Project 1

Inferential Statistics in the Popular Press and Scholarly Journal

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Introduction

The purpose of this research project was to identify statistical inference in a popular press and
a scholarly journal. According to Salkind (2017), inferential Statistics are used to make interpretations
based on a minor collection of data, such as a sample, about a probable bigger one, such as inferring
resources of a population in a research (Salkind, 2017). Furthermore, adaptive learning methods in
higher education classroom will be the main component of this report. Research shows as high school
students graduate, sixty percent of them found themselves unprepared for college and fail the college
assessment test (Baugher, 2012; Rochford, 2004). Those students end up taking remedial classes such
as developmental mathematics or remedial English; which sometimes can delay their graduation
process in college, or they sometimes drop out of college. Mathematics has been a tough field or
subject for many students because of the lack of math fluency; in addition, students tend to be
frustrated and anxious when taking a mathematics class or a math test. Furthermore, students struggled
in English classes because of the language barrier or they are unable to express themselves properly at
the college level.

As a result, majority of schools and colleges/universities implement various technology
assessments into the curriculum to try to improve students' learning outcome. This technology
assessment is called adaptive learning tools. Murray & Pérez (2015) defined adaptive learning
assessments as a "technology-based device that interact with various learners and create assignments
based upon those interaction" (Murray & Pérez, 2015). The scholarly journal will be reporting on
Murray & Pérez (2015) research about, "Informing and performing: A study comparing adaptive
learning to traditional learning" and the mainstream media will be based on Shelle et al. (2018) report
on, "Adaptive Learning: An Innovative Method for Online Teaching and Learning".

Part 1: Mainstream Media

Shelle *et al.* (2018), "Adaptive Learning: An Innovative Method for Online Teaching and Learning"

Shelle *et al.* (2018) report discovered different type of adaptive learning software assessments. The research also determined the best tool for students to use in a trial project based on Michigan State University (MSU) extension online course, such as Brightspace LeaP as the adaptive learning tool. Participants (n = 192) had to complete the adaptive learning course by submitting the pretest and posttest, accessing the present assignment, completing a survey, and sending feedback in an online platform. Participants (n = 192) mean scores were (μ = 85.50) for the pretest and (μ = 90.81) for the posttest. Then t-test results had a difference between the pretest and posttest average result of 5.31, with a standard deviation of 13.97, and statistically significant ($p < 0.0001$). As a survey result, shown in Appendix C and D, participants who completed the survey had a 96% showed that they would take the course with adaptive learning assessments (see table 1). The majority of the participants answers were positive with 83% agreeing or strongly agreeing that the adaptive learning tool was very useful and helpful. Furthermore, 81% of participants agreed or strongly agreed that reading was valuable while using the adaptive learning tool (see table 2).

The strengths of the analysis were a clear statement about the result of the average, standard deviation, and statistically significant compared to the scholarly journal. In addition, the participants response to the survey makes it clear on why an individual should or should not use adaptive learning assessments. Feedbacks are always important when dealing with new devices. The weakness was that it would have been good to see a graph of the p-value.

Part 2: The scholarly journal

Murray & Pérez (2015), "Informing and performing: A study comparing adaptive learning to traditional learning"

Murray & Pérez (2015) report was based on comparing of adaptive learning and traditional learning methods in technological literacy course delivered as an online platform at the university. The adaptive learning development was based on utilizing online interactive practice exercises; the traditional approach was based on objective quizzes drawn from a test bank. The report observed the completion rates for the online assessment and the quiz scores. There were 105 participants (n = 105) who enrolled in the technological literacy class with the adaptive learning assessment; 103 students (n = 103) who took the objective quiz. Both methods cover the same subjects' content with similar learning outcomes and taught by the same professor.

The adaptive learning procedure allowed students to interact with eleven various exercises; which were included multiple choice, matching, and fill-in-the blank. In addition, the adaptive learning activities allowed students to get instant feedback and immediately give them a chance to go over the incorrect answers. Students' completion rates for the online exercises were very high; 63% (n = 67) tried to do all the assignments and 95% tried to do eight of the eleven exercises (Murray & Pérez, 2015; see Appendix A, figure 4 and table 2). Individual results were very high; in which a mode for all completed assignment was 100. The test scores for test 1 was 84.38 and test 2 was 85.11 (see Appendix A, figure 6); with a p-value (r = 0.33 and $p < 0.05$) for the first test and (r = 0.133) for the second test.

The objective quiz, which follows the traditional learning, also assigned eleven various quizzes to students in the form of multiple choice, matching, and true or false response. There were approximately 21 to 25 items in the quiz. In addition, 67% (n = 76) of students completed all quizzes

(see Appendix B, figure 7 and table 3). The students had a quiz mean scores that ranged from 69 to 82 over one hundred points (see Appendix B, figure 8). 50% of students (n = 103) score an average of 82.3 as the highest quiz score (See Appendix B, figure 8). The first test had 69% and 58% on second test of students with higher score (1st Exam: r = 0.29, p <0.05; 2nd Exam: r = 0.25, p <0.05).

As a result of this study, it was determined that there was no significant change in the exam score for students who took adaptive learning and traditional learning method. The t-test results comparing both exams did not have a significant difference either (see Appendix B, figure 9 and 10). The strengths were that some of the values for the tests were clearly stated; however, the weakness was that the number of participants differ and got a little confusing at time.

Part 3: Conclusion

Murray & Pérez (2015) and Shelle *et al.* (2018) had a lot of similarities when using statistics; such as the p-value was stated in both articles. Although both articles used statistics, the way it was conducted was different. Shelle *et al.* (2018) research study was more understandable when reading the statistical values. The results for both articles had no significant difference because most of the results concluded that adaptive learning assessment was necessary in the classroom and it is a tool that guide various students to work at their own pace.

References

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Murray, M. C., & Pérez, J. (2015). Informing and performing: A study comparing adaptive learning to traditional learning. Informing Science: the International Journal of an Emerging Transdiscipline, 18, 111-125. Retrieved from http://www.inform.nu/Articles/Vol18/ISJv18p111-125Murray1572.pdf

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Appendix A

The scholarly journal
Murray & Pérez (2015), "Informing and performing: A study comparing adaptive learning to traditional learning"
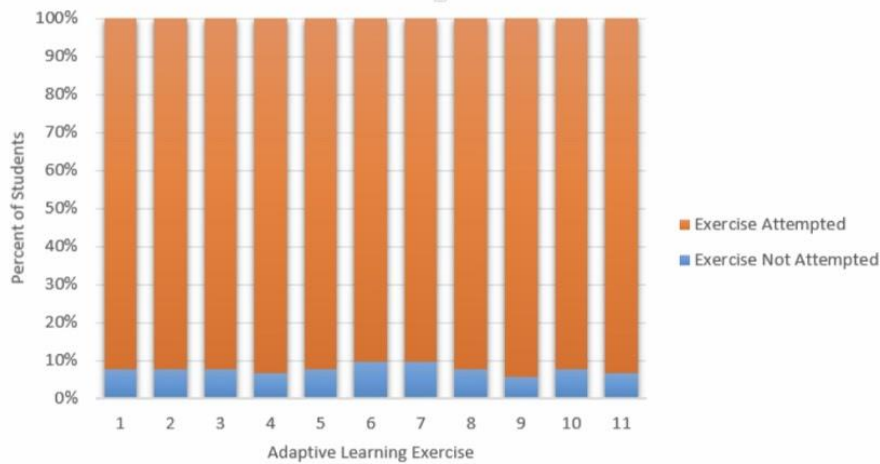
Adaptive Learning Method

Murray & Pérez

Figure 4. Student attempts by adaptive learning exercise

Table 2. Number of adaptive learning exercises attempted by students

Number of Exercises Attempted	Students	
	Frequency	Percent
11	67	63.8%
10	16	15.2%
9	12	11.4%
8	5	4.8%
7	1	1.0%
6	1	1.0%
5	1	1.0%
4	1	1.0%
3	0	0.0%
2	0	0.0%

Scores on individual exercises were exceptionally high. The mode score for all completed assignments for all students on all exercises was 100. For the most part, a student who attempted an exercise successfully completed all learning units in that exercise. For example, 97 students attempted the first adaptive learning exercise, and all 97 students successfully completed all items associated with it. This pattern remained consistent throughout the course. On the last assigned adaptive learning exercise, 97 of 98 students who attempted the exercise completed all units therein. Only 83% of students who attempted adaptive learning exercise 8 completed all units in the exercise, the lowest completion rate among exercises. Figure 5 shows the percent of items completed by each student on the adaptive learning exercises. Not attempted, quartile ranges and 100% completion rates are represented by different colored bars grouped by adaptive learning

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exercise. The bar to the left of each grouping indicates the percentage of students who did not attempt the exercise; the bar to the right indicates the percentage of students who completed all learning items. A gap indicates no student scores in that quartile range. Non completion rates in the 51-75% range were not reported for any adaptive learning exercise.
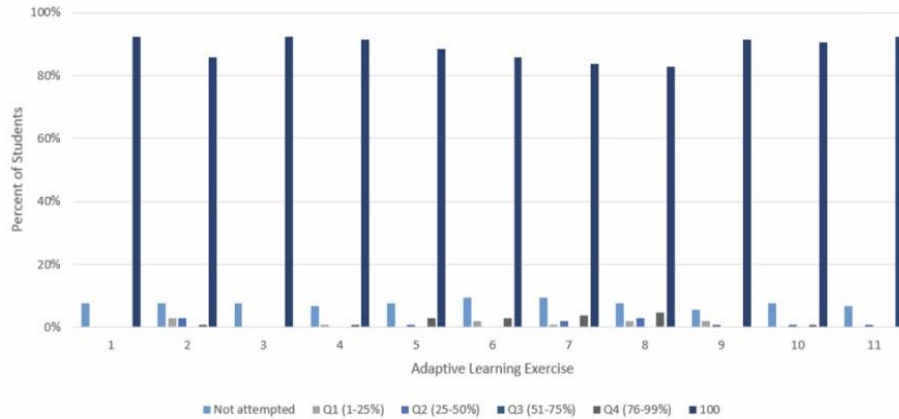

Figure 5. Student scores by adaptive learning exercise

The instructor assessed student learning via two objective exams, one after module 5 and another after module 11. The average test scores on the first exam and second exam were 84.38 and 85.11, respectively. A plot of student adaptive learning exercise scores (x-axis) against exam scores (y-axis) for both exams appears in Figure 6. The graphs exhibit a similar pattern of vertical clusters that depict variation in exam scores for a specific exercise score. For example, the cluster on the right side of the x-axis represents the various exam scores students received, even though those same students successfully completed 100% of the adaptive learning exercises. While a positive correlation existed between adaptive learning exercises and exam scores, it was only slightly significant on the first exam ($r=.33$, $*p<.05$), and not significant on the second exam ($r=.133$). It is noteworthy that student achievement on the adaptive learning exercises was not necessarily indicative of their performance on exams.
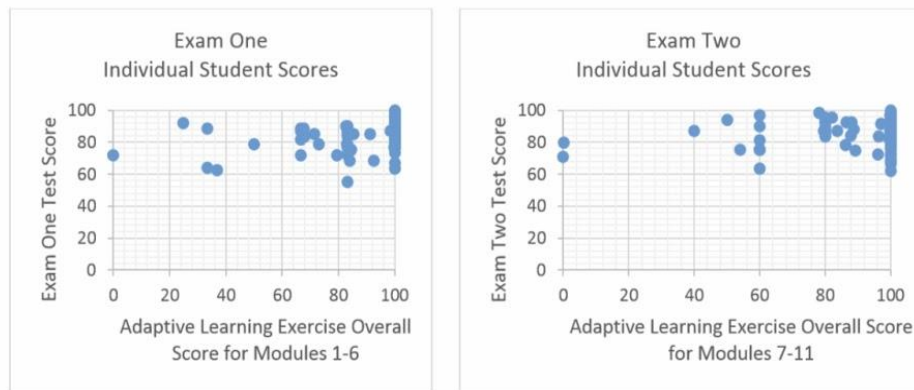

Figure 6. Student exam scores plotted against adaptive learning exercise scores

Appendix B

The scholarly journal
Murray & Pérez (2015), "Informing and performing: A study comparing adaptive learning to traditional learning"

Traditional Learning Methods – Objective Quizzes

Objective-type Quiz Method

Using an approach similar to the strategy used in the adaptive learning method, students in the objective-type quiz method were assigned 11 different quizzes. Multiple choice, matching and true/false quiz questions were drawn from the test bank provided by the textbook publisher. The number of items per quiz ranged from 21 to 25. As in the adaptive learning course section, students were directed to read the textbook material and then take the quiz. In contrast, students in this section took quizzes via an online course management system. Students were given one week to complete each quiz, but each quiz did not have a time limit for completion. During the period the quiz was available, students were able to access the quiz as often as desired and change their answers. However, once a quiz was submitted, answers could not be modified.

Most students attempted a majority of the quizzes, and more than 67% of the students completed all quizzes. The fewest number of quizzes attempted by any student was 4. Figure 7 depicts the percentage of students who completed each quiz, and Table 3 shows the percentage of quizzes taken by each student.
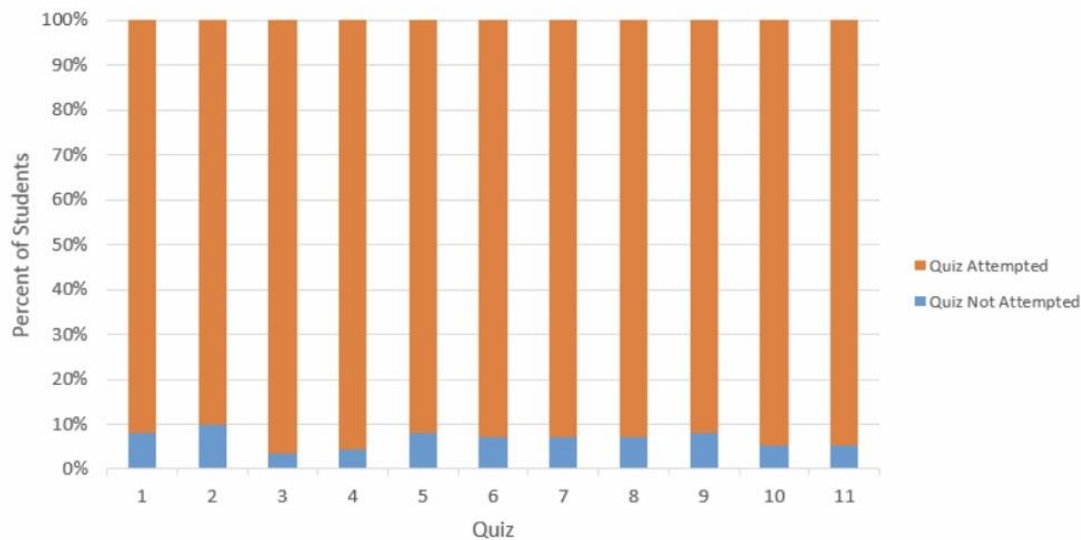

Figure 7. Student attempts by quiz

Table 3. Number of quizzes attempted by students

Number of Quizzes Attempted	Students	
	Frequency	Percent
11	76	67.3%
10	18	15.9%
9	10	8.8%
8	4	3.5%
7	2	1.8%
6	1	0.9%
5	1	0.9%
4	1	0.9%
3	0	0.0%
2	0	0.0%
1	0	0.0%
0	0	0.0%

Informing and Performing

Average quiz scores ranged from 69 to 82 out of a possible 100 points. Within that consistency, scores of each individual student varied significantly on the 11 quizzes, as depicted in Figure 8, in which each bar represents a range of scores. The height of the bar indicates the percentage of students achieving a score in that range. Scores were organized using a traditional A, B, C, D and F grading scale of 90-100, 80-89, 70-79, 60-69 and less than 60. The bar to the left of each quiz grouping represents students who did not attempt the quiz; the bar to the far right represents students earning the highest grades. The average quiz score appears above each grouping. The majority of students scored above 70 on all quizzes. On the first quiz, which covered introductory material, half of the students scored in the highest possible range. Scores were much lower on the second, fifth and ninth quizzes. The uneven distribution of quiz scores is intriguing since quizzes were untimed, providing students with the opportunity to verify their answers.
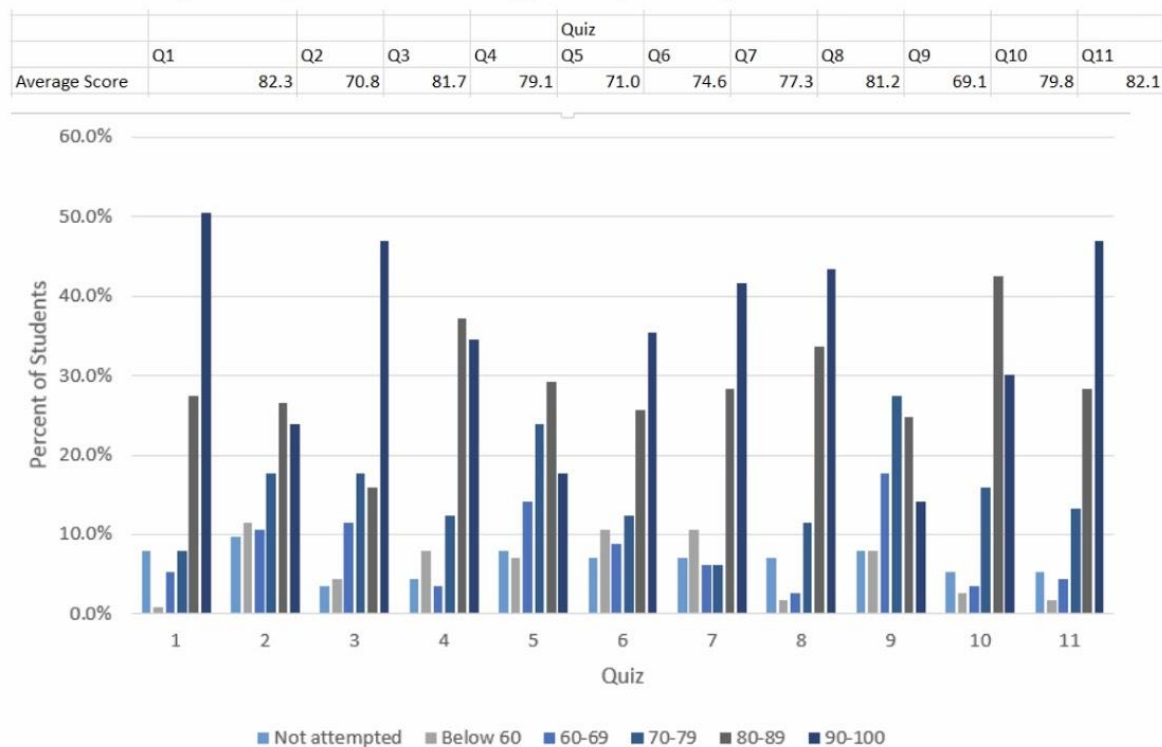
					Quiz						
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Average Score	82.3	70.8	81.7	79.1	71.0	74.6	77.3	81.2	69.1	79.8	82.1

Figure 8. Student scores by quiz

The instructor assessed student learning via an objective exam given after modules 5 and 11, as in the adaptive learning course sections. The average test scores on the first and second exams were 84.13 and 83.15, respectively. A plot of student overall average quiz scores (x-axis) against exam scores (y-axis) for both exams is depicted in Figure 9. Exam scores tended to be higher than average quiz scores. On the first exam, 69% of the students had higher exam scores than average quiz scores. On the second exam, 58% had higher exam scores. A positive but weak correlation exists between quiz scores and exam scores (exam 1: $r=.29$, $*p<.05$; exam 2: $r=.25$, $*p<.05$). If students did well on the quizzes, they were likely to do well on the exams; on the other hand, students with low quiz scores often also did well on the exams.
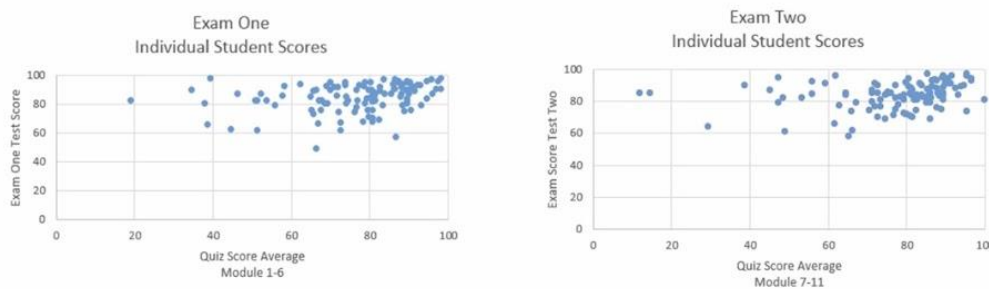
Figure 9. Student exam scores plotted against quiz scores

There was no significant difference in test scores between students enrolled in courses using adaptive learning and traditional instruction. Results of a t-test comparing exam scores across methods for the first exam (***$p<.001$) and the second exam (***$p<.001$) were not significant. A graph of individual student test scores for each exam for both groups of students is presented in Figure 10. The data overwhelmingly supports the conclusion that neither the adaptive learning approach nor the traditional, objective quiz approach provided a definitive learning advantage.
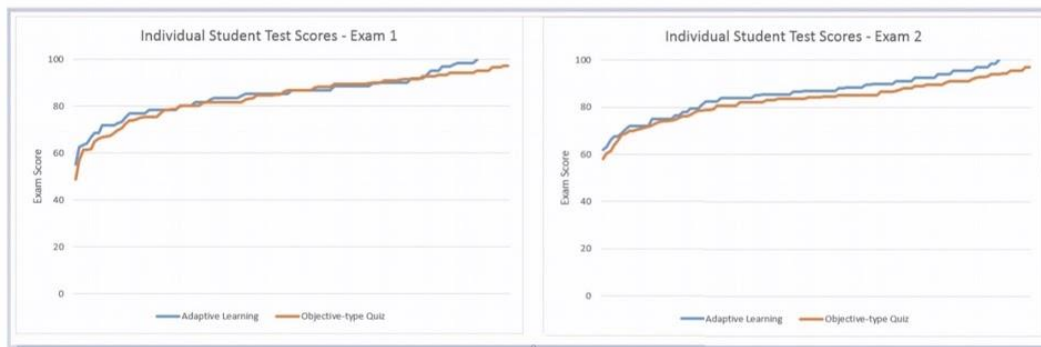

Figure 10. Student exam by instructional method

Conclusion

Adaptive learning is touted as a potential game-changer in higher education, a panacea with which institutions may solve the riddle of the iron triangle: quality, cost, and access. Though the research is scant, this study and a few others like it indicate that today's adaptive learning systems have negligible impact on learning outcomes, one aspect of quality. There is also evidence that adaptive systems positively impact other aspects of quality such as student persistence and engagement (Jarrett, 2013; Zimmer, 2014). More compelling still are the intuitively appealing cases for adaptive learning systems as engines with which institutions can increase access and reduce costs. One cautionary note that arises from these dynamics is the danger that educational institutions will, in the throes of ongoing waves of online learning, dismantle the triangle by relying on adaptive learning to cut costs and increase access without paying due attention to quality. These dynamics illuminate one way that the informing science framework can serve as a lens through which to explore the evolution of adaptive learning systems.

This study compared an adaptive learning system with a traditional objective assessment approach to instructional content delivery and assessment in a digital literacy course. Findings indicate that student learning, gauged via two examinations, did not vary significantly across the

Appendix C

The popular press
Shelle *et al.* (2018), "Adaptive Learning: An Innovative Method for Online Teaching and Learning"

Table 1

Effect of Adaptive Learning Method and Tool on Learning Experience

Item	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	NA (%)
The adaptive learning tool was helpful in mastering the content of this course	5.26	5.26	5.26	37.89	45.26	1.05
It was easy to navigate through the adaptive learning tool	6.23	7.37	26.32	23.16	36.84	0.0
I preferred this method of learning compared to a traditional self-paced course	4.26	9.57	21.28	34.04	28.72	2.13

Appendix D

The popular press

Shelle *et al.* (2018), "Adaptive Learning: An Innovative Method for Online Teaching and Learning"

Table 2

Effectiveness of Additional Aspects of the Adaptive Learning Course

Item	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
Practice tests were effective in allowing review of the material presented	4.21	2.11	12.63	48.42	32.63
Recommended readings were valuable for further remediation	4.21	1.05	5.26	54.74	34.74
Access to the personalized learning path, its objectives, and the overall use in this course was clear and well communicated to me.	4.26	10.64	15.96	37.23	31.91