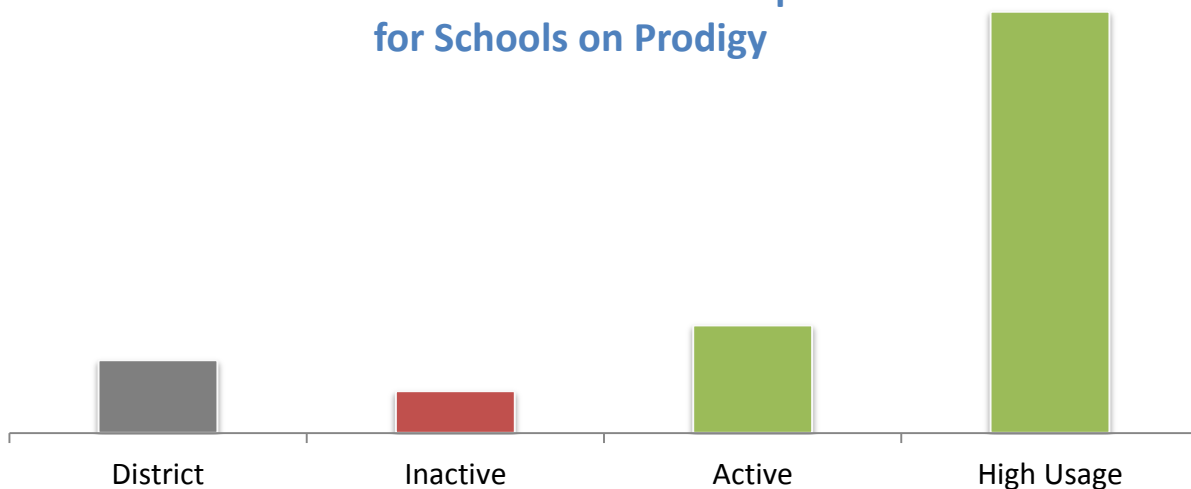


Can Game-Based-Learning Increase Standardized Test Scores?

A Statistical Analysis of Prodigy in Kawartha Pine Ridge DSB

Grade 3 Standardized Test Score Improvements for Schools on Prodigy



Abstract:

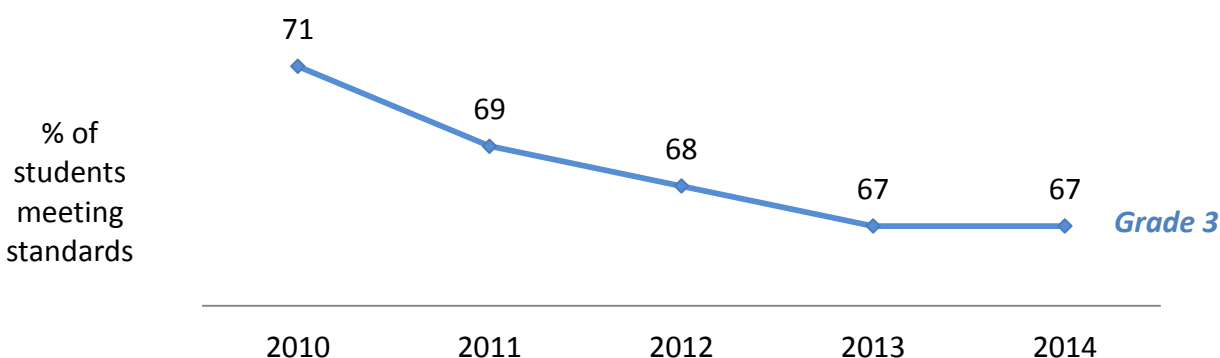
This paper compares the change in grade 3 standardized test scores for schools that are using Prodigy in a district of over 20,000 students against schools that are not. Prodigy is a free, self-paced math game that is curriculum-aligned (Ontario, Common Core, TEKS, and MAFS) for grades 1-8. The data shows that schools where over 85% of grade 3 students were active on Prodigy in the 2013-2014 school year had 11.6% more students meeting standards on EQAO (Ontario's annual standardized test) compared to the previous year. This represents an 11.5% difference over inactive schools, which only saw a 0.1% increase in students meeting standards over the same period of time.

Introduction

Scores are Declining

Each year, all grade 3 students in Ontario, Canada have to participate in standardized testing from the Education Quality and Accountability Office (EQAO). The test looks at students' efficacy with the application of math knowledge, critical thinking, and problem solving skills, instead of rote computation. With math scores declining, ***finding solutions that both engage students and improve outcomes has become the number one priority for districts in Ontario***¹.

Figure 1 – Decline in EQAO Math Scores Across Ontario Over 5 Years²



A Game-Based Approach

Kawartha Pine Ridge District School Board (KPRDSB) was one of the first innovative districts in Ontario to adopt Prodigy. Kawartha Pine Ridge's Director, Rusty Hick, saw potential in using a game-based approach to improve math engagement, and his team started informing schools about Prodigy early in the 2013-2014 school year.

"My team and I were very impressed with the way Prodigy incorporates the Math Curriculum into a video game format that appeals to this generation of students. The supports for teachers are excellent, and the free price tag made it an easy decision to roll Prodigy out to our schools."

– Rusty Hick, Director of Education

Figure 2 – District Overview (Kawartha Pine Ridge DSB)

Elementary Schools	Students (K-12) ³	Grade 3 Students ⁴
75	21,828	2,100

¹ Source: Math: Number one problem for Ontario school boards – The Toronto Star (http://www.thestar.com/yourtoronto/education/2014/08/27/math_number_one_problem_for_ontario_school_boards.html)

² Source: Education Quality and Accountability Office (<http://www.eqao.com>)

³ Source: Kawartha Pine Ridge DSB (<http://www.kprschoools.ca/about-us/GeneralInformation.html>)

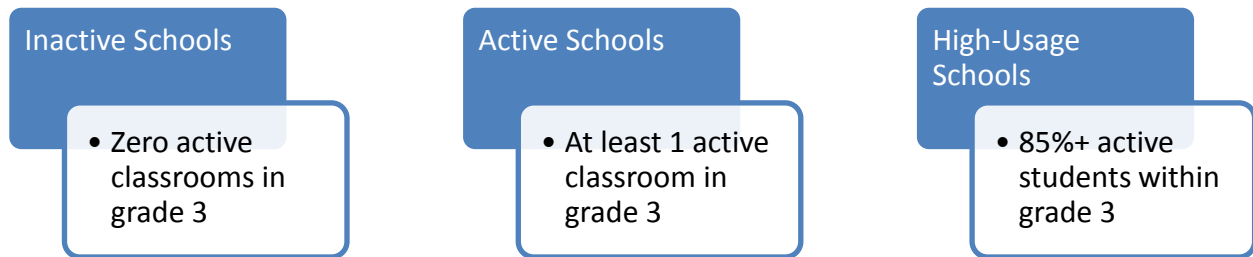
⁴ Source: EQAO School Board Report – Kawartha Pine Ridge DSB (<http://www.eqao.com>)

Evaluation Method

Schools and Grouping

All 75 elementary schools in the district are included in the scope of this study, and are divided into three categories based on their activity on Prodigy: Inactive schools (zero active classrooms in grade 3); Active Schools (at least one active classroom in grade 3); and High-Usage Schools (>85% active students within grade 3). Grade 6 EQAO results were not analyzed.

Figure 3 – School Categorization



A classroom is classified as active if students in the classroom had answered a combined 10,000 math questions on Prodigy (roughly 10 hours of gameplay per child). Schools in the High-Usage category are also included in the Active Schools category.

Data Collection

All EQAO data (EQAO scores and number of students participating) was collected from publicly available information on EQAO’s website⁵. All student activity data (number of students, time played and questions answered) was collected from data logged on Prodigy’s servers. All grade 3 classrooms in KPRDSB were using the free version⁶ of Prodigy.

EQAO Comparisons Over Time

All EQAO data was evaluated at the school level, as information for individual classrooms or students is not publicly available from the Education Quality and Accountability Office. Any improvements on EQAO data are calculated at the school level, by subtracting the percentage of students meeting standards in the 2012-2013 school year from the percentage of students meeting standards in the 2013-2014 school year. While this introduces factors which cannot be strictly controlled (e.g. new set of students, differences between teachers, etc.), using a large sample size of students and the district as a baseline mitigates the impact of these errors.

⁵ EQAO’s official website - <http://www.eqao.com>

⁶ Prodigy offers two membership types: Free and Premium. On free memberships, schools have access to 100% of Prodigy’s educational content, reports, assignments, and teacher features. The premium version unlocks vanity game features such as larger selection of robes, wardrobes, hairstyles, etc.

Results

School Breakdown

In grade 3, 24 elementary schools in KPRDSB were active on Prodigy, and 8 of these schools were in the high usage category.

Table 1 –Active and High-Usage Schools on Prodigy (Grade 3)

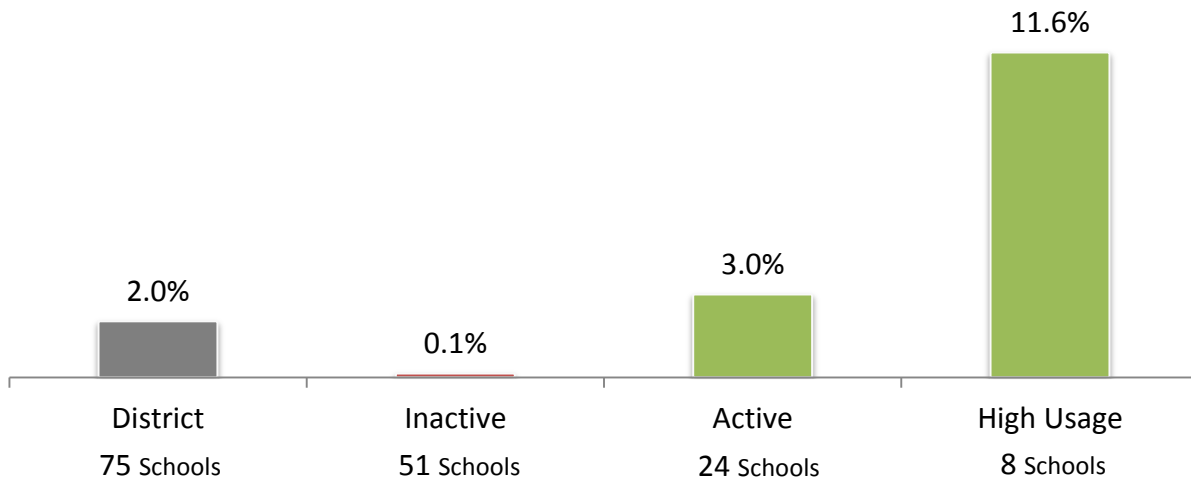
School	Category	Students (Gr 3)	% Students Active	Proficient 2013 (%)	Proficient 2014 (%)	Improvement (2014-2013)
Armour Heights	High-Usage	15	100%	70	80	10
C R Gummow	Active	66	62%	80	77	-3
Charles Bowman	Active	57	21%	51	47	-4
Dr G J MacGillivray	Active	107	19%	52	60	8
Dr Ross Tilley	High-Usage	38	89%	50	66	16
Grafton	Active	17	65%	64	65	1
Harold Longworth	Active	40	53%	54	55	1
Havelock-Belmont	Active	26	42%	51	42	-9
Hillcrest	High-Usage	23	87%	38	43	5
James Strath	Active	45	62%	79	69	-10
John M James	High-Usage	38	95%	66	82	16
Kawartha Heights	Active	23	61%	68	78	10
Keith Wightman	High-Usage	25	84%	61	60	-1
Kent	High-Usage	27	96%	53	71	18
King George	Active	17	65%	72	77	5
Millbrook/South Cavan	Active	36	78%	58	47	-11
Murray Centennial	Active	42	29%	55	40	-15
North Cavan	Active	20	70%	69	95	26
Norwood	Active	30	37%	68	67	-1
Otonabee Valley	High-Usage	26	100%	53	57	4
Plainville	High-Usage	22	100%	67	55	-12
Ridpath	Active	42	31%	47	52	5
Vincent Massey	Active	35	60%	86	77	-9
Waverley	High-Usage	33	100%	35	52	17
Average		850	67%	61.1	64.1	3.0

Improvements on EQAO by Category

In grade 3, a weighted average⁷ of schools that were active on Prodigy showed a 3.0% improvement on EQAO versus only a 0.1% improvement for schools that were inactive. Schools in the high-usage category improved by an average of 11.6%. This represents an 11.5% improvement over inactive schools.

⁷ Please see Appendix A for calculations of weighted averages

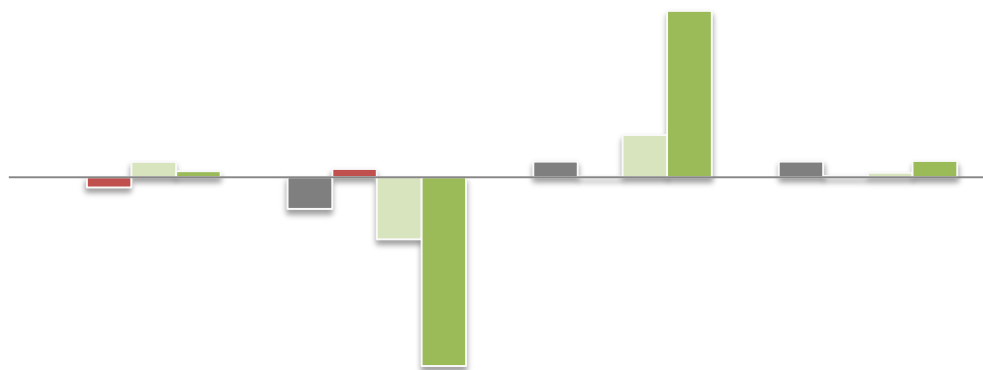
Figure 4 – Grade 3 EQAO Improvements for Inactive, Active, and High-Usage Schools on Prodigy



Distribution of Scores Across Levels

EQAO uses an achievement scale of 1 (low) to 4 (high) for student scores, with level 3 being the provincial standard⁸. In grade 3, schools that were active on Prodigy saw 2.7% more students move into level 3 from lower levels compared to the previous year, while there was little movement in inactive schools. The biggest change was in high-usage schools, where over 10% of students moved from level 2 to level 3 compared to the previous year.

Figure 5 – Change in Distribution of Scores Across Levels for 2013-2014 (Grade 3)



	Level 1	Level 2	Level 3	Level 4
■ District	0.0%	-2.0%	1.0%	1.0%
■ Inactive	-0.7%	0.5%	0.0%	0.1%
■ Active	1.0%	-3.9%	2.7%	0.3%
■ High-Usage	0.4%	-12.0%	10.6%	1.0%

⁸ Source: <http://www.eqao.com/Parents/FAQ.aspx?Lan>

Conclusion

Overall, schools that were active on Prodigy in the 2013-2014 school year saw large improvements in grade 3 EQAO scores compared to the previous year.

Schools with at least one active grade 3 classroom improved by 3.0%, versus a 0.1% improvement for inactive schools. Schools where over 85% of grade 3 students were active on Prodigy saw an 11.6% improvement on EQAO scores compared to the previous year, which was 11.5% higher than inactive schools!

The results suggest that along with classroom instruction and proper implementation, Prodigy's game-based approach to learning can have a positive impact on standardized test scores!

"As a teacher, I have never been a fan of video games. Prodigy changed my mind in a hurry. My students talked non-stop about Math, their mental math abilities skyrocketed and their confidence when completing problem solving questions was boosted. Bring on the standardized testing; we're ready for a battle."

Jeffory Hargrove, Grade 3 Teacher, KPRDSB

Appendix A – Calculation of Grade 3 EQAO Results by School

Table 1 – Number of Grade 3 Students by Level in Active Schools

School	2013				2014			
	Lvl1	Lvl2	Lvl3	Lvl4	Lvl1	Lvl2	Lvl3	Lvl4
Armour Heights	0	6	13	1	0	3	11	1
C R Gummow	0	11	39	10	2	11	45	6
Charles Bowman	4	23	25	5	3	27	24	3
Dr G J MacGillivray	2	59	62	6	3	38	59	5
Dr Ross Tilley	2	19	23	0	2	11	21	4
Grafton	1	13	23	2	1	4	10	1
Harold Longworth	2	17	23	2	2	15	21	1
Havelock-Belmont	3	14	17	1	3	12	11	0
Hillcrest	5	9	9	0	3	10	10	0
James Strath	0	10	35	6	0	14	25	6
John M James	3	14	28	5	0	3	28	5
Kawartha Heights	0	4	16	1	0	4	13	5
Keith Wightman	0	8	17	0	2	5	15	0
Kent	0	13	13	5	1	6	15	5
King George	0	6	17	6	0	4	9	4
Millbrook/South Cavan	2	11	14	4	3	15	16	1
Murray Centennial	0	16	20	2	0	19	15	2
North Cavan	0	5	11	0	0	1	15	4
Norwood	0	9	19	0	1	9	19	1
Otonabee Valley	2	13	18	0	3	7	15	1
Plainville	1	8	14	4	1	8	12	0
Ridpath	0	18	15	3	0	17	20	2
Vincent Massey	0	4	20	5	1	7	20	7
Waverley	7	21	13	2	7	9	17	0
TOTAL	34	331	504	70	38	259	446	64

Table 2 – Number of Grade 3 Students by Level in the District, Active, and Inactive Schools

Category	2013				2014			
	Lvl1	Lvl2	Lvl3	Lvl4	Lvl1	Lvl2	Lvl3	Lvl4
District	90	702	1175	184	86	636	1137	179
Active Schools	34	331	504	70	38	259	466	64
High-Usage Schools	20	103	131	17	17	57	129	16
Inactive Schools	56	371	671	114	48	377	671	115

Table 3 – Percentage of Grade 3 Students by Level in the District, Active, and Inactive Schools

Category	2013 (% of Students)				2014 (% of Students)			
	Lvl1	Lvl2	Lvl3	Lvl4	Lvl1	Lvl2	Lvl3	Lvl4
District	4.2	32.6	54.6	8.6	4.2	31.2	55.8	8.8
Active Schools	3.6	35.3	53.7	7.5	4.6	31.3	56.3	7.7
High-Usage Schools	7.4	38.0	48.3	6.3	7.8	26.0	58.9	7.3
Inactive Schools	4.6	30.6	55.4	9.4	4.0	31.1	55.4	9.5