RESEARCH REPORT

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The Effect of IXL Math among ELL and Special Education Students

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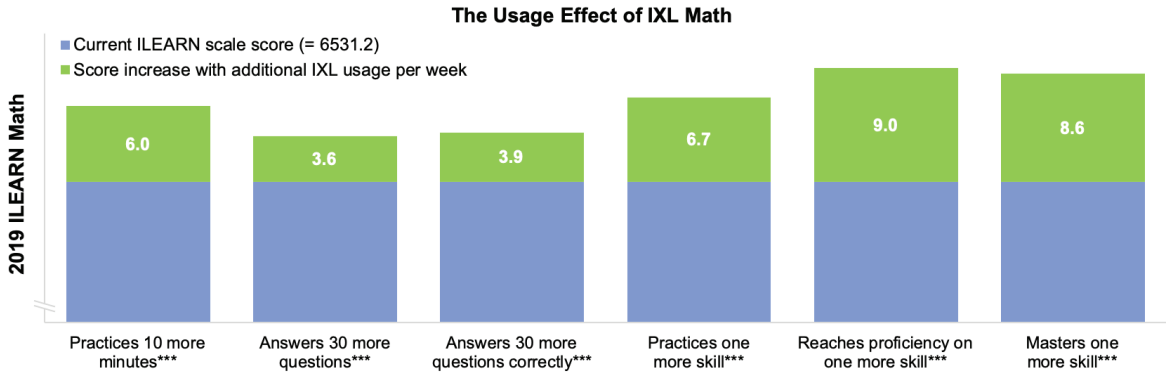
Executive Summary

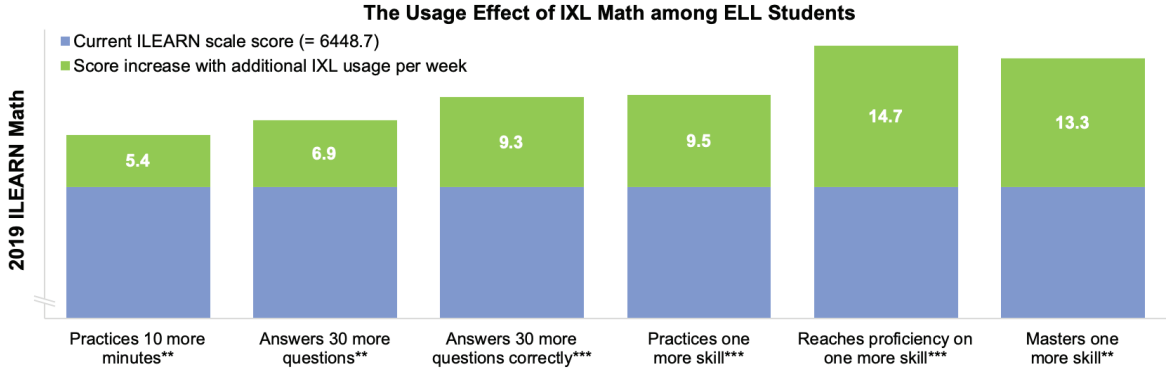
IXL is a personalized learning platform designed to help students build academic skills. Previous research has shown that IXL can have a significant impact on academic performance at schools or districts (Empirical Education, 2013).

To further evaluate the impact of IXL Math, especially for the populations of English language learners (ELL) and students enrolled in special education services, researchers studied 2,898 students from 12 public elementary schools in an Indiana school district who used IXL for the first time in the 2018-19 school year. Using multilevel linear regression models to control for students' baseline performance and demographic background, researchers found statistically significant positive effects on student performance on the 2019 Indiana Learning Evaluation Assessment Readiness Network (ILEARN) across a series of usage indicators. Key findings include:

- **More IXL Math practice is associated with better math performance.** Overall, students performed better on the 2019 ILEARN math assessment when they spent more time on IXL practicing, answering more questions, answering more questions correctly, practicing more skills, reaching proficiency in more skills, and/or mastering more skills in IXL Math[1,2].



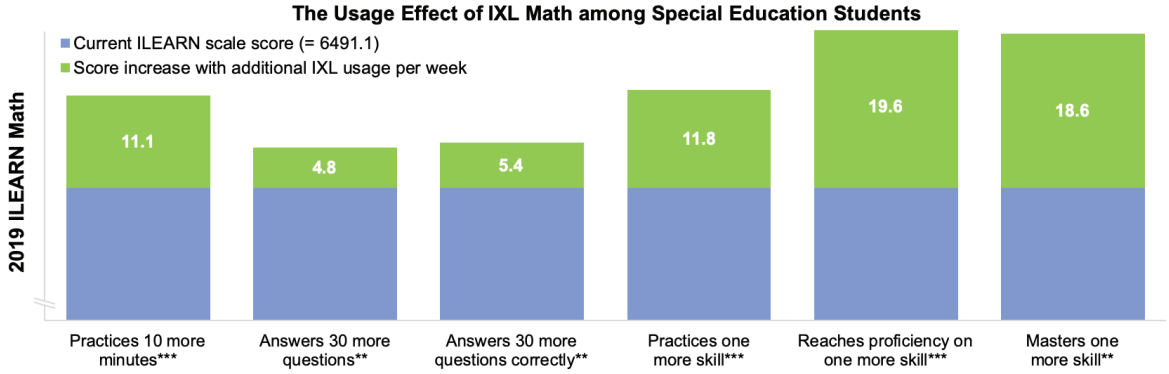
- **IXL supports ELL students.** ELL students experienced similar or even greater gains in performance with additional practice compared to their peers.



[1] *In all figures: * indicates significance at the .05 level; ** indicates significance at the .01 level; *** indicates significance at the .001 level.*

[2] *Current ILEARN scale score: averaged scale score after adjusting for prior performance and demographic characteristics.*

- **IXL supports special education students.** Special education students experienced similar or even greater gains in performance with additional practice compared to their peers.



THE EFFECT OF IXL MATH AMONG ELL AND SPECIAL EDUCATION STUDENTS

Study Design and Methodology

This study analyzed data from 2,898 students in 12 public elementary schools in an Indiana school district who used IXL for the first time during the 2018-19 school year. Two sources of data were used in this study: students' state math assessment data and their IXL Math practice data.

The district provided the 2018 and 2019 state assessment data as well as the demographic background data for students in grades 3 through 6. Each year, the state math assessments are administered to students in grades 3 and above. The Indiana Statewide Testing for Educational Progress (ISTEP) was used between 2014 and 2018 as the statewide assessment, and the Indiana Learning Evaluation Assessment Readiness Network (ILEARN) replaced ISTEP in 2019. ILEARN reports student achievement levels according to the Indiana Academic Standards, and students' proficiency levels are determined based on their scale scores. For example, for 6th graders, ILEARN math scores ranging from 6488 to 6544 indicate *Approaching Proficiency*, and ILEARN math scores ranging from 6545 to 6604 indicate the student is *At Proficiency* (Indiana Interpretive Guide for Statewide Assessments).

Students' math performance as measured by the 2018 ISTEP was used as the pretest to control for baseline performance prior to using IXL. Students' math performance on the 2019 ILEARN assessment served as the posttest and was used to examine the impact of IXL Math. In order to trace each student's math performance from spring 2018 to spring 2019, the study design required students with both pretest and posttest scores available. Therefore, data from three cohorts, encompassing 2,898 students, were analyzed in the present study (Figure 1). See Appendix A for details on students' background and state math assessment performance.

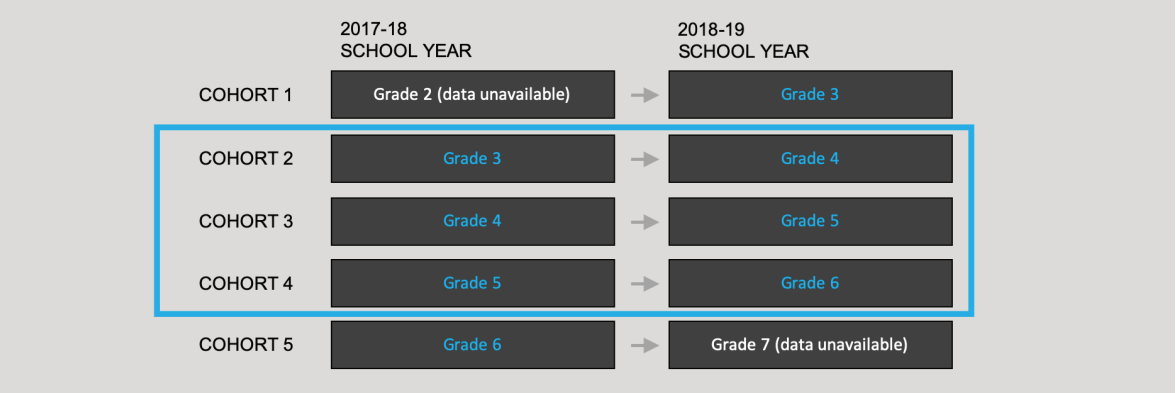


Figure 1. Study Design

Demographic background information provided by the district included student gender, race/ethnicity, economically disadvantaged status, English language learner status, and special education status. Among the 2,898 students, 321 were identified as English language learners, and 448 were identified as special education students. See Appendix A for details on student demographics. In addition, school-level demographics were retrieved from the Indiana Department of Education and included school size, school location, and Title I status. Among the 12 elementary schools, the average school size was 585. The majority of the schools (*n* = 9) were located in cities, along with one suburban school and two rural schools. Four were Title I schools.

Students' IXL Math usage data from the 2018-19 school year were retrieved from the IXL database. The IXL Math usage indicators included the amount of time spent on IXL Math, the number of questions answered, the number of questions answered correctly, the number of skills practiced, the number of skills reaching proficiency, and the number of skills mastered[3]. See Table 1 for detailed information on IXL Math usage across the 2018-19 school year. There was a wide range of usage among the 2,898 students. For example, time spent on IXL Math ranged from 0 to over 2 hours per week; the number of skills reaching proficiency ranged from 0 to over 10 skills per week.

[3] *IXL uses its proprietary SmartScore to measure student progress on a skill. SmartScores range from 0 to 100 and are calculated based on a number of metrics, including the percentage of questions answered correctly, question difficulty, and response pattern consistency. Students reach proficiency with a SmartScore of 80 and mastery with a SmartScore of 100.*

Table 1. IXL Math Weekly Practice

	M	*SD*	Min	Max
Time spent (in minutes)	15.86	11.79	0.00	120.65
Questions answered	44.65	47.04	0.00	761.52
Questions answered correctly	37.42	42.42	0.00	731.79
Skills practiced	1.58	1.12	0.00	11.39
Skills proficient	0.93	0.90	0.00	10.33
Skills mastered	0.61	0.71	0.00	9.77

Research Questions

This study aimed to answer three research questions:

1. What were the effects of IXL Math usage indicators on students' 2019 ILEARN math scores (controlling for 2018 baseline math performance prior to IXL Math usage and demographic background)? More specifically, what changes in performance would be expected with additional IXL Math usage?

2. Did the predictive effects of IXL Math usage on ILEARN math scores hold for ELL students?

3. Did the predictive effects of IXL Math usage on ILEARN math scores hold for special education students?

Analyses

Multilevel linear regression models were used to examine the IXL usage effect in math. These models specify students (Level 1) as clustered within schools (Level 2) and account for any shared variability within schools. In the overall analysis, at Level 1 (i.e., the student level), the outcome variable was students' scores on the 2019 ILEARN math assessment, controlling for the students' prior math performance in 2018 and demographic background, including gender, race/ethnicity, economically disadvantaged status, English language learner status, and special education status. At Level 2 (i.e., the school level), we accounted for clustering and controlled for school demographics, including school size (i.e., 2019 enrollment), school location (i.e., city, suburban, or rural), and Title I status. Upon this baseline model, the six IXL Math usage indicators were added at Level 1 one at a time to avoid multicollinearity issues due to the strong correlations among them (e.g., students who spent more time on IXL also practiced more skills).

To answer the second and the third research questions, we used the same sets of multilevel linear regression models described above, but only on the two targeted students subgroups. For the second research question, data from the 321 ELL students were analyzed (removing ELL status from the analysis as a covariate). For the third research question, data from the 448 special education students were analyzed (removing special education status from the analysis as a covariate).

Following What Works Clearinghouse (2020) guidelines, each effect is accompanied by a test of statistical significance and a probability (*p*) value. The *p*-value is the probability of observing the current or more extreme data, assuming the effect is zero (Cohen, 1994). As such, the smaller the p-value, the less likely it is the result occurred at random, with .05, .01, and .001 commonly used as thresholds in research practice. Effects associated with *p*-values smaller than these thresholds are considered statistically significant at each of these significance levels.

Results

Overall results showed positive and statistically significant associations between all tested IXL Math usage indicators and 2019 ILEARN math performance. The amount of time spent, number of questions answered, number of questions answered correctly, number of skills practiced, number of skills reaching proficiency, and number of skills mastered were all significant predictors of performance gains on the 2019 ILEARN math assessment (all p values $< .001$). The findings applied to ELL students and special education students as well.

The Usage Effect of IXL Math for All Students

The results for mathematics indicated that the more a student practiced with IXL Math, the better he or she performed on the 2019 ILEARN math assessment. See Table B1 in Appendix B for the full regression results. Figure 2 shows the expected improvement in ILEARN math scale scores with additional IXL Math usage.

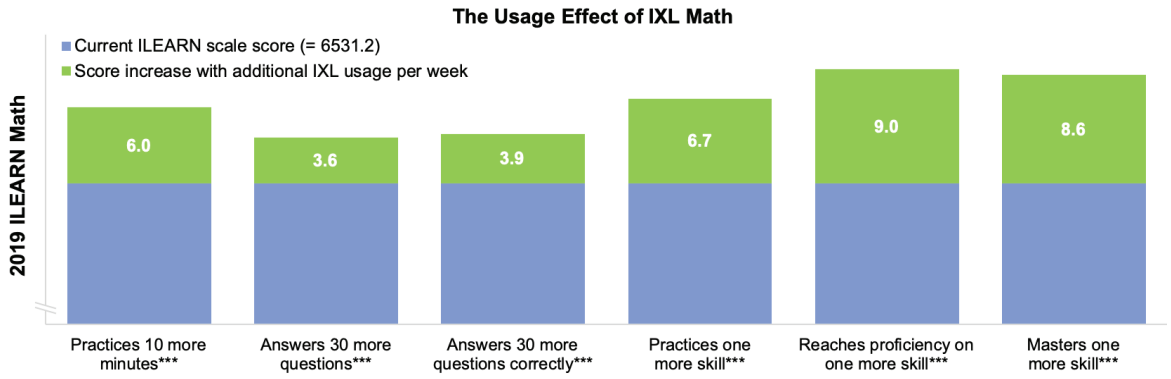


Figure 2. The Usage Effect of IXL Math

Specifically, with each additional minute spent on IXL Math per week, an average student's ILEARN math score is expected to increase by 0.60 points. For example, if a student practiced for 10 more minutes per week, their math score would increase by 6.0 points. For each additional question answered per week, the ILEARN math score is expected to increase by 0.12 points. Meaning, if a student answered 30 more questions per week, their math score would increase by 3.6 points. Similarly, for each additional question answered correctly per week, a typical student's ILEARN math score is expected to increase by 0.13 points. In other words, if a student answered 30 more questions correctly per week, their math score is expected to increase by 3.9 points. Finally, even more sizable gains in ILEARN scores are expected, as students practice, become proficient in, and master more skills per week as shown in Figure 2.

The Usage Effect of IXL Math among ELL Students

Compared to the usage effects among all students, similar and even larger usage effects were found for the population of ELL students. Significant positive associations were found between IXL Math usage indicators and 2019 ILEARN math scores, with *p* values < .01. The results indicated that the more an ELL student practiced with IXL Math, the better he or she performed on the 2019 ILEARN math assessment. See Table B2 in Appendix B for the full regression results. Figure 3 shows the expected improvement in ILEARN math scale scores with additional IXL Math usage.

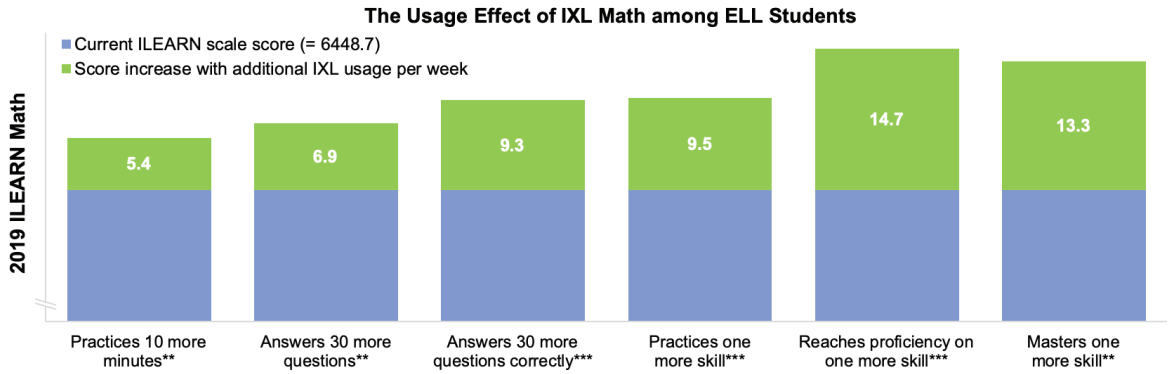


Figure 3. The Usage Effect of IXL Math among ELL Students

Specifically, with each additional minute spent on IXL Math per week, an average ELL student's ILEARN math score is expected to increase by 0.54 points. For example, if an ELL student practiced for 10 more minutes per week, their math score would increase by 5.4 points. For each additional question answered per week, the ILEARN math score is expected to increase by 0.23 points. Meaning, if an ELL student answered 30 more questions per week, their math score would increase by 6.9 points. Similarly, for each additional question answered correctly per week, a typical ELL student's ILEARN math score is expected to increase by 0.31 points. In other words, if an ELL student answered 30 more questions correctly per week, their math score would increase by 9.3 points. Finally, even more sizable gains in ILEARN scores are expected, as students practice, become proficient in, and master more skills per week as shown in Figure 3.

The Usage Effect of IXL Math among Special Education Students

Compared to the usage effects among all students, larger usage effects were found for special education students. Significant positive associations were found between IXL Math usage indicators and 2019 ILEARN math scores, with *p* values < .01. The results indicated that the more a special education student used IXL Math, the better he or she performed on the 2019 ILEARN math assessment. See Table B3 in Appendix B for the full regression results. Figure 4 shows the expected improvement in ILEARN math scale scores with additional IXL Math usage.

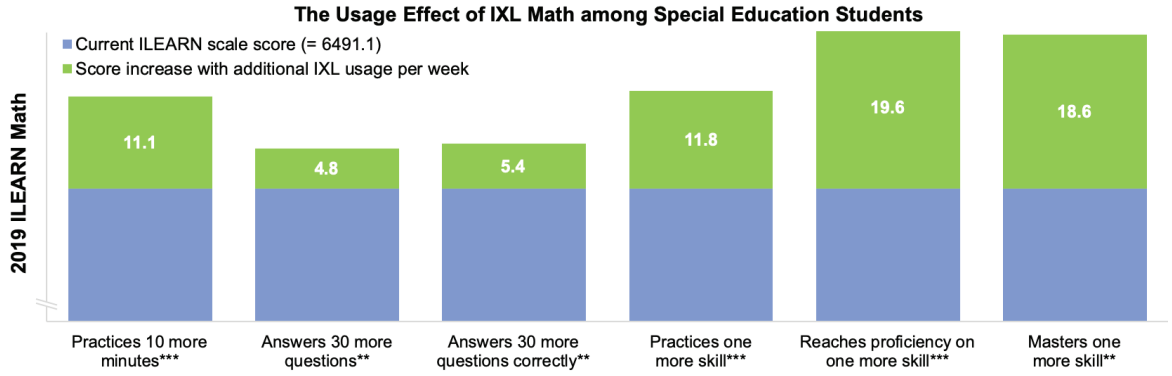


Figure 4. The Usage Effect of IXL Math among Special Education Students

Specifically, with each additional minute spent on IXL Math per week, an average special education student's ILEARN math score is expected to increase by 1.11 points. For example, if a special education student practiced for 10 more minutes per week, their math score would increase by 11.1 points. For each additional question answered per week, the ILEARN math score is expected to increase by 0.16 points. Meaning, if a special education student answered 30 more questions per week, their math score would increase by 4.8 points. Similarly, for each additional question answered correctly per week, a typical special education student's ILEARN math score is expected to increase by 0.18 points. In other words, if a special education student answered 30 more questions correctly per week, their math score is expected to increase by 5.4 points. Finally, even more sizable gains in ILEARN scores are expected, as students practice, become proficient in, and master more skills per week as shown in Figure 4.

Conclusion

This study found a positive and statistically significant association between IXL Math practice and 2019 ILEARN math performance. The amount of time spent on IXL, number of questions answered, number of questions answered correctly, number of skills practiced, number of skills reaching proficiency, and number of skills mastered were all statistically significant predictors of student math performance gains on the ILEARN assessment. Based on prior research and the results presented here, we expect our findings to generalize to other similar schools—the more students practice with IXL Math, the better they will perform on state math assessments. Importantly, the effects of IXL Math are cumulative, so schools seeking larger assessment gains in math should encourage additional practice with IXL Math.

Moreover, the usage effects found in the full sample applied to ELL students as well as special education students. Some of these effects were even larger for these subgroups. As such, IXL is an ideal product for schools that are specifically targeting gains in achievement for these vulnerable student populations.

References

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Appendix A. Student Performance and Background Information

Table A1. Performance on state assessments and background information for all students, ELL students, and special education students

	All students		English language learners		Special education students	
# of students	2,898		321		448	
Pretest and posttest averages	***M***	***SD***	***M***	***SD***	***M***	***SD***
2018 ISTEP Math	470.5	67.1	428.7	59.3	427.0	64.7
2019 ILEARN Math	6511.7	93.2	6460.1	79.8	6438.4	93.1
Student demographic	***M***	**%**	***M***	**%**	***M***	**%**
Gender:						
Female	1,448	50.0%	148	46.1%	164	36.6%
Male	1,448	50.0%	173	53.9%	284	63.4%
Race/Ethnicity:						
American Indian/Alaska Native	10	0.3%	2	0.6%	1	0.2%
Asian	218	7.5%	60	18.7%	12	2.7%
Black/African American	66	2.3%	5	1.6%	9	2.0%
Hispanic	498	17.2%	236	73.5%	63	14.1%
Native Hawaiian/Other Pacific Islander	7	0.2%	0	0.0%	1	0.2%
White	1,973	68.1%	16	5.0%	346	77.2%
Multiracial/Two or More Races	120	4.1%	2	0.6%	16	3.6%
Status:						
Economically disadvantaged students	1,396	48.2%	201	62.6%	255	56.9%
English language learners	321	11.1%	-	-	44	9.8%
Special education students	448	15.5%	44	13.7%	-	-

Appendix B. IXL Math Usage Effects

Table B1. Usage effects of IXL Math for all students (*n* = 2,898)

IXL Math usage (per week)	*Coef.*	*SE*	*t*	*p*
(Intercept in baseline model)	6531.20	12.78	511.08	< .001
Time spent (in minutes)	0.60	0.09	6.93	< .001
Questions answered	0.12	0.02	5.77	< .001
Questions answered correctly	0.13	0.02	5.99	< .001
Skills practiced	6.71	0.89	7.52	< .001
Skills proficient	9.02	1.11	8.13	< .001
Skills mastered	8.58	1.34	6.39	< .001

Table B2. Usage effects of IXL Math for ELL students (*n* = 321)

IXL Math usage (per week)	*Coef.*	*SE*	*t*	*p*
(Intercept in baseline model)	6448.67	25.02	257.76	< .001
Time spent (in minutes)	0.54	0.20	2.64	.009
Questions answered	0.23	0.07	3.18	.002
Questions answered correctly	0.31	0.09	3.57	< .001
Skills practiced	9.50	2.57	3.70	< .001
Skills proficient	14.66	3.43	4.27	< .001
Skills mastered	13.32	4.01	3.32	.001

Table B3. Usage effects of IXL Math for special education students (*n* = 448)

IXL Math usage (per week)	*Coef.*	*SE*	*t*	*p*
(Intercept in baseline model)	6491.10	23.25	279.24	< .001
Time spent (in minutes)	1.11	0.31	3.65	< .001
Questions answered	0.16	0.06	2.67	.008
Questions answered correctly	0.18	0.07	2.83	.005
Skills practiced	11.77	3.42	3.44	< .001
Skills proficient	19.60	4.59	4.27	< .001
Skills mastered	18.60	5.67	3.28	.001