage and mastery variables. A Pearson’s product-moment correlation was run to explore the relationship between the number of questions answered in PassPoint and overall ML. There was no correlation between the number of questions a student answered and overall ML, $r(87) = .085$, $p = .43$. This finding is in contrast with other analyses conducted on similar samples in which we tend to find a strong, positive correlation between questions answered and quiz ML. One possible explanation for this finding is that students are using PassPoint to take Mastery Level assignments and often when doing so, students will stop quizzing when they reach their target ML, thereby decreasing the variance in overall ML across the class. We see this in the overall average class quizzing ML which was 6.4 +/- 1.

Given that students now have the option to take practice exams, we explored the association between exam questions and ML using a Pearson product moment correlation. There was a significant positive correlation between the number of exam questions a student answered and overall exam ML, $r(87) = .342$, $p < .01$. Thus as students took more practice exams, their ability to correctly answer more difficult practice exam questions increased.

		Overall Exam ML	# Practice Exams	# Practice Exam Questions
Overall Exam ML	Pearson Correlation	1	.181	.342**
	Sig. (2-tailed)		.093	.001
	N		87	87
# Practice Exams	Pearson Correlation		1	.852**
	Sig. (2-tailed)			.000
	N			87
# Practice Exam Questions	Pearson Correlation			1
	Sig. (2-tailed)			
	N			

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

VIII. HESI First Time Passing Group Comparisons

The following data (Table 7) present usage and mastery patterns for those students who passed the HESI exam on their first try ($N = 41$).

	N	Min	Max	M	SD
Quiz Log Ins	41	22	99	48.39	18.01
Number of Quizzes	41	107	254	157.93	39.29
Number of Questions	41	557	1565	934.22	218.03
Overall Quiz ML	41	2.70	7.60	6.41	1.14
Quiz Remediation Views	41	0	99	8.49	20.06
Number of Practice Exams	41	4	7	5.05	.44
Overall Exam ML	41	6.45	8.00	7.70	.41

When comparing the overall (end of semester) PassPoint usage for students who passed the HESI the first time and those who did not, we see that those who did not pass the HESI the first time answered more questions, took more quizzes than the first time passing group. At the end of the semester, however, the two groups had roughly the same ML (see Table 8 below).

	HESI I Outcome	N	Mean	SD
Total Number of Practice Exams	Passed HESI I	41	5.05	.44
	Failed HESI I	46	4.93	.39
Total Number of Practice Exam Questions	Passed HESI I	41	789.02	52.34
	Failed HESI I	46	774.67	63.07
Overall Exam ML	Passed HESI I	41	7.70	.41
	Failed HESI I	46	7.55	.68
Quiz Log Ins	Passed HESI I	41	48.39	18.01
	Failed HESI I	46	49.89	15.70
Number of Quizzes*	Passed HESI I	41	157.93	39.29
	Failed HESI I	46	196.09	90.29
Number of Questions*	Passed HESI I	41	934.22	218.03
	Failed HESI I	46	1077.52	263.13
Overall Quiz ML	Passed HESI I	41	6.41	1.14
	Failed HESI I	46	6.38	.87
Quiz Remediation Views	Passed HESI I	41	8.49	20.06
	Failed HESI I	46	2.37	5.83

An independent samples t-test revealed significant differences in number of quizzes, $t(85) = -2.50, p < .05$ and questions, $t(85) = -2.746, p < .01$, between these two

groups (with the group who passed HESI 1 on the first attempt answering fewer questions and taking fewer quizzes than those who did not pass). There was no significant difference in final ML. It may be that students who passed the HESI the first time did not feel compelled to continue practicing as much as those who did not pass. Or, the group who passed the HESI the first time may have taken less time to reach a higher ML. Ultimately, however, all students ended up with a ML of 6.4 (rounded) at the end of the semester, regardless of their first HESI result. The difference in quiz remediation link views was close to statistically significantly different with those students passing HESI I with more remediation views than those who did not pass.

We compared PassPoint usage for those students who did not reach the passing standard on either HESI exam, and those who passed on the second attempt. There were no significant differences between the two groups in terms of usage or mastery variables in PassPoint (see Table 9).

	Fail Both HESI	N	M	SD
Total Number of Practice Exams	Yes	35	4.97	.30
	No	11	4.82	.60
Total Number of Practice Exam Questions	Yes	35	781.71	49.54
	No	11	752.27	93.98
Overall Exam ML	Yes	35	7.55	.55
	No	11	7.42	1.04
Quiz Log Ins	Yes	35	50.71	15.80
	No	11	48.91	15.37
Number of Quizzes	Yes	35	190.54	49.77
	No	11	220.73	164.05
Number of Questions	Yes	35	1092.80	285.31
	No	11	1060.64	180.96
Overall Quiz ML	Yes	35	6.49	.78
	No	11	6.05	1.06
Quiz Remediation Views	Yes	35	2.51	6.25
	No	11	2.00	4.43

Both groups finished the semester with an average overall quizzing ML of between 6.49 and 6.05, and an average exam ML of between 7.55 and 7.42.

IX: Relationship between HESI Exams and PassPoint variables

Looking at the sample as a whole, there was a significant, moderate positive correlation between HESI I score and overall Exam ML, $r(87) = .252, p < .05$, but not for any other PassPoint variables. In other words, there was no correlation between student quizzing usage and mastery level in PassPoint and score on the HESI exams. The HESI exams are one-time data points, while PassPoint data is collected across the semester and the numbers analyzed here are the end points. It is possible that those students who did not perform as they would have liked on the HESI exam, subsequently answered more questions within PassPoint—by way of remediation or extra practice. But without collecting data at various time points across the semester, we cannot confirm this.

X. HESI Score and Course Percentage

The score on HESI 1 was also strongly, positively correlated with final course points $r(87) = .739, p < .001$. This result indicates that the two measures were potentially measuring a similar construct. A higher HESI I score was associated with a higher final percentage in the course. Those students who were the higher achieving students in the class (as measured by a higher final percentage in the course) were also the students who performed better on the HESI exam I. There was also a significant, positive correlation between the score on the second HESI exam and final course percentage, $r(87) = .578, p < .001$ (see Table 10).

Table 10: Correlation between HESI and Course Outcomes

		HESI I	HESI II	Final Grade
HESI I	Pearson Correlation	1	.245	.739**
	Sig. (2-tailed)		.101	.000
	N		46	87
HESI II	Pearson Correlation		1	.578**
	Sig. (2-tailed)			.000
	N			46
Final Grade	Pearson Correlation			1
	Sig. (2-tailed)			
	N			

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

Students were divided into three groups based on HESI outcome: (passed first time: $N = 41$; failed then passed: $N = 11$; failed both times: $N = 35$). Normality tests revealed one outlier case in Group 1. This case was removed for this analysis and having removed it, data was normally distributed for each group, as assessed by Shapiro-Wilk test ($p > .05$) and there was homogeneity of variances, as assessed by Levene’s test of homogeneity of variances ($p > .05$).

A one-way ANOVA was conducted to determine if there were differences in final course percentage between the three HESI groups defined above. The final course percentage was significantly different between the three groups, $F(2,83) = 59.511, p < .001$. A Tukey post-hoc analysis revealed that the difference between all groups was statistically significant. Students who passed the HESI on the first attempt had a higher final course percentage ($M = 92.88$) than the other two groups and those who failed the HESI both times had the lowest course percentage ($M = 86.80$).

Table 11: Comparison of Final Grade by HESI Outcome Group

	N	Mean	SD	Min	Max
Passed HESI I	40	92.88	2.09	88.67	97.39
Failed HESI I	11	89.77	1.79	86.16	92.55
Failed HESI II	35	86.80	2.87	79.41	90.99
Total	86	90.01	3.71	79.41	97.39

Important to note here is that the minimum final percentage score for any student was 79.41 and we can see that the variance both within and between groups was low. Thus, although we see significant differences between these groups, overall the whole cohort of students is performing well (in terms of the % of points earned across the course).

The analyses of HESI scores and groupings indicates that the HESI scores are indicative of student ability in a way which reflects student overall performance in the course. That is—a higher HESI score is correlated with a higher course grade percentage (within this course). This is interesting in that it confirms that the HESI score is not necessarily providing additional information to an institution, or a student on how likely they are to pass the NCLEX—above and beyond what can be gleaned from looking at the course grade. This association does not provide any information about predictability of the HESI exams to determine success on the NCLEX exam (as discussed in the next section).

XI: NCLEX Success

In the current group of students, 86/87 have taken the NCLEX and of those 86/83 passed on the first attempt. Thus, 96.5% of the students in the sample passed the NCLEX exam (on their first attempt) even though 35 students did not achieve the passing standard on either of two HESI E² attempts. HESI E² data for these students is shown in Table 12 below. These 35 students had an average first HESI attempt score of 829.74 and 809.54 for the second attempt.

Table 12: HESI Scores for Students who did not achieve > 900					
	N	Min	Max	M	SD
HESI_I	35	691.00	897.00	829.74	57.22
HESI II	35	645.00	890.00	809.54	68.78

Based on the published HESI E² categories, scoring intervals and expectations (see Table 13) a score of 829, or 809 gives

a student a “below average probability of passing” (category D). Within the context of this course HESI scores were not useful in predicting NCLEX success as 96.5% of students took and passed the NCLEX. Of the 83 students who passed the NCLEX, 32 were in the group who did not achieve the passing standard on either of the HESI E² attempts.

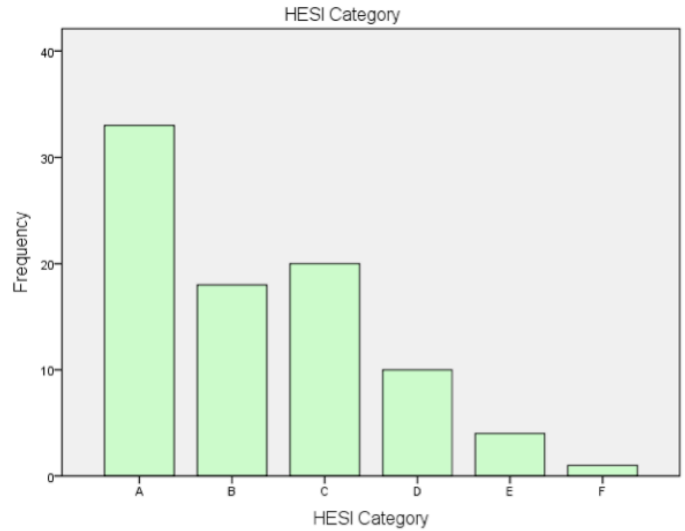


Figure 5: HESI Scoring Interval Categories for Highest HESI Score (N=87)

Figure 6 below shows the groupings for the 35 students who did not achieve > 900 on either HESI attempt.

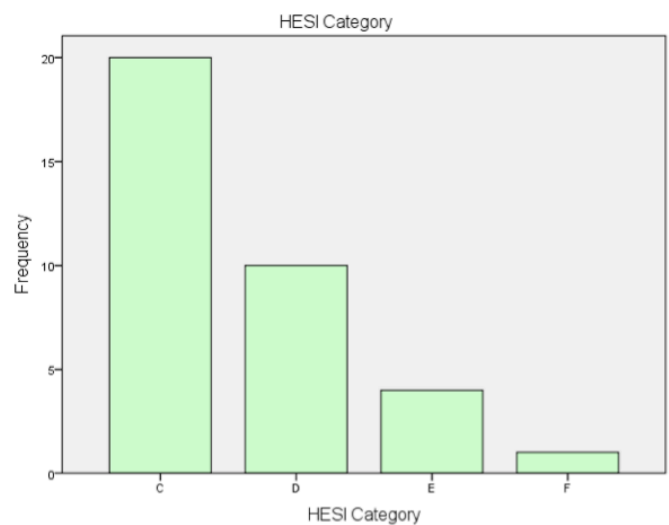


Figure 6: HESI Scoring Interval Categories for Students not Achieving >900 (N=35)

Of this group of students, almost half (42.9%) were in category D, E, or F (see Table 13 for descriptions of these cut offs). All three students who did not pass the NCLEX exam were in the group who did not achieve the passing standard on the HESI (and scored 797, 830, and 858) and yet 32 students who were in categories C and below did pass the exam on the first try.

XII: Discussion

The current retrospective analysis explored the usage of PassPoint in concert with the HESI E² during the final semester of a BSN nursing program (in spring, 2014). PassPoint was used by a group of 87 students and instructor implementation of PassPoint was high. Students completed both Mastery Level and question collection assignments throughout the semester with an overall average student quizzing ML of 4.97 (*SD* = 0.64) and a range from 4.0-7.0). Students answered an average of 1,343 questions within PassPoint across the semester. Students had access to remediation links to help provide more information on difficult concepts (as identified by questions answered incorrectly on their quizzes). Although faculty often reports that remediation links are very valuable to students, the pattern of usage within this course was low. Over 55% of students did not access the links at all, almost 14% accessed one link, and the remaining students accessed between 2 and 99 links. But the average was 5.25 +/- 14.64. Students may need more guidance into using these links and help incorporating them into their study plans.

Students took the HESI E² and if they scored < 900, they were able to retake the exam. If they did not score > 900 on the second try, they were allowed to graduate, and had support from faculty in terms of a remediation plan. The variance of HESI scores across the student group was large, ranging from 691 to 1094 on HESI I (*SD*=88.62) and 645-1024 on HESI II (*SD* = 89.49)—but 96.5% of the students in the study group passed the NCLEX on their first attempt.

And as we can see from the graphs above, student scores within the course had varying “correlations” with potential NCLEX success—based on the categories provided by HESI. Given that almost all of the students passed the NCLEX it is not possible to do a logistic regression analysis which we can usually do to help measure how well one variable (in this case HESI score) predicts another (NCLEX success). But as only three students didn’t pass, there is not enough variance in NCLEX outcome to explore.

Some schools use scores on the HESI exit exam to make graduation decisions, the study school does not and so even though 40% of students did not achieve the passing standard on the HESI E², all students were allowed to graduate and take the NCLEX. What is interesting in the above analyses is how little additional information we glean from the HESI scores—in terms of student outcome and mastery. Given the range of performance on the HESI, one might have expected a larger percentage of students to not pass the NCLEX. Indeed, if the study school implementing a progression to graduation requirement based on the HESI scores (as so many do), then 40% of the sample would not have been permitted to graduate (even though 32/35 of passed the NCLEX). The study school instead uses the HESI as a check to determine relative student preparedness. It is possible that this exam served to motivate students to practice more within the adaptive quizzing area of PassPoint which in turn helped improve their content mastery. We did see an increased level of usage (questions answered) in those students who did not pass the HESI 1. The implementation of ML assignments as well helps to level the playing field for students and allows instructors to confirm that all students are reaching approximately the same level of understanding and mastery of course content.

We can make no assertions as to causal relationships in the above analysis—in other words we can’t say that using PassPoint caused students to all pass the NCLEX. These findings do, however, reflect other findings in which

PassPoint ML for students who passed the NCLEX a consistent factor. In the study sample, the average quizzing ML was 6.4 +/- 1, while the HESI scores had a much larger variance.

A noteworthy comparison between large scale standardized exams and PassPoint is that the summative type of exams (e.g., E²) are designed to report on an end state and something which is not necessarily changing. Students receive a score at a time when they may or may not be “ready” to take the NCLEX—but may be penalized by not being able to graduate. PassPoint provides continuing, ongoing measures of student learning and progress. As the student engages with the program, they get practice answering questions, increase their mastery and continue learning.

This study reflects early efforts to better understand student use of PassPoint to help prepare for the NCLEX and also the impact of usage on NCLEX success. As discussed earlier, the nature of the NCLEX data (pass/fail) and the high percentage of students passing the NCLEX on their first try renders analysis complex as there is little or no variation in student outcomes. We will continue to explore the extent to which PassPoint usage influences student learning, mastery of course material, and ultimately student success on the NCLEX.

Appendix A: Mastery Level Assignments (Spring 2014)

Client Need	ML target	Start Date	End date	# Completed
Level 4 BCC Assignment	4	13-Jan-14	16-Feb-14	87
Level 4 RRP Assignment	4	14-Jan-14	16-Feb-14	87
Level 4 MOC Assignment	4	19-Jan-14	16-Feb-14	86
Level 4 SIC Assignment	4	19-Jan-14	16-Feb-14	86
Level 4 HPM Assignment	4	19-Jan-14	23-Feb-14	85
Level 4 PA Assignment	4	19-Jan-14	2-Mar-14	85
Level 4 PPT Assignment	4	19-Jan-14	9-Mar-14	87
Level 4 PI Assignment	4	19-Jan-14	9-Mar-14	85
Level 5 BCC Assignment	5	14-Jan-14	6-Apr-14	86
Level 5 RRP Assignment	5	14-Jan-14	6-Apr-14	86
Level 5 MOC Assignment	5	19-Jan-14	6-Apr-14	86
Level 5 SIC Assignment	5	19-Jan-14	6-Apr-14	84
Level 5 HPM Assignment	5	19-Jan-14	6-Apr-14	86
Level 5 PA Assignment	5	19-Jan-14	6-Apr-14	84
Level 5 PPT Assignment	5	19-Jan-14	6-Apr-14	83
Level 5 PI Assignment	5	19-Jan-14	6-Apr-14	81
Level 6 BCC Assignment	6	14-Jan-14	13-Apr-14	86
Level 6 RRP Assignment	6	14-Jan-14	13-Apr-14	86
Level 6 MOC Assignment	6	19-Jan-14	13-Apr-14	85
Level 6 SIC Assignment	6	19-Jan-14	13-Apr-14	85
Level 6 HPM Assignment	6	19-Jan-14	13-Apr-14	86
Level 6 PA Assignment	6	19-Jan-14	13-Apr-14	82
Level 6 PPT Assignment	6	19-Jan-14	13-Apr-14	81
Level 6 PI Assignment	6	19-Jan-14	13-Apr-14	81
Level 7 BCC Assignment	7	14-Jan-14	27-Apr-14	86
Level 7 RRP Assignment	7	14-Jan-14	27-Apr-14	86
Level 7 MOC Assignment	7	19-Jan-14	27-Apr-14	85
Level 7 SIC Assignment	7	19-Jan-14	27-Apr-14	86
Level 7 HPM Assignment	7	19-Jan-14	27-Apr-14	86
Level 7 PA Assignment	7	19-Jan-14	27-Apr-14	86
Level 7 PPT Assignment	7	19-Jan-14	27-Apr-14	84
Level 7 PI Assignment	7	19-Jan-14	27-Apr-14	82