

Use of personalized learning platforms in one pandemic-era microschool: A case study | Technical appendix

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The Covid-19 pandemic brought drastic changes to K-12 education in the U.S. When school buildings closed for in-person instruction in March 2020, many parents sought other solutions for the education and social and emotional development of their school-age children. Microschools, which enrolled small numbers of students and hired staff to educate them, were one such solution. The Center on Reinventing Public Education (CRPE) profiled the first year of implementation—2020-21 school year—of one microschool established during the early months of the pandemic in Clark County, Nevada, called the Southern Nevada Urban Micro Academy (SNUMA). SNUMA employed personalized learning platforms—Zearn Math, Lexia, and Dreambox—along with one-to-one and whole-group instruction as a key approach to helping students access grade-level content. RAND built on CRPE’s research on SNUMA to more deeply understand the role such personalized learning platforms played in SNUMA’s instructional approach during its first year of operation and the types of data available across platforms.

This technical appendix accompanies the report *Use of personalized learning platforms in one pandemic-era microschool: A case study* and describes the sample, data, and analytic methods we employed to analyze the personalized learning platforms employed by SNUMA during the 2020-21 school year.

Sample and data

We received demographic and personalized learning platform (hereafter, “platform”) data for students in SNUMA during the 2020-21 school year. SNUMA provided demographic information on enrolled students that included age, gender, race/ethnicity, and date of enrollment into SNUMA. Prenda provided platform data for grades 1 and 2 on Zearn Math and Lexia Core5. Cadence Learning provided platform data for Dreambox (grades 3-8), Lexia Core5 (grades 3-5), and Lexia PowerUp (grades 6-8).

Variables contained in the data included amount of time students spent on the platform, the target amount of time the platform recommended students spend using the platform (i.e., target usage), student grade-level status at the beginning and/or end of year, and measures of progress on the platform such as the number of activities, lessons, units, badges, and/or standards completed (i.e., target progress). There was little overlap in the variables available across all platforms and many variables (e.g., units completed) were defined specifically to a platform. Table A1 shows the variables used in our analysis by platform.

SNUMA staff provided demographic data for 76 students who appeared in the platform data files. Table A2 shows the demographics of students represented in the analysis. The sample of students was diverse: 32 percent identified as Black, 25 percent identified as Hispanic, and 39 percent identified as White. The sample contains more students in lower grades (10–18 students per grade in grades 1–5) and fewer in higher grades (three to five students per grade in grades 6–8).

Analysis

We performed a series of descriptive analyses to understand student enrollment patterns and the relationship between student background characteristics and platform outcomes. To understand enrollment patterns, we plotted the number of students in the sample each month of the 2020–2021 school year, overall and disaggregated by race.

We analyzed student usage of the platforms throughout the year by plotting the average number of hours used per week on Lexia (Core5 and PowerUp) and Dreambox, the platforms for which these data were available. For Lexia Core5, we additionally plotted the average target hours per week the platform recommended students use. Finally, we disaggregated actual platform use and target platform use by students who started at or above grade level and students who started below grade level (as assessed by the platform) to understand how starting level and use are related. We centered platform week on the date of enrollment due to the staggered nature of student enrollment throughout the year. Thus, the first week a student enrolled in SNUMA counted as the first week they used a given platform. Further, though some platforms (such as Dreambox) provided more granular usage data, such as minutes of use per day, we aggregated to hours of use per week because this was the smallest unit of calendar time that was consistent across platforms that provided use data.

We used transition matrices to understand growth in students based on platform metrics. Specifically, for Zearn Math and Lexia Core5, we looked at the percentage of the sample that started below, at, or above grade level in the beginning of the year and tracked the percentage of each that were deemed below, at, or above grade level at the end of the year.

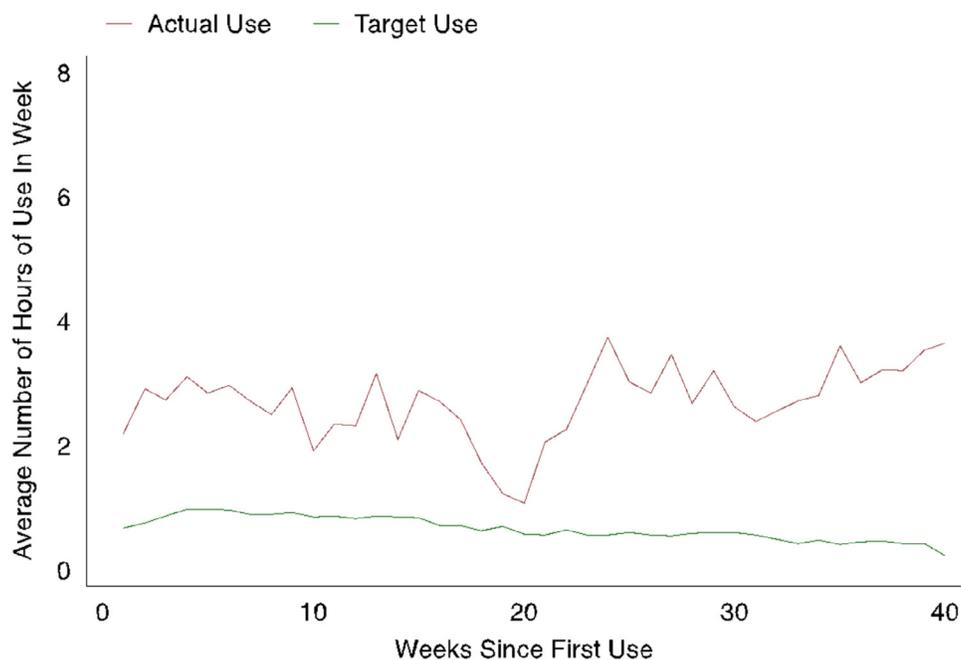
Finally, we explored the relationship between student background characteristics and platform outcomes via Ordinary Least Squares models of the following form:

$$Y_i = \beta_0 + X_i\beta_1 + \varepsilon_i \quad (1)$$

where Y_i is the platform outcome of interest for student i , X_i is a vector of student background characteristics, and ϵ_i is an individual level stochastic error term. We employed separate regressions for each platform because many of the outcomes and some of the baseline characteristics (e.g., starting grade level) are platform and subject specific. Outcomes for Lexia Core 5 included total minutes used, units completed, activities completed, weeks the student met the platform usage target, weeks the student met the platform progress target, and ending grade level (i.e., below, at, or above grade level).

For Zearn Math, the outcomes included number of lessons completed, total badges earned, total Kindergarten activities completed (as a measure of below-grade-level content accessed), and end-of-year grade level (e.g., below, at, or above grade level).¹ For Dreambox, the outcomes analyzed were total minutes used, number of standards proficient, number of standards progressed, and total lessons passed. Dreambox did not provide end-of-year grade-level determinations. In all cases, baseline characteristics included race/ethnicity, gender, age, grade, number of weeks possible to use the platform (based on enrollment), and starting grade level, as measured by the individual platform. Lexia PowerUp was not included in the analysis because outcomes were not consistent between Lexia Core5 and PowerUp and too few students in the sample used PowerUp to support regression analysis. All models include robust standard errors.

Figure A1. Average actual use and platform indicated targeted use of Lexia Core5, centered on week of first use



¹ Zearn does not use a diagnostic assessment and begins with grade-level content, supplemented with practice on prerequisite skills, if needed. If the supplemental practice is not enough for the student to access grade-level content, teachers are alerted and may choose to assign below-grade-level lessons. We used the information about lesson grade level to impute starting and end-of-year grade-level assignments. At the beginning of the year, a child was marked below grade level if they were assigned below-grade-level lessons by the teacher. At the end of the year, a child was marked above grade level if they were completing above-grade-level lessons.

Figure A2. Platform indicated targeted use of Lexia Core 5 by starting grade level, centered on week of first use

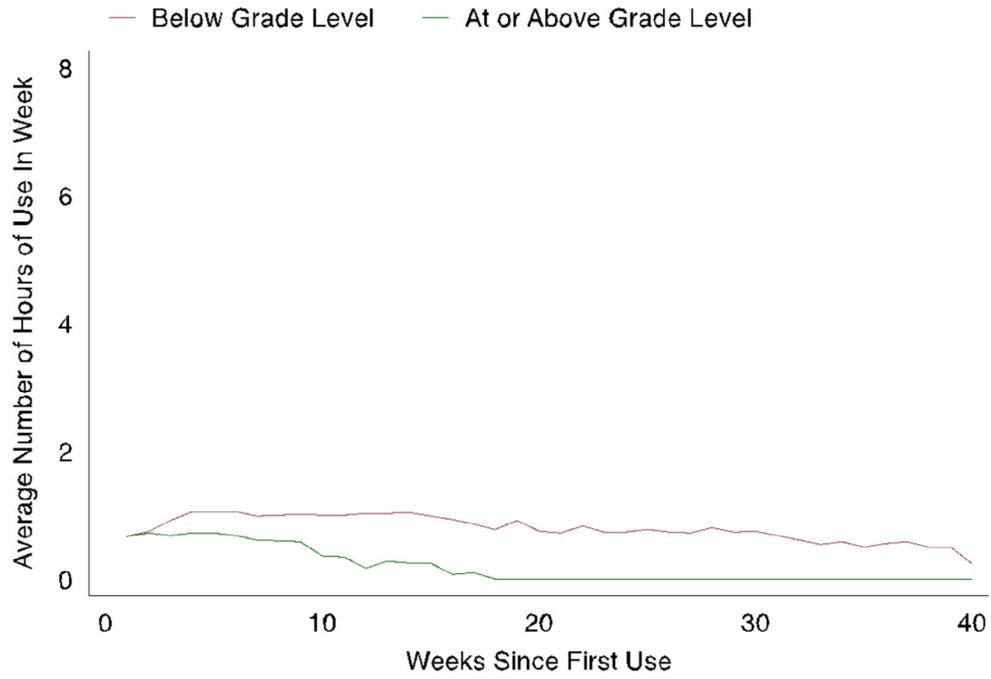


Table A1. Data elements by platform available and used in analysis

	Zearn Math (Grades 1 and 2)	Dreambox (Grades 3–8)	Lexia Core5 (Grades 1–5)	Lexia PowerUp (6–8)
Total minutes used (by week)		✓	✓	✓
Total minutes Used (Total)		✓	✓	✓
Target minutes (by week)			✓	✓
Activities completed	✓		✓	✓
Lessons completed (or passed)	✓	✓		
Units completed			✓	✓
Badges earned	✓			
Standards proficient		✓		
Standards progressed		✓		
Weeks met platform usage target			✓	✓
Weeks met platform progress target			✓	
Beginning of year grade level	✓	✓	✓	✓
End-of-year grade level	✓		✓	✓

Table A2. Descriptive statistics

	N	N(Percentage)	Age
All	76	100.00	8.85
Female	35	46.05	8.87
Male	41	53.95	8.83
Black	24	31.58	9.01
White	30	39.47	9.31
Hispanic	19	25.00	8.00
Other	3	3.95	8.29
Grade 1	18	23.68	6.35
Grade 2	10	13.16	7.30
Grade 3	14	18.42	8.34
Grade 4	12	15.79	9.29
Grade 5	10	13.16	10.74
Grade 6	5	6.58	11.52
Grade 7	3	3.95	13.05
Grade 8	4	5.26	13.19

Table A3. Relationship between background characteristics and outcomes on Lexia Core5 platform

Variables	(1) Total minutes	(2) Units completed	(3) Activities completed	(4) Weeks met progress	(5) Weeks met usage	(6) End below grade level	(7) End at grade level	(8) End above grade level
Black	1,015.167* (385.999)	13.369 (43.925)	0.094 (2.906)	0.221 (0.812)	1.080* (0.518)	0.104 (0.111)	0.002 (0.149)	-0.106 (0.147)
Hispanic	274.901 (295.593)	-57.452 (48.832)	-4.331 (3.245)	-1.477 (0.949)	0.056 (0.612)	0.006 (0.087)	0.029 (0.122)	-0.035 (0.136)
Other	747.976 (607.791)	22.679 (78.239)	-0.005 (5.307)	-0.377 (1.132)	-0.175 (0.876)	-0.197* (0.091)	0.049 (0.325)	0.147 (0.307)
Female	853.735** (263.170)	27.826 (35.612)	1.614 (2.376)	1.405+ (0.754)	1.217* (0.604)	0.007 (0.076)	-0.100 (0.107)	0.092 (0.114)
Age	-769.668** (233.732)	-52.283 (34.845)	-3.615 (2.415)	-0.402 (0.748)	-1.108* (0.479)	0.041 (0.123)	-0.209+ (0.105)	0.169 (0.128)
Grade 2	472.880 (485.556)	110.452+ (57.044)	5.294 (4.031)	1.234 (1.135)	0.791 (0.662)	0.005 (0.167)	0.092 (0.203)	-0.097 (0.192)
Grade 3	872.073 (584.952)	128.657 (83.947)	5.839 (5.716)	0.969 (1.674)	1.350 (0.987)	-0.020 (0.264)	0.340 (0.229)	-0.321 (0.278)
Grade 4	2,182.373* (969.098)	214.365+ (110.950)	12.227 (7.657)	0.330 (2.376)	2.055 (1.394)	0.199 (0.397)	0.358 (0.332)	-0.557 (0.409)
Grade 5	3,789.190** (1,001.711)	417.379** (148.065)	24.965* (10.359)	-2.157 (3.335)	2.341 (2.250)	0.021 (0.545)	0.834 (0.516)	-0.855 (0.560)
Weeks used	154.828** (16.298)	17.242** (1.613)	1.121** (0.108)	0.772** (0.032)	0.840** (0.024)	-0.008* (0.004)	-0.013* (0.005)	0.021** (0.005)
Start at grade level	-822.515** (266.043)	-80.972+ (45.657)	-7.050* (2.888)	-0.305 (0.953)	-0.921 (0.821)	-0.127+ (0.069)	-0.217+ (0.108)	0.344** (0.115)
Start above grade level	-1,342.198* (528.891)	-338.771** (50.860)	-28.949** (3.190)	2.132* (1.019)	-0.140 (0.577)	-0.046 (0.118)	-0.347+ (0.178)	0.393* (0.194)
Constant	4,830.831** (1,351.111)	387.196+ (223.858)	28.514+ (15.524)	4.302 (5.086)	8.558* (3.378)	-0.022 (0.802)	2.084** (0.722)	-1.062 (0.814)
Observations	64	64	64	64	64	64	64	64
R-squared	0.822	0.768	0.762	0.937	0.973	0.315	0.243	0.435

Note: Robust standard errors in parentheses. ** indicates $p < 0.01$, * $p < 0.05$, and $p < 0.1$.

Table A4. Relationship between background characteristics and outcomes on Zearn Math platform

Variables	(1) Total number of lessons	(2) Total badges	(3) Total K activities	(4) End below grade level	(5) End at grade level	(6) End above grade level
Black	-5.152 (12.885)	-1.620 (10.815)	0.912 (4.611)	-0.102 (0.108)	-0.209 (0.172)	0.312* (0.132)
Hispanic	3.270 (18.245)	-0.939 (15.764)	-0.843 (2.611)	-0.089 (0.090)	-0.007 (0.165)	0.096 (0.148)
Other	6.689 (15.240)	21.610 (13.374)	-3.096 (3.956)	-0.171 (0.151)	0.076 (0.184)	0.096 (0.139)
Female	-10.102 (16.645)	-6.437 (14.454)	-1.090 (1.855)	0.095 (0.091)	0.072 (0.161)	-0.167 (0.134)
Age	49.819+ (25.664)	49.063* (22.103)	1.945 (4.856)	0.174 (0.166)	-0.712* (0.281)	0.539* (0.256)
Grade 2	-37.671+ (19.693)	-41.799* (17.394)	-6.557 (6.076)	-0.105 (0.129)	0.731* (0.321)	-0.625* (0.295)
Weeks used	3.376** (0.522)	3.290** (0.472)	-0.096 (0.077)	-0.005 (0.005)	-0.025** (0.007)	0.029** (0.005)
Start at grade level	1.135 (10.598)	3.736 (9.433)	-6.198* (2.308)	-0.118 (0.114)	-0.033 (0.151)	0.151 (0.112)
Start above grade level	-50.808 (36.986)			-0.272 (0.246)	0.748+ (0.362)	-0.476 (0.308)
Constant	-297.544+ (159.696)	-292.466* (139.068)	-1.628 (31.947)	-0.887 (0.896)	5.710** (1.627)	-3.823* (1.571)
Observations	28	27	27	28	28	28
R-squared	0.817	0.824	0.390	0.330	0.709	0.768

Note: Robust standard errors in parentheses. ** indicates $p < 0.01$, * $p < 0.05$, and $p < 0.1$.

Table A5. Relationship between background characteristics and outcomes on Dreambox platform

VARIABLES	(1) Total minutes	(3) Standards proficient	(4) Standards progressed	(5) Total lessons passed
Black	-3.329 (775.950)	-9.314* (4.304)	1.045 (1.571)	-110.583* (48.823)
Hispanic	1,181.020 (1,184.896)	-5.969 (5.431)	3.681+ (2.162)	-110.069 (67.035)
Other	499.307 (1,738.549)	-6.395 (7.041)	0.775 (1.663)	58.234 (177.437)
Female	182.801 (711.828)	-6.586 (4.780)	1.834 (1.581)	-62.106 (48.591)
Age	5.929 (636.945)	3.448 (4.790)	-0.327 (1.903)	12.185 (43.113)
Grade 4	-39.363 (1,108.940)	-11.960+ (6.913)	4.021 (2.522)	-37.190 (77.223)
Grade 5	-3,636.431+ (1,868.181)	-22.245 (15.939)	5.586 (5.292)	-226.659+ (121.820)
Grade 6	-2,508.898 (2,427.421)	-27.265 (18.853)	1.376 (6.975)	-233.690 (169.010)
Grade 7	-2,751.023 (3,046.738)	-30.708 (26.287)	-11.551 (9.055)	-236.890 (224.235)
Grade 8	-2,397.565 (3,178.167)	-25.565 (24.887)	-7.900 (9.314)	-249.103 (234.985)
Weeks used	190.907** (38.282)	0.396 (0.236)	0.250** (0.091)	13.258** (2.670)
At or above grade level	-2,777.847+ (1,554.985)	-36.159** (11.335)	-12.246** (3.583)	-355.973** (113.596)
Constant	4,726.715 (4,844.702)	30.501 (37.086)	34.427* (15.033)	486.287 (342.678)
Observations	47	47	47	48
R-squared	0.688	0.427	0.761	0.719

Note: Robust standard errors in parentheses. ** indicates $p < 0.01$, * $p < 0.05$, and $p < 0.1$.

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