



Sumdog Effectiveness Study

Glasgow City Council Schools

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Abstract

Sumdog is an educational website that motivates students to practise mathematics skills through online games. This study found that the length of time spent using Sumdog has a highly significant, positive impact on students' mathematics improvement.

Students who spent an average of 1 hour per week on Sumdog progressed 3 times faster in mathematics than students who spent less than 5 hours on Sumdog over the 6 month study. Students and teachers observed an improvement in both mathematics ability and attitude towards learning mathematics since beginning regular Sumdog use.

Introduction

Study Overview

The aim of this study is to determine whether there is a correlation between the length of time spent playing mathematics games on Sumdog and improvement in mathematics proficiency.

Andrew Gallacher, Mathematics Education Coordinator at The University of Glasgow and Dr. Afi Y. Wiggins, Senior Research Analyst at Texas State University are acting as independent reviewers to validate the methodology of this study.

The study ran between the 7th December 2015 and 24th June 2016 with 118 Primary 4 classes in Glasgow City. Participating classes were given a subscription to Sumdog's premium features. Students completed two diagnostic tests to determine their mathematics proficiency level at the start and end of the study. The total length of time they spent on Sumdog between these two tests was recorded.

Using ANCOVA and effect size, this study found that the more time students spend on Sumdog, the greater their proficiency improvement in mathematics.

Sumdog Overview

Sumdog is an educational website that motivates students to practise their mathematics, reading and writing skills through online games. All the mathematics questions on Sumdog are displayed in a consistent format. After selecting one of the 33 games, students are asked a multiple choice question with four possible answers. If the correct answer is selected, students can take part in the game. If students answer incorrectly, they are shown the correct answer and move onto the next question.

The majority of questions on Sumdog are automatically generated to ensure they are always different. At the end of the game students are shown corrections to any questions they answered incorrectly and for many of the skills, they can then watch a Khan Academy tutorial to help them understand the concept.

Sumdog's adaptive learning engine monitors and guides students to ensure that the questions asked are always appropriate for each student's ability level.

All of the games have a competitive aspect. Students can choose to compete against a computer opponent, students from their class, or students from around the world. Because students are asked their own personalised questions during the games, students of all ability levels can compete against each other fairly.

To motivate students, Sumdog rewards both effort and progress. When students answer questions correctly, their effort is rewarded by earning coins to spend in their on-screen house. When students master new skills through demonstrating fluency in their answers, their progress is rewarded by earning new tricks for their on-screen pets and their proficiency level increases.

Teachers with a subscription to Sumdog can access detailed reports on each student's progress and they can also create activities and assessments to focus each student's learning. Sumdog's skills are correlated to several curricula worldwide including the Scottish Curriculum for Excellence. The skills are ordered in line with the published outcomes for each curriculum. Teachers also have the option to adjust the order of these skills to match their teaching plan for the year.

Method

Experimental Design

This study uses a quasi-experimental pre-test post-test design. The mathematics proficiency level of students was measured at the start of the study using Sumdog's diagnostic test which students complete through playing games on

Sumdog. The initial diagnostic test was available from the 7th December, 2015.

Sumdog continuously updates each student's proficiency level as they master new skills on Sumdog. On the 30th May, 2016 the diagnostic test was reset for all students taking part in the study to re-assess their mathematics ability level and calculate their improvement in mathematics proficiency.

All teachers and students taking part in the study were asked to complete an online attitudinal survey in June 2016 to investigate the impact Sumdog had on their teaching and learning experiences. The survey questions were developed with the help of Andrew Gallacher who also visited three participating classes to interview teachers and students about their experiences.

Usage Measurement

Teachers agreed to use the mathematics section of Sumdog for 1 hour weekly with their class between the 7th December 2015 and the 24th June 2016 on computers or tablets, either at school or at home. To encourage usage, teachers were emailed weekly during the course of the study with advice on how to use Sumdog effectively.

Some teachers notified us that they did not have access to a computer suite in the school and only had a few computers in their classroom. For students who do not have access to the internet at home, this made one hour weekly usage difficult. On the 24th June 2016, the total length of time students spent playing games on Sumdog between initial and final diagnostic test was calculated.

Sample Selection

All Primary 4 classes in Glasgow (including composite classes) were invited to take part in the study with the help of Stephen Watters, Quality Improvement Officer at Glasgow City Council Education Services. Teachers who participated in the study were offered a free hands-on training course from Sumdog as well as a free subscription to all of Sumdog's premium features until the end of the school year for their class. Teachers agreed to use the mathematics section of Sumdog for 1 hour weekly with their students until the end of the school year, 24th June 2016.

118 teachers agreed to take part in the study which created a sample size of 2874 students. Students who did not complete the initial diagnostic test were not included in the study which reduced the sample size to 1093 students across 103 classes in 74 Glasgow Primary schools. This includes 75 Primary 4 classes, 14 Primary 3/4 classes and 14 Primary 4/5 classes. The majority of teachers had not used Sumdog before. 108 of the teachers attended a 1.5 hour hands-on training course to introduce them to Sumdog before the start of the study.

Students who did not complete both diagnostic tests have not been included in the study. This reduced the final sample size to 764 students across 63 schools. See Appendix 4 for full list of schools involved in the study.

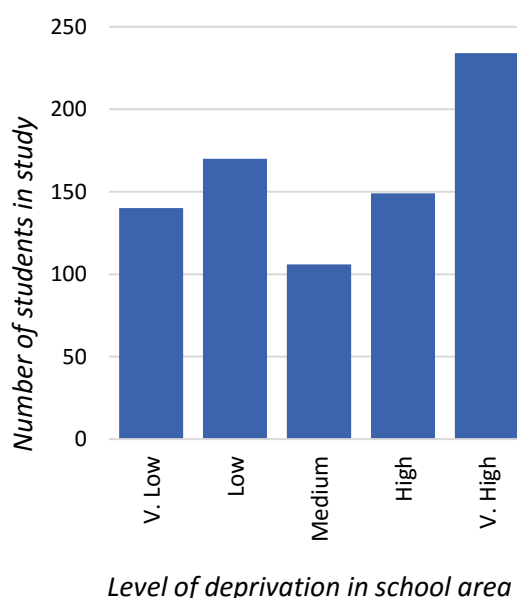
Demographics

Figure 1 shows the number of students in the final sample size of 764 students who live in deprived areas of Scotland using data from the Scottish Index of Multiple Deprivation, 2012.

The majority of students in this study attend a school where over 60% of the school population live in the 20% most deprived datazones in Scotland.

See Appendix 4 for more detailed demographic information.

Figure 1: Level of deprivation in school area of students participating in the study. Data from the Scottish Index of Multiple Deprivation, 2012



Level of Deprivation	Proportion of students in the school who live in the 20% most deprived datazones in Scotland
Very Low	0 - <20%
Low	20 - <40%
Medium	40 - <60%
High	60 - <80%
Very High	80% or more

Proficiency Measurement

Students completed a diagnostic test at the start of the study to determine their initial mathematics proficiency level. During this initial assessment, students answered up to 200 questions through playing games on Sumdog. The questions were automatically generated and gradually increased in difficulty depending on the answers chosen by students.

After completing the diagnostic test, students were given a skill to focus on depending on the result of the test. Sumdog records the accuracy and answering speed for each question to determine when students have mastered a skill. Each time a student masters a skill, their Sumdog proficiency level increases and they are given a new skill to focus on. Sumdog also periodically asks revision questions to maintain fluency of easier skills.

The proficiency levels on Sumdog are calculated by determining the percentage of Sumdog skills a student has mastered. For example, for skills at first level in the Curriculum for Excellence, the Sumdog proficiency levels range from 1.00 to 2.00.

A student with a proficiency level of 1.00 has not yet mastered any first level Sumdog skills, at 1.50 they have mastered 50% of the first level Sumdog skills. Table 1 defines the Curriculum for Excellence levels of learning.

The diagnostic test was reset for all students on the 30th May and teachers were asked to ensure students completed this final assessment before the end of term. The students' mathematics proficiency improvement was then calculated by subtracting their initial diagnostic level from their final diagnostic level. Students who had not completed both diagnostic tests were not included in the analysis. This resulted in a final sample size of 764 students.

The data was analysed by Emma Brown from Glasgow University using SPSS. ANCOVA and effect size were used to determine the relationship between time spent on Sumdog and improvement in mathematics proficiency correcting for student's initial diagnostic level, the date they completed the test, and the length of time between the two diagnostic tests.

Table 1: Scottish Curriculum for Excellence Levels of Learning

Level	Stage
Early	The final two years of early learning and childcare before a child goes to school and P1 (age 4-5), or later for some
First	To the end of P4 (age 7-8), but earlier or later for some
Second	To the end of P7 (age 10-11), but earlier or later for some

Results

Proficiency Improvement

Figure 2 shows the average improvement in mathematics proficiency between the initial and final diagnostic tests for students who spent increasing lengths of time on Sumdog.

As the length of time students spent on Sumdog increases, the average improvement in student's mathematics proficiency level also increases.

Improvement in mathematics proficiency was calculated by taking the difference between the initial and final diagnostic test results for each student in the study.

The average proficiency improvement was then calculated by taking the average of all student proficiency improvement values within each time interval. The number of students included in each of these time intervals is displayed in table 2.

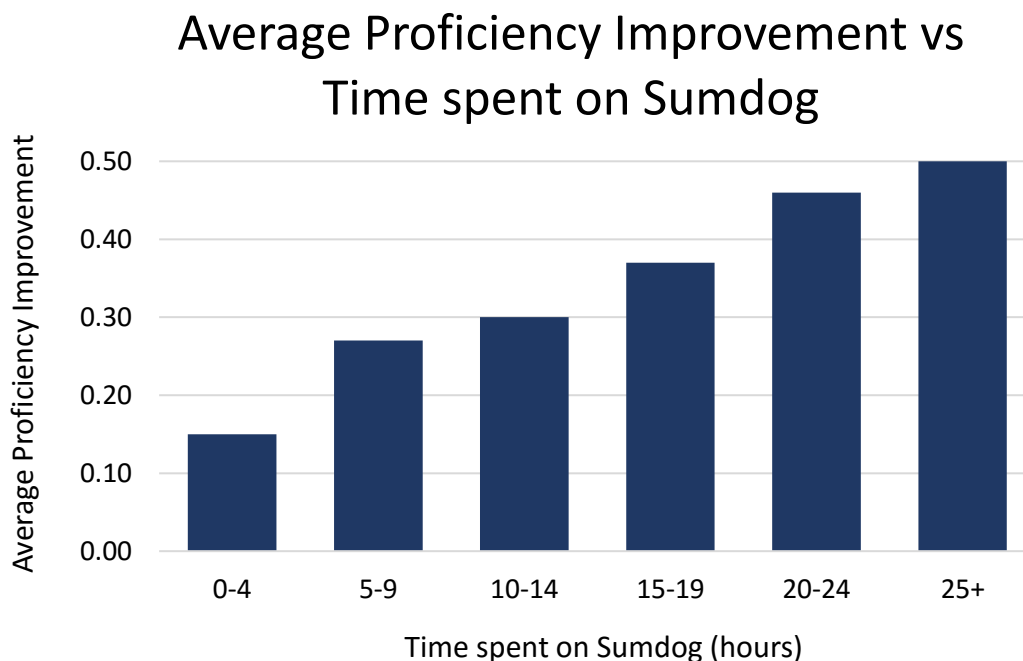


Figure 2: Average mathematics proficiency improvement for students who spent increasing lengths of time on Sumdog. The time intervals are defined as follows: 0-4 = $0 < t < 5$, where t = time spent on Sumdog (hours).

Table 2: Number of students in each time interval

Time spent on Sumdog (hours)	0-4	5-9	10-14	15-19	20-24	25+	Total
Number of students	188	193	146	100	51	86	764

On average, students who spent less than 5 hours on Sumdog over the course of the study (7th December 2015 – 24th June 2016) experienced a proficiency improvement of 0.15 which is 15% of a level of the Curriculum for Excellence. This corresponds to half a year of school work.

Students who spent 20 to 24 hours on Sumdog over the course of the study (on average 1 hour per week) experienced a proficiency improvement of 0.46 on average which is 46% of a level of the Curriculum for Excellence. This corresponds to a year and a half of school work.

Students who spent an average of 1 hour per week on Sumdog experienced 3 times the improvement of students who spent less than 5 hours on Sumdog over the course of the study.

A one-way analysis of covariance (ANCOVA) was conducted by Emma Brown, Glasgow University. The independent variable was time spent on Sumdog, the dependant variable was proficiency improvement and the covariates were initial diagnostic level and the time between diagnostic tests.

Table 3 shows the mean and standard deviations for each of the variables involved in this analysis. The mean

proficiency improvement was 0.30 with a standard deviation of 0.43. The value of 0.30 corresponds to an average proficiency improvement of 30% of a level in the Scottish Curriculum for Excellence.

Table 4 shows the ANCOVA results. The corrected model and all included variables are significant to at least 0.1%. This high level of significance suggests that proficiency improvement is dependent on the model that was created in ANCOVA.

The values of the partial eta squared effect statistic for the individual variables are 0.162, 0.015 and 0.059 for initial diagnostic level, time between diagnostic tests and time spent on Sumdog respectively. Using the guidelines for Cohen's d statistic suggests that the initial diagnostic level has a large effect size while the time between diagnostic tests has a small effect size. The lower a student's initial diagnostic test, the greater their proficiency improvement. The effect size value for time spent on Sumdog is 0.59 which is close to the border value of 0.06 for a moderate effect size.

The initial diagnostic level, time between diagnostic tests and time spent on Sumdog variables, all have a highly significant impact on the proficiency improvement. The more time a student spends on Sumdog, the greater their improvement in mathematics proficiency.

Table 3: Descriptive Statistics

Variable	Mean	Std. Deviation	N
Initial Diagnostic Level	0.91	0.49	764
Final Diagnostic Level	1.21	0.51	764
Proficiency Improvement	0.30	0.43	764
Time between diagnostic tests (days)	138.5	27.9	764
Time spent on Sumdog (hh:mm:ss)	13:17:46	13:22:29	764

Table 4: Analysis of Co-Variance for Proficiency Improvement by Time Spent on Sumdog

Source	Sum of Squares	Df	Mean Square	F-value	p-value	Partial Eta squared
Corrected Model	32.693	3	10.898	76.263	.000	.231
Initial Diagnostic Level	20.972	1	20.972	146.761	.000	.231
Time between Diagnostic Tests	1.709	1	1.709	11.956	.001	.015
Time spent on Sumdog	6.817	1	6.817	47.706	.000	.059
Error	108.601	760	.143	-	-	-
Total	208.361	764	-	-	-	-
Corrected Total	141.294	763	-	-	-	-

Attitudinal Surveys

Attitudinal surveys were sent to all teachers and students participating in the study to be completed by June 2016. See Appendix 5 for attitudinal survey questions. ICT restrictions within schools made it difficult for all students participating in the study to complete the survey. There were 43 teacher responses and 387 student responses in total which corresponds to 41% and 51% of participants respectively.

Students

The responses to the student attitudinal survey show that the majority of students have a positive attitude towards learning maths using Sumdog both in the classroom and at home. Figure 3 shows the responses to the first five questions of this survey.

Of the 387 students to complete the survey, 50% feel very happy when learning maths and 80% feel either very happy or happy. When asked how much they like

learning maths using Sumdog, 84% of the students were very happy and 96% were either very happy or happy.

The vast majority of the students would like to spend more time on Sumdog at school, with 79% of students selecting very happy and 92% of students selecting either very happy or happy with just 1% selecting unhappy.

The student attitudinal survey also investigated students' attitude towards mathematics homework as shown in Figure 4.

The majority of students who responded to the survey have a positive attitude towards learning maths at home through using Sumdog. Of the 387 students who responded, 41% of students selected very happy or happy when asked if they would like more maths homework and 33% selected unhappy.

Student Attitudinal Survey Responses

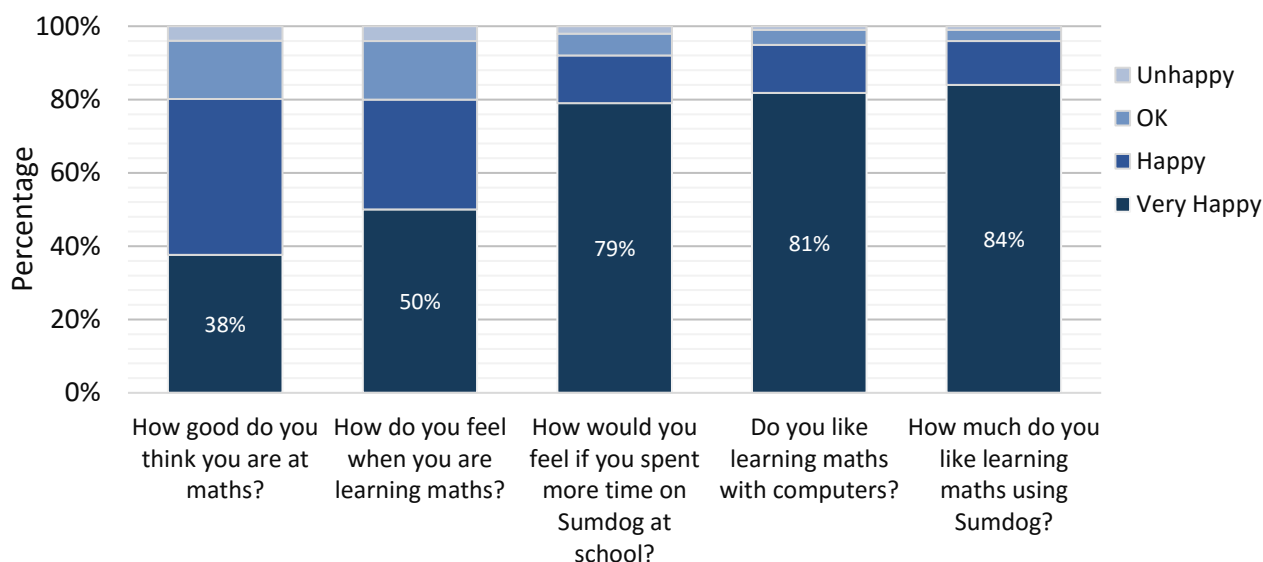


Figure 3: Student attitudinal survey responses to the first five questions of the survey

Student Attitudinal Survey Responses

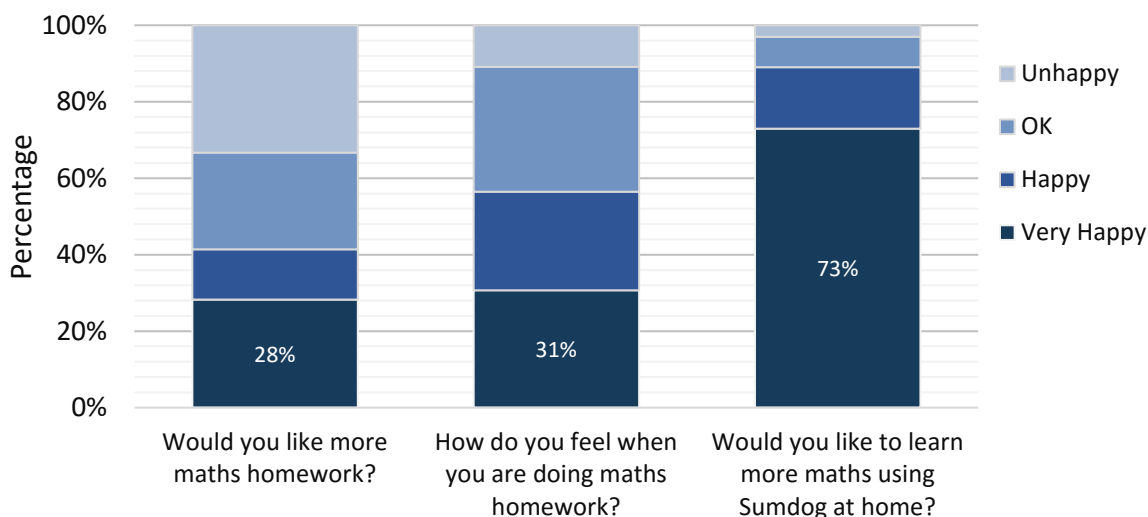


Figure 4: Student attitudinal survey responses to questions regarding mathematics homework.

When students were asked if they would like to learn more maths using Sumdog at home, 89% of students selected very happy or happy and only 3% of students selected unhappy.

Teachers

Of the 103 teachers who participated in the study, 43 teachers responded to the teacher attitudinal survey which consisted of 9 multiple choice questions followed by 6 longer questions. The responses to the multiple choice questions are shown in Figures 5 and 6.

77% of teachers who responded to the survey agreed or strongly agreed that Sumdog training prepared them to use the program and 79% agreed or strongly agreed that they were able to support students when they are using Sumdog to complete maths questions.

The majority of teachers saw an improvement in student engagement in maths since starting to use Sumdog. 65% of teachers selected agree or strongly

agree and only 4% selecting disagree or strongly disagree. When asked if their students had become more positive about maths homework through using Sumdog, 65% of teachers selected agree or strongly agree with 7% selecting disagree.

Figure 6 shows the teacher responses to questions regarding ICT access both at school and at home. 70% of teachers agreed or strongly agreed that their students have access to ICT in the classroom and 58% of teachers agreed their students have access to ICT at home. A later question in the survey allowed teachers to expand on this issue which revealed that access to ICT in the classroom was often limited. These comments are summarised in the next section of this report.

81% of teachers disagreed or strongly disagreed that students have more difficulties learning maths when they are using computers and 67% of teachers disagreed or strongly disagreed that they had had to reorganise their classroom to accommodate using computers.

Teacher Attitudinal Survey Responses

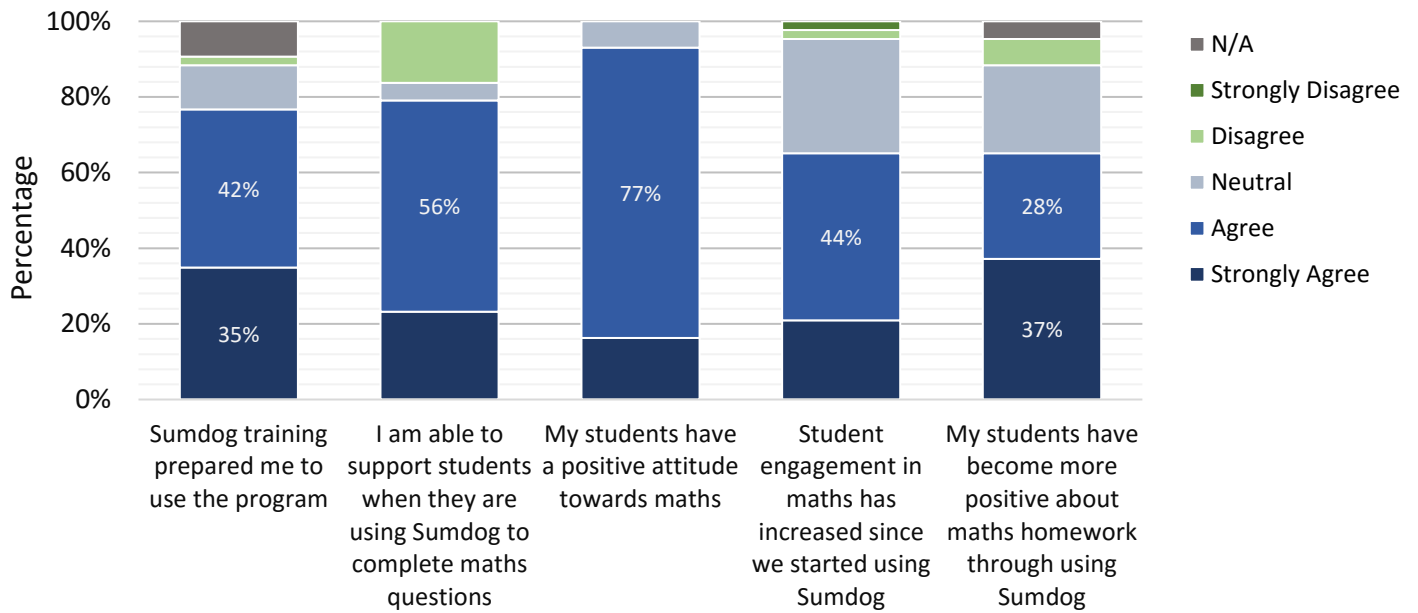


Figure 5: Teacher attitudinal survey responses 1-5

Teacher Attitudinal Survey Responses

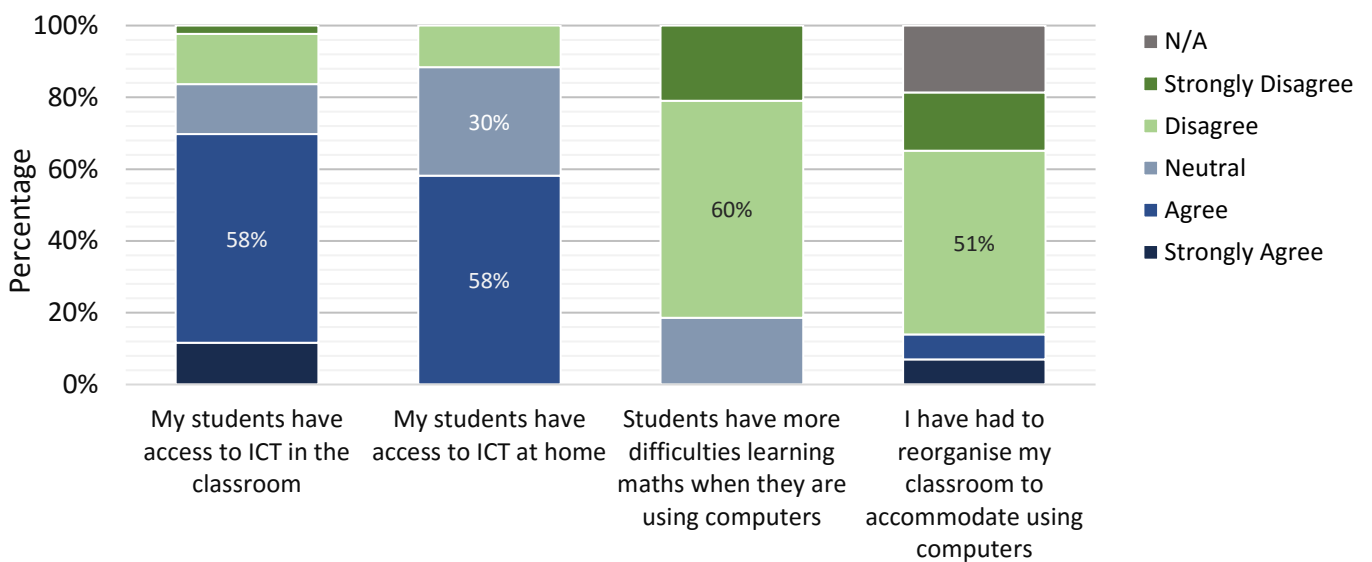


Figure 6: Teacher attitudinal survey responses for questions regarding ICT at school and at home

Overall, do your students enjoy learning with computers?

All 43 teachers who responded to the survey agreed that their students enjoy learning with computers. This matches the responses of the student survey discussed earlier.

How have your students' attitude towards maths changed since they started using Sumdog?

38 teachers noticed a positive change student's attitude towards maths. 26 teachers stated that Sumdog has increased their students' mathematics engagement. 9 teachers saw an increase in students' confidence in mathematics after starting to use Sumdog regularly;

'They are more confident when answering real life word problems'

- K. Jonker, Knightswood Primary

'They approach new concepts with more confidence and are more willing to take chances/less scared to get things wrong because of the fast pace and fun context'

- C. MacKay, Glasgow Gaelic School

3 teachers commented that students notice more connections between different mathematical processes, as well as between skills learned in the classroom and questions asked on Sumdog.

2 teachers commented that students are not aware they are learning when using Sumdog and 3 teachers noticed no change in students' attitude towards mathematics.

How has your enjoyment of, or success in teaching maths changed as a result of using Sumdog with your students?

26 teachers found their enjoyment of, or success in teaching mathematics was improved by using Sumdog;

'I have taken a great deal of satisfaction in seeing the increased enthusiasm for maths as a result, pupils request homework!'

- S. Gallagher, OLR Primary

'Using Sumdog has allowed me to spend more one to one time with the children to support them, rather than having to prepare materials and plan for hours, it has very much supported me as a teacher and made the implementation of maths more enjoyable.'

- D. McLeod, Oakwood Primary

'I have found setting homework through Sumdog has taken workload from me. I have found the ability to set assessments before a new topic in maths is started very useful.'

- F. McIntosh, Knightswood Primary

'It has improved as I can set baseline tests to extract what the students already know which allows me to target the areas where they are not so sure. I also use Sumdog to assess throughout to monitor to inform my teaching.'

- P4 teacher, Sandwood Primary

'I love that individual pupils are asking for tailor-made challenges to do at home!'

- P4 teacher, Camstradden Primary

5 teachers commented that the shortage of computer facilities in their school had limited their Sumdog usage. 7 teachers noticed no change.

How easy is it for your students to access ICT while at school? Are there any particular issues that may prevent you from making more use of computers?

29 of the 43 teachers commented that it is difficult for their class to access ICT at school due to limited access to laptops or an ICT suite. 1 teacher commented students could only access Sumdog at home. 4 teachers commented that Sumdog usage was limited as their assigned ICT time had to also be used for other aspects of technology such as coding practice.

'Unfortunately it is difficult to access ICT as the school only has a handful of laptops, which have to be shared between the whole school.'

- P4 teacher, Kelvindale Primary

'I have one stand alone computer in my class for 25 children. Getting the correct amount of time on Sumdog has been difficult. It has meant trying to get a share of the ten laptops in the school along with the other 13 classes'

- J. Rowe, Cardonald Primary

10 teachers were able to use an ICT suite regularly with their class.

How have you had to undertake changes to classroom organisation and management as a result of using Sumdog?

25 teachers did not have to make any changes to their classroom organisation or management. 8 teachers commented that they re-planned their ICT time to accommodate using Sumdog.

Due to limited computer access, 3 teachers commented that they split their class so that some worked on Sumdog while teachers worked with the others.

Compare the type of homework you assigned before using Sumdog to the type of homework you assign now. How have your maths homework assignments changed as a result of using Sumdog?

19 teachers now use Sumdog as homework. 12 teachers set a mixture of written homework and Sumdog homework. 7 teachers have made all maths homework online using Sumdog to set skills students focus on;

'Numeracy homework is now Sumdog based. Pupil engagement has been greater. There are obvious benefits to marking and setting task for a teacher.'

- K. Jonker, Knightswood Primary

'Before using Sumdog, I would generally send home a worksheet for children to complete. This took time, and a lot of paper, to organise. Setting homework through Sumdog has been much easier, and children tend to complete a lot more questions. All parents questioned at parents evening said they preferred homework being set through Sumdog. Where children have problems accessing the internet, I give them the opportunity to do their homework one lunchtime a week.'

- F. McIntosh, Knightswood Primary

'Pupils regularly play this at home through choice, I doubt they'd do this with other homework tasks.'

- C. MacKay, Glasgow Gaelic School

10 teachers commented that because not all of their students have internet access at home, they set Sumdog homework for their class but it is not obligatory;

'Many of the children have used Sumdog at home, however being in an area of high deprivation, I have not been able to assign specific homework based on Sumdog - more than two thirds of my class do not have computers / internet access at home.'

- D. McLeod, Oakwood Primary

'I tried setting Sumdog as a homework activity but not a lot of my children have access to the internet. Those who did have access enjoyed playing it at home and the parents were happy with them playing a safe game at home.'

- J. Rowe, Cardonald Primary

12 teachers did not change how homework was set, 3 of these teachers stated this was because of a lack of student internet access at home.

Overall experience of Sumdog

'I am particularly pleased with the effect it has had on those with barriers to learning for whom traditional classroom learning methods are not always appropriate.'

- L. Slinger, St Joseph's Primary

'Highly motivational for kids, fast pace unlike other websites.'

- G. Roulston, Kelvindale Primary

'Engagement levels have increased and I believe they have all made improvements - some with faster recall, some with answering word problems'

- K. Jonker, Knightswood Primary

'The children have really enjoyed using Sumdog, working their way through the activities, gaining new things for their pets and comparing what level they are on or what their pet can do. I would thoroughly recommend it for use with this age to encourage ongoing learning.'

- J. Hamilton, Whiteinch Primary

'The children have thoroughly enjoyed using Sumdog as part of their regular learning. It has given them the skills of encouraging each other to learn and supporting those who face maths as a challenge. Sumdog encourages everyone to be involved with maths. That is the most beneficial part about it.'

- M. Bennett, Tinto Primary School

'I cannot believe how successful Sumdog has been in my class. The children have been hooked on it since the start and love our sessions. It has transformed how many of them approach maths - in such a positive way! The challenges and assessments tool has been of great benefit to me as I can relate it to current work. Without doubt, attending the initial Sumdog training was one of the most beneficial things I have done. Thank you so much for the opportunity to use this amazing resource!'

- K. Robertson, Shawlands Primary

Case Studies

After an initial analysis of the teacher and student attitudinal surveys, three of these primary schools were visited by Andrew Gallacher, Mathematics Education Coordinator, University of Glasgow, in June 2016 to conduct face-to-face discussions with teachers and Primary 4 students who had been participating in the study.

The schools visited were Sandwood Primary School, Riverside Primary School and Tinto Primary School in Glasgow, Scotland. These three schools cover a range of deprivation levels as shown in Table 5.

The responses from these case studies reflect the results of the attitudinal surveys

with both teachers and students demonstrating a strongly positive attitude towards learning maths through using Sumdog at school and at home. See Appendices 1-3 for full case studies.

Table 5: Demographic information for case study schools. Data from the Scottish Index of Multiple Deprivation, 2012.

School	Proportion of students who live in 20% most deprived datazones in Scotland	Proportion of students from minority ethnic groups
Tinto Primary	25 - < 30%	> 20%
Riverside Primary	90 - < 95%	> 20%
Sandwood Primary	70 - < 75%	5 - < 10%

Conclusion

This study found that the length of time students spend on Sumdog has a highly significant, positive impact on their improvement in mathematics proficiency. The more time a student spends on Sumdog, the greater their improvement in mathematics proficiency.

Students who spent an average of 1 hour per week on Sumdog experienced a proficiency improvement of 0.46 of a level of the Curriculum for Excellence. This corresponds to a year and a half of school work and 3 times the improvement of students who spent less than 5 hours on Sumdog over the course of the study.

The feedback from the teacher attitudinal surveys suggest that teachers have seen an improvement in both the mathematics ability of their class and student attitude towards learning mathematics since they started to use Sumdog regularly.

There was also a very positive response from students both through the attitudinal surveys as well as in the case studies. The majority of students found learning mathematics at school more enjoyable when using Sumdog and would like to have the opportunity to use Sumdog more often, both at school and at home.

References

Scottish Index of Multiple Deprivation, 2012, full dataset available here:
<http://www.gov.scot/Topics/Statistics/Browse/School-Education/Datasets/contactdetails>

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Contributors

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Delivery of teacher training	Helen Le-Mar Steph Mann Charles Matthias
Collection and analysis of teacher training feedback	Helen Le-Mar
Weekly communication with participating classes	Helen Le-Mar
Weekly analysis of student activity	Helen Le-Mar
Implementation of timed diagnostic tests	Steve Robinson
Development of attitudinal surveys	Andrew Gallacher Helen Le-Mar
In person interviews with teachers and students	Andrew Gallacher
Write up of case studies	Andrew Gallacher
Analysis of diagnostic data with SPSS	Emma Brown
Review of methodology	Andrew Gallacher Afi Y. Wiggins
Review of data analysis	Andrew Gallacher Afi Y. Wiggins

Appendix 1: Sandwood Case Study

Sandwood Primary School Glasgow City Council

Andrew Gallacher
Mathematics Education Coordinator, University of Glasgow

Introduction

On the 9th of June 2016, Sandwood Primary School in Glasgow was visited to investigate student and teacher experiences using Sumdog.

The school visit was undertaken by Andrew Gallacher who has eight years experience as Mathematics Education Coordinator at the University of Glasgow. He has much experience with all aspects of both primary and secondary education by involvement in Initial Teacher Education but also through policy development at a National Level with Education Scotland, Scottish Survey of Literacy and Numeracy and the Scottish Qualifications Authority.

The format of this visit was a structured one hour discussion with pupils. Initially the visit was to involve a group of six pupils, but due to the pupils' enthusiasm to discuss Sumdog, it was quickly agreed with the class teacher that the discussion would involve all 30 pupils in the Primary 4 class.

After the class discussion there was a 30 minute discussion with the class teacher, Mrs. Lynne Scott, to gather her ideas and thoughts on the following pre-prepared themes:

- What experience do pupils have in using computers for learning?
- What is liked about Sumdog?
- Do pupils enjoy learning maths? Were attitudes changed?
- Do pupils use Sumdog outside the classroom? If so are there any issues?
- What could be improved?

School Demographics

Sandwood Primary School serves the area of Hillington in Glasgow and has a pupil population of 280, with 17 full-time teachers.

70-75% of students at the school live in the 20% most deprived datazones in Scotland and 5-10% of students are from minority ethnic groups (Scottish Index of Multiple Deprivation, 2012).

Mrs. Scott had been a computer programmer before retraining as a primary teacher. This gave her a unique perspective on digital skills and the use of computers in learning.

Experience of Learning with Computers

One of the first questions asked was whether the use of Sumdog had required any changes to practice or classroom arrangement? The answer was that using Sumdog had not resulted in any change to classroom layout as pupils were familiar with using the trolley of laptops in other curricular areas. It had been straight forward to allocate pupils to accessing Sumdog as required.

In terms of learning and teaching there was a blended approach which involved direct teaching, individual work and use of laptops. It was strongly felt that the information provided through Sumdog helped inform the teacher about each individual pupil's progress and understanding of skills covered in class. This allowed the teacher to adapt their teaching to support pupil's learning.

Pupils were keen to highlight several programs they had tried. These were mainly from BBC and GLOW websites and included titles from different curricular areas.

Pupils' experience of these titles was not very positive as they thought that they were boring or lacked progression. The only exception was with coding where the pupils liked the interface and the tasks they were given.

School laptops were very regularly used, when available, for all curricular areas and pupils were confident in their use.

The class teacher was very keen to develop ICT skills across the curriculum for her pupils. This was reflected in their developing skills and confidence in using the laptops as well as various other websites and programs. She also observed that pupils were very confident in helping each other when they encountered problems and they enjoyed sharing experiences about the site.

Sumdog Usage

Overwhelmingly pupils thought that Sumdog was better than any other maths or numeracy program they had used.

The ability to develop a character, or avatar, was very exciting for pupils and they would like to see further features to allow this to become an even more creative undertaking. This was also linked to the reward system of coins. Pupils liked earning coins and gave suggestions as to how they spent them.

“Pupils thought that Sumdog was better than any other maths or numeracy program that they had used”

The option to play against their classmates was also a very positive aspect of Sumdog. Most pupils had used this feature.

Around half of the pupils had been involved in a Sumdog contest where pupils compete against others from Glasgow or around the country. They enjoyed this aspect of the game although not all pupils had realised that it had existed when they had played.

The attitude of parents and carers was very positive and pupils enjoyed discussing progress and what they were learning after spending time on Sumdog. It was also possible to demonstrate the work to adults, which was well received.

The class teacher endorsed the pupil comments and added that the game format was very encouraging for pupils to engage with.

Training

There was a training session organised for teachers at the start of the program and it was the teacher’s opinion that this was very informative.

Pupils had been shown the program by the class teacher. She then demonstrated the features to the class and ensured that all laptops had software updates.

After this initial stage, pupils confirmed they had been very comfortable progressing with Sumdog as they felt it was easy to use. When they did encounter issues this was because initially they were not familiar with the game format. However, pupils confirmed that if they got stuck a classmate or friend would give them advice. Pupils enjoyed this opportunity to help and support each other.

Attitude towards learning maths

Pupils were keen to share that they had been fairly positive about learning maths before using Sumdog. Overwhelming opinion was that maths was more fun using Sumdog than before when most of the work was from textbooks. Some pupils were very vocal that they felt the textbook was boring.

During the visit, pupils decided to have a vote on their favourite subject. This came about as several pupils mentioned that maths had been enjoyable before, but now it had become even more enjoyable due to Sumdog. By show of hands all pupils rated maths as one of their top two favourite subjects to learn and this was regardless of their ability level.

“Overwhelming opinion was that maths was more fun using Sumdog than before when most of the work was from textbooks”

When asked to explain why they enjoyed using Sumdog, the main response was that pupils felt they were progressing with maths and they could see that in the program.

Some pupils liked the competitive element Sumdog offered as they had competition from classmates. The class also had the opportunity to compete as a team in a Glasgow contest which inspired all of the pupils.

During the visit Andrew witnessed the enthusiasm of all the pupils to do well for the class team. They enthusiastically celebrated after checking the class average to find they had been promoted to the contest leaders on the day of the visit.

The class teacher noted that several pupils had been up early in the morning to complete their quota of questions as participating in a school show had reduced their usual Sumdog time in school.

Pupils made it clear that they understood the importance of answering questions correctly on Sumdog in order to progress rather than guessing answers.

The contests are set by Sumdog on a regular basis to help engage pupils. However, challenges can also be set by the class teachers. This was a feature that the class teacher had used but pupils had preferred the centrally organised events.

Pupils can answer up to a thousand questions during the week long Sumdog contests which are open to all classes in the region that use Sumdog. A class average of the correct scores is calculated and then displayed in a contest leader board. This is what the Sandwood pupils were very keen to reach the top of.

At the end of the allotted time the contest winners are determined and prizes awarded for classes and students with the highest scores.

Challenges set by the teacher were seen as a positive idea by pupils, but they wanted a new set of questions and hoped that the rewards could be set differently for this type of challenge.

Sumdog use outwith the classroom

There were a small number of issues getting online outwith the classroom. The main issue was with home wifi connection, which by pupil accounts were not always great. The second issue was with pupils using older technology at home and not having updated the software that was suited for purpose such as Internet Explorer.

Some pupils had used the Sumdog app, but would like it to offer more features. App usage was mainly on smartphones or tablet devices.

“Sumdog is a great website it helps my learning. Games are a great opportunity to help and make learning more fun”

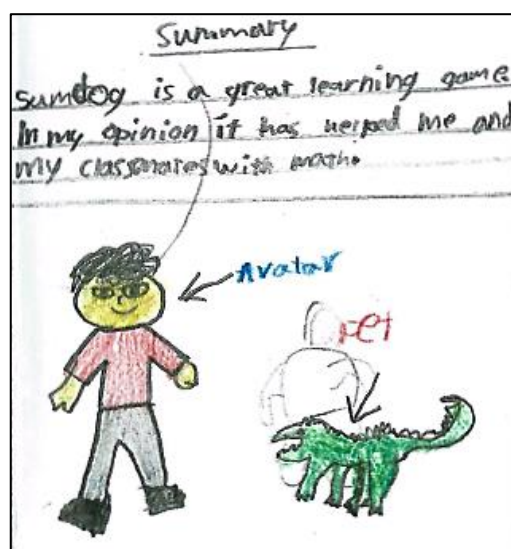
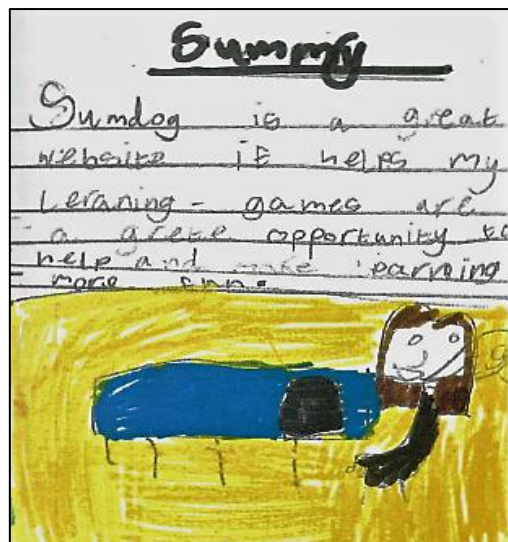
- Abbie, P4, Sandwood Primary

It also came across very clearly from pupils that they felt able to help fellow pupils to rectify some of the access problems. This came about through usage in class and by organised discussion where pupils were able to share knowledge and experience.

Sumdog use outwith the classroom also increased parent and adult awareness of Sumdog. A few of the adults had tried the games and many had mentioned to the class teacher about what they felt were the positive effects of their children using Sumdog. This included seeing the progress pupils were making and that they were enjoying maths.

Some adults were concerned about the length of time spent on computers, but felt this could be moderated. They also preferred that the activity was educational rather than just a gaming format.

The teacher indicated that they would like a greater number of laptops to share within the school. She also indicated that the number of access issues amongst her pupils were very small and she was confident that they had been overcome.



Extracts from student reports on Sumdog produced by Primary 4 students at Sandwood Primary School, Glasgow.

“Our class have been using Sumdog regularly over the last 6 months and I notice an increase in the speed, accuracy and motivation of the mental maths”

- Mrs L. Scott, Sandwood Primary

Suggestions for improvement

Comments from pupils were very imaginative and at times corresponded to the type of game play or characterisation that is prevalent in commercial games on home consoles. This would include more characterisation features as well as an expansion of the playing area to include streets, blocks of flats or houses.

Additional games and adventures were also heavily discussed and although there was no clear consensus the likes of Basketball and Dodgeball were mentioned as possibilities that pupils felt they would enjoy.

Having listened to the pupil comments, their teacher Mrs Scott added that the existing games and format were very popular with pupils.

She was very pleased with the curricular content but had noted there were a couple of gaps relating to geometry and angles as well as coordinates and would like to see this developed to give full curricular coverage. Since this visit Sumdog has added these suggested skills and worked to ensure all relevant primary school level skills are covered on Sumdog.

Advice to new users

Pupils

The advice of pupils to new Sumdog users was that they really need to try the questions and games as they would enjoy them.

They felt that the format was easy to understand and any questions could be supported by classmates.

There were several comments about persevering with the initial diagnostic test which may include some hard questions as the pupils understood this was the program trying to identify their ability level.

Teachers

The class teacher felt very much the same as the pupils in that the format was easy to use. She also thought that new pupils would enjoy using Sumdog after an initial explanation regarding the variety of questions asked during the diagnostic test.

There was no need to rearrange classrooms. Instead it was very possible to incorporate the information on pupil progress across the different topics to inform the teacher about their own teaching and planning.

“Sumdog is a great learning game, in my opinion it has helped me and my classmates with maths”

- Alex, P4, Sandwood Primary

Summary

Pupils were very keen to use computers to learn mathematics.

The classroom teacher liked the additional information on progress and support on topics that Sumdog offered. She also used this information to inform her planning and teaching.

Pupils enjoyed the variety of questions, the ability to track their progress, and ability to share this with classmates as well as parents and carers.

Pupils would like to see even more scenarios to challenge them and further personalisation of their online characters.

Most pupils were already positive about maths but the use of Sumdog had promoted this attitude so that it was now rated as either first or second favourite subject.

Outwith the classroom pupils were very keen to use Sumdog whether it was for homework or the contests.

There were minor issues relating to internet access via home wifi and software updates that collectively pupils managed to overcome by sharing advice.

“I think Sumdog is a fantastic tool for me as a teacher to track student progress. I love to set up assessments prior to beginning a new numeracy topic to assess what the students already know to inform my planning. In addition, during and at the end to ensure my teaching is effective and my students are progressing. The children enjoy participating in contests at class, city and national levels.”

- Mrs L. Scott, Sandwood Primary

References

Scottish Index of Multiple Deprivation, 2012, full dataset available here: <http://www.gov.scot/Topics/Statistics/Browse/School-Education/Datasets/contactdetails>

Appendix 2: Riverside Case Study

Riverside Primary School Glasgow City Council

Andrew Gallacher
Mathematics Education Coordinator, University of Glasgow



Introduction

On the 9th of June 2016, Riverside Primary School in Glasgow was visited to investigate student and teacher experiences using Sumdog.

The school visit was undertaken by Andrew Gallacher who has eight years experience as Mathematics Education Coordinator at the University of Glasgow. He has much experience with all aspects of both primary and secondary education by involvement in Initial Teacher Education but also through policy development at a National Level with Education Scotland, Scottish Survey of Literacy and Numeracy and the Scottish Qualifications Authority.

The format of this visit was a structured one hour discussion with pupils. It was agreed with the class teacher during a telephone conversation that the discussion would involve all pupils in the class.

After the class discussion there was a 20 minute discussion with the class teacher, Ms. Meney, to gather her ideas and thoughts on the following pre-prepared themes:

- What experience do pupils have in using computers for learning?
- What is liked about Sumdog?
- Do pupils enjoy learning maths? Were attitudes changed?
- Do pupils use Sumdog outside the classroom? If so are there any issues?
- What could be improved?

School Demographics

Riverside Primary School serves the area of Govan in Glasgow and has a pupil population of 216, with 14 full-time teachers. It was formed in 2010 as an amalgamation of two previous schools. The school is in a new building as part of a shared campus with a denominational primary school.

90-95% of students at the school live in the 20% most deprived datazones in Scotland and more than 20% of students are from minority ethnic groups (Scottish Index of Multiple Deprivation, 2012).

The class visited was a composite class which contained both Primary 4 and Primary 5 pupils.

Experience of Learning with Computers

There were a small number of maths programs that pupils had tried before using Sumdog. Opinions varied on these programs and some pupils had liked using angle estimator. Other programs were mainly from BBC and GLOW websites and these mainly covered languages. Pupil experiences of these programs were not always positive as they didn't enjoy the games and often found the content had not been covered as yet in class.

School laptops were used fairly regularly when available through a booking process. For all curricular areas pupils were becoming confident in using online content. There were some issues at times with wi-fi connection.

The class teacher was keen for her pupils to develop ICT skills across the curriculum and this was reflected in pupil's confidence

using the laptops for different websites and programs.

The class teacher also thought that the pupils were positive in offering help to each other when then they encountered problems and liked to share experiences.

Pupils also discussed this idea of peer help a lot during our time and gave practical examples of where this had happened. Overall they were very positive about both giving and receiving advice and help from fellow pupils. It was also clear that some pupils had friends or siblings who had also used Sumdog and advice was also shared using this method.

Training

There had been a training session for teachers at the start of the program which the class teacher had found very informative.

The class teacher had demonstrated Sumdog features to her class and then ensured that she was able to support logins and how to start answering questions. This was not thought to be difficult or time consuming.

After this introduction the pupils had been very comfortable progressing with Sumdog as they felt that the system was easy to use. When pupils encountered a problem they initially relied on the class teacher, but after a short period of time they tended to rely on classmates for this advice or help.

Pupils enjoyed this opportunity to help and support each other. This helped develop confidence in both Sumdog and computers in general.

Sumdog Usage

Pupils accessed Sumdog in school using laptops and there were no classroom organisational issues that affected pupil usage apart from availability of these shared computers.

Coin rewards were a great incentive for the pupils. Pupils enjoyed decorating their on-screen house and developing their character through using the coins they earned to buy new items and outfits. Pupils would like to see more items added to the on-screen store to allow further personalisation.

The attitude of parents and carers was also very positive as pupils liked the chance to discuss progress and what they had learned after spending time on Sumdog.

Ms. Meney also said that several parents and even grandparents had approached her about Sumdog. The comments and discussions were extremely positive with the adults commenting that they were very keen to support the pupils in using computers as they were very aware of the pupil enthusiasm and progress with Sumdog.

Several pupils had been sceptical about using computers to learn maths, but now that they had engaged they were very enthusiastic.

Attitude towards learning maths

Most pupils were keen to share that they had been positive about learning maths before using Sumdog. They also felt that on the whole they were good at maths.

Some of these responses were positively surprising to the class teacher who had not expected some of the pupils who

volunteered this information to think about maths in that positive way. A large majority of the class were of the opinion that maths was more fun now they used Sumdog.

Many pupils liked being able to track their progress. A handful of pupils also commented that they liked to have competition from classmates to see both who had successfully completed more questions and for the levels attained in each topic.

“A large majority of the class were of the opinion that maths was more fun now they used Sumdog”

Sumdog use outwith the classroom

There were a small number of issues getting online outwith the classroom which was mainly due to home wi-fi connection. The second issue was with pupils using older technology at home.

It also came across very clearly from pupils that they felt able to help fellow pupils to rectify some of the access problems that were encountered outwith the classroom. This came about through usage in class and by organised discussion where pupils were able to share knowledge and experiences.

The class teacher also ensured that pupils knew they could have free access Sumdog, and the internet, both in the school library and in the local library.

The teacher indicated that they would like a greater number of laptops to share within the school. This would allow time to be dedicated to developing IT skills and ensuring online access.

She also indicated that the number of access issues amongst her pupils were relatively small and had diminished over time. She was confident that they had been overcome through peer help and her support.

Suggestions for improvement

When asked how to make the Sumdog experience even better, pupils were very imaginative in their responses. As with pupils from other schools, they wanted to make the games more elaborate and possibly to include other games such as basketball.

Characterisation was also very important to pupils as was an expansion of the playing area to include larger flats of houses or even streets for the characters to move around.

Additional adventures were also heavily discussed although there was no clear consensus as to the form that these would take.

Having listened to the pupil comments their teacher, Ms. Meney, added that the existing games and format had become very popular with her pupils.

References

Scottish Index of Multiple Deprivation, 2012, full dataset available here: <http://www.gov.scot/Topics/Statistics/Browse/School-Education/Datasets/contactdetails>

“Attitudes towards learning mathematics have improved since pupils began using Sumdog”

Summary

Pupils, parents and teachers had become very confident in using computers for learning due to the positive experiences of Sumdog.

Role playing was a strong reason for the pupil enjoyment, but the best part of using Sumdog for all pupils was the ease of use and the ability to see their progress.

Attitudes towards learning mathematics improved since pupils began using Sumdog. This was evidenced by pupils questionnaires and follow up discussions where the overall positivity had even surprised the class teacher.

Outwith the classroom many pupils used Sumdog regularly and in turn they were strongly supported by parents and carers. This was due to the adults becoming aware of pupil enthusiasm and the chance to discuss progress.

Appendix 3: Tinto Case Study

Tinto Primary School Glasgow City Council

Andrew Gallacher
Mathematics Education Coordinator, University of Glasgow

Introduction

On the 9th of June 2016, Tinto Primary School in Glasgow was visited to investigate student and teacher experiences using Sumdog.

The school visit was undertaken by Andrew Gallacher who has eight years experience as Mathematics Education Coordinator at the University of Glasgow. He has much experience with all aspects of both primary and secondary education by involvement in Initial Teacher Education but also through policy development at a National Level with Education Scotland, Scottish Survey of Literacy and Numeracy and the Scottish Qualifications Authority.

The format of this visit was a structured one hour discussion with pupils based on themes that arose from recent online surveys. The initial plan was to involve a group of six pupils. However, due to the pupils' enthusiasm to become involved in the discussion and give their opinions about Sumdog, it was quickly agreed with the class teacher that the discussion would involve all 30 pupils in the Primary 4 class.

After the class discussion there was a 30 minute discussion with the class teacher, Mr. Bennett, to gather his ideas and thoughts on the following pre-prepared themes:

- What experience do pupils have in using computers for learning?
- What is liked about Sumdog?
- Do pupils enjoy learning maths? Were attitudes changed?
- Do pupils use Sumdog outside the classroom? If so are there any issues?
- What could be improved?

School Demographics

Tinto Primary School serves the area of south Glasgow including Darnley and Merrylee and has a pupil population of 454, with 22 full-time teachers.

25-30% of students at the school live in the 20% most deprived datazones in Scotland and more than 20% of students are from minority ethnic groups (Scottish Index of Multiple Deprivation, 2012).

Experience of Learning with Computers

After a series of short questions to put the pupils at ease with the session format, we began the more structured questioning which was to last for around an hour.

Pupils had tried several programs such as Poisson Rouge for learning language and Scratch for coding, but very few maths programs were mentioned. Pupils stated this was because they seldom found maths programs that matched what they were learning in class and the programs were boring and lacked progression. This was different to their experiences with coding where pupils liked the interface and the tasks they were given.

Mr. Bennett was very keen to develop ICT skills across the curriculum for his pupils. The central computer room was viewed as an excellent asset, but due to the size of the school population it was constantly in demand which limited computer availability.

Pupils were very positive in explaining how they supported fellow pupils when they had become stuck or had technical issues. Mr. Bennett encourage this as he felt it was beneficial for pupils to become confident in helping each other.

Training

A training session was organised for teachers, but unfortunately due to illness the class teacher had been unable to attend. Pupils had been shown how to use the program by the class teacher. He had demonstrated some of the features to the class and then allowed them to explore the site themselves as they had been so keen to get started.

Pupils explained with enthusiasm that they had been very comfortable learning to use Sumdog on their own as they found the website easy to use. When issues were encountered, pupils were happy to help and advise each other to overcome them.

Overall the pupil responses were very positive about the ease of use and the only delay in progress was in some pupils not quite grasping the aim of certain games. These pupils then said that when the format was understood they were very happy with tasks and subsequent progress. Any initial problems were minor did not deter their enthusiasm.

Sumdog Usage

Mr. Bennett used Sumdog with the whole class when he was able to book a central computer room. During these sessions pupils also practised coding skills using Scratch. The computer room was the main way the class accessed Sumdog so Mr. Bennett did not have any classroom organisational issues using Sumdog.

Mr. Bennett used information on pupil progress from Sumdog to personalise classroom work for individual pupils. This allowed him to support weaker areas and amend progression for topics that pupils were more confident with.

“Pupils were very enthusiastic about using Sumdog stating it was better than any other maths or numeracy program they had used”

Pupils were very enthusiastic about using Sumdog stating it was better than any other maths or numeracy program they had used. When asked, they said that Sumdog helped them understand the work they were doing in class and that it was fun to learn using Sumdog.

Coin rewards were also a great incentive for the pupils. Pupils enjoyed decorating their on-screen house and developing their character, or avatar, through using the coins they earned to buy new items and outfits. Pupils would like to see more items added to the on-screen store to allow further personalisation.

Pupils were motivated by the ability to compete against their classmates during the games and with pupils from around the world during Sumdog contests.

Contests are set by Sumdog on a regular basis to help engage pupils. Pupils can answer up to a thousand questions during the week long Sumdog contests which are open to all classes in the region that use Sumdog. A class average of the correct scores is calculated and then displayed in a contest leader board.

Nearly all of the pupils had been involved in a Sumdog contest where pupils compete against others from Glasgow or around the country. They had enjoyed this aspect of the website, especially as many pupils had won prizes.

Mr. Bennett endorsed the pupil comments and added that the game format was very encouraging for pupils to engage with.

Attitude towards learning maths

Pupils were keen to share that they had enjoyed learning maths with Mr. Bennett before using Sumdog. However, the overwhelming opinion of the class was that practicing maths was more fun when using Sumdog than it was when most of the work was from textbooks. Some pupils were very vocal that work from textbooks were very boring.

When asked to explain why they enjoyed using Sumdog, the response was that pupils could see their progress which allowed pupils to challenge themselves more. Pupils also liked the variety of questions asked on Sumdog.

Some pupils commented that they enjoyed the competitive element of Sumdog which motivated them to answer questions correctly in order to beat their classmates. Other pupils were keen to report that they thought their progress had improved through using Sumdog.

Pupils made it clear that they understood the importance of answering questions correctly on Sumdog in order to progress rather than guessing answers.

Sumdog use outwith the classroom

A number of pupils encountered issues accessing Sumdog outwith the classroom. The main issue was with home wi-fi connection, which by pupil accounts, were not always great. The second issue was with pupils using older technology at home and not having updated the software that was suited for purpose such as Internet Explorer.

Access to the internet was available through both school and public libraries and there was evidence that a number of pupils had taken the opportunity to use these facilities.

It also came across very clearly from pupils that they felt able to help fellow pupils to rectify some of the access problems. This came about through usage in class and by organised discussion where pupils were able to share knowledge and experience.

Sumdog use outwith the classroom also increased parent and adult awareness of Sumdog. The class teacher commented that the attitude of parents and carers towards using Sumdog to practice maths skills was extremely positive.

Many of the adults commented on what they felt were the positive effects of their children using Sumdog. These included seeing pupils enjoy maths homework and being able to view pupils' progress.

Pupils enjoyed the opportunity to discuss their progress and demonstrate their work to adults. This was well received and discussed with the class teacher in a very positive manner.

Mr. Bennett commented that he would like greater access to computers for his pupils and would like the subscription to Sumdog to continue as he had seen the positive effect it had on his class over the last 3 months.

Suggestions for improvement

Pupil comments were very imaginative when discussing possible customisation of their characters. Some of the costume ideas were based on projects the class had been studying such as pirates.

The class would like to see more characterisation features to purchase with coins. They would also like to see an expansion of the playing area to include streets, blocks of flats or houses.

Additional games and adventures were also discussed and although some suggestions sounded like descriptions of console games already used there were many suggestions to enhance the features of existing games such as football.

“The overwhelming opinion of the class was that practicing maths was more fun when using Sumdog than it was when most of the work was from textbooks”

Advice to new users

Pupils

The advice of pupils to new Sumdog users was that they really need to try the questions and games as they would enjoy them. They also felt that the format was easy to understand, and then, any issues could be supported by fellow pupils.

There were several comments about persevering with the initial diagnostic test which may include some hard questions as the pupils understood this was the program trying to identify their ability level.

Teachers

The class teacher agreed that the website was easy to use. Mr. Bennett commented that it was important to let parents and colleagues know what Sumdog has to offer. This allowed parents and carers to talk to their children about Sumdog and what they were learning. This was invaluable to both the children and adults.

Mr. Bennett also felt quite strongly that Sumdog could also be used successfully with pupils younger than his Primary 4 class. He would like to use his pupils to act as mentors to help younger Primary 2 and Primary 3 pupils get started.

Summary

Pupils felt strongly that the use of computers, and especially Sumdog, had increased their enthusiasm for learning mathematics compared to using textbooks or worksheets.

There was a very strong focus on sharing information and working together that made the use of Sumdog very straightforward and popular for all pupils.

The additional information that Sumdog produced in relation to progress helped the class teacher in lesson planning and teaching of certain topics. This was especially the case after having been absent due to illness for some weeks.

Pupils were very keen to use Sumdog outside the classroom. This was because they felt confident using it and they really liked sharing their progress with both parent/carers and classmates.

The very imaginative ideas about providing additional games and rewards have been used to inform future developments of Sumdog.

References

Scottish Index of Multiple Deprivation, 2012, full dataset available here: <http://www.gov.scot/Topics/Statistics/Browse/School-Education/Datasets/contactdetails>

Appendix 4: School Demographics

List of all Glasgow schools who signed up to take part in the study.

Demographic information is from the Scottish Index of Multiple Deprivation, 2012. Students were not included in the final sample unless they had completed both the initial and final diagnostic tests, and there were at least 30 days between these two diagnostic tests.





No.	School Name	Proportion of pupils who live in the 20% most deprived datazones in Scotland	Proportion of pupils from minority ethnic groups	Number of pupils signed up for study	Number of pupils with data used in the final sample
1	Battlefield Primary School	0 - <5%	>20%	65	24
2	Merrylee Primary School	0 - <5%	>20%	33	20
3	Hyndland Primary School	10 - <15%	>20%	31	9
4	Broomhill Primary School	10 - <15%	10 - <20%	50	0
5	King's Park Primary School	10 - <15%	10 - <20%	57	19
6	Riverside Primary School	10 - <15%	10 - <20%	22	18
7	Kelvindale Primary School	15 - <20%	>20%	66	10
8	St Bride's Primary School	15 - <20%	>20%	58	2
9	Mount Vernon Primary School	15 - <20%	10 - <20%	25	0
10	Swinton Primary School	15 - <20%	5 - <10%	32	2
11	St Albert's Primary School	20 - <25%	>20%	27	1
12	St Angela's R.C. Primary School	20 - <25%	>20%	31	1
13	Croftfoot Primary School	20 - <25%	5 - <10%	59	49
14	Caledonia Primary School	25 - <30%	>20%	24	1
15	Tinto Primary School	25 - <30%	>20%	33	17
16	Cardonald Primary School	25 - <30%	10 - <20%	75	32
17	Mosspark Primary School	25 - <30%	10 - <20%	27	11
18	Lorne Street Primary School	30 - <35%	>20%	29	4
19	Knightswood Primary School	35 - <40%	>20%	58	10
20	Our Lady of the Rosary Primary School	35 - <40%	>20%	29	1
21	St Conval's Primary School	35 - <40%	>20%	31	10
22	Carmunnock Primary School	35 - <40%	10 - <20%	21	2
23	Hillington Primary School	35 - <40%	5 - <10%	35	29
24	Thornwood Primary School	40 - <45%	>20%	26	3
25	Darnley Primary School	40 - <45%	10 - <20%	28	2
26	Wallacewell Primary School	45 - <50%	>20%	54	20
27	Caldercuilt Primary School	45 - <50%	5 - <10%	28	7
28	Shawlands Primary School	5 - <10%	>20%	58	44
29	Golfhill Primary School	50 - <55%	>20%	28	9
30	St Monica's Milton Primary School	50 - <55%	>20%	26	3

31	Blairdardie Primary School	50 - <55%	5 - <10%	28	2
32	Alexandra Parade Primary School	55 - <60%	>20%	76	17
33	Oakgrove Primary School	55 - <60%	>20%	33	0
34	St Denis' Primary School	55 - <60%	>20%	26	2
35	Holy Cross Primary School	60 - <65%	>20%	30	0
36	St Bridget's Primary School	60 - <65%	>20%	25	0
37	St Charles' Primary School	60 - <65%	>20%	33	21
38	Crookston Castle Primary School	65 - <70%	10 - <20%	60	32
39	Eastbank Primary School	65 - <70%	10 - <20%	40	0
40	St Blanes' Primary School	65 - <70%	10 - <20%	25	0
41	St Rose of Lima Primary School	70 - <75%	>20%	77	13
42	Whiteinch Primary School	70 - <75%	>20%	26	3
43	Carntyne Primary School	70 - <75%	10 - <20%	50	13
44	St Bernard's Primary School	70 - <75%	10 - <20%	78	1
45	Sandaig Primary School	70 - <75%	5 - <10%	28	21
46	Sandwood Primary	70 - <75%	5 - <10%	30	20
47	Parkview Primary School	75 - <80%	>20%	31	14
48	St Joseph's Primary School	75 - <80%	>20%	48	2
49	St Francis' Primary School	75 - <80%	>20%	46	7
50	Avenue End Primary School	75 - <80%	10 - <20%	50	2
51	St Philomena's Primary School	75 - <80%	10 - <20%	20	0
52	St Vincent's Primary School	80 - <85%	>20%	54	21
53	Yoker Primary School	80 - <85%	>20%	21	3
54	Cleeves Primary School	80 - <85%	10 - <20%	22	8
55	St Benedict's Primary School	80 - <85%	10 - <20%	57	2
56	Pirie Park Primary School	85 - <90%	10 - <20%	67	35
57	St Bartholomew's Primary School	85 - <90%	10 - <20%	57	11
58	Thorntree Primary School	85 - <90%	10 - <20%	56	0
59	Antonine Primary School	85 - <90%	5 - <10%	24	23
60	Chirnsyde Primary School	85 - <90%	5 - <10%	33	5
61	Gowanbank Primary School	85 - <90%	5 - <10%	25	0
62	Elmvale Primary School	90 - <95%	>20%	25	3
63	Haghill Park Primary School	90 - <95%	>20%	56	9
64	St Michael's Primary School	90 - <95%	>20%	25	0
65	Miller Primary School	90 - <95%	10 - <20%	24	17
66	Our Lady Of Peace Primary School	90 - <95%	10 - <20%	33	20
67	St Clare's Primary School	90 - <95%	10 - <20%	53	2
68	St Cuthbert's Primary School	90 - <95%	10 - <20%	47	9
69	Aultmore Park Primary School	90 - <95%	5 - <10%	26	15
70	Cadder Primary School	95% or more	>20%	24	5
71	Royston Primary School	95% or more	>20%	20	8
72	St Maria Goretti Primary School	95% or more	>20%	16	10
73	Camstradden Primary School	95% or more	10 - <20%	47	21
74	Miltonbank Primary School	95% or more	10 - <20%	36	7





Appendix 5: Attitudinal Survey Questions

Student Survey





1 How do you feel when you are learning maths? *

 <input type="radio"/> Very happy	 <input type="radio"/> Happy	 <input type="radio"/> OK	 <input type="radio"/> Unhappy
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2 How good do you think you are at maths? *

 <input type="radio"/> Very good	 <input type="radio"/> Quite good	 <input type="radio"/> OK	 <input type="radio"/> Not good
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3 How do you feel when you are doing maths homework? *

 <input type="radio"/> Very happy	 <input type="radio"/> Happy	 <input type="radio"/> OK	 <input type="radio"/> Unhappy
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4 Would you like more maths homework? *

 <input type="radio"/> Very happy	 <input type="radio"/> Happy	 <input type="radio"/> OK	 <input type="radio"/> Unhappy
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5 Do you like learning maths with computers? *

			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very happy	Happy	OK	Unhappy





6 How much do you like learning maths using Sumdog? *

			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very happy	Happy	OK	Unhappy

7 Would you like to learn more maths using Sumdog at home? *

			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very happy	Happy	OK	Unhappy

8 How would you feel if you spent more time on Sumdog at school? *

			
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Very happy	Happy	OK	Unhappy

Teacher Survey

Sumdog Survey for Glasgow Partnership Teachers

We would like to know how you feel about using Sumdog with your students to learn maths. Your responses will help us know how we can get better at supporting you and helping your students learn.

Thank you for taking the time to give us your contribution to the survey.

1 Please select the response that best corresponds to your experiences with Sumdog.

a. Sumdog training prepared me to use the program *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

b. My students have access to ICT in the classroom *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

c. My students have access to ICT at home *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

d. My students have a positive attitude towards maths *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

e. My students have become more positive about maths homework through using Sumdog *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

f. I am able to support students when they are using Sumdog to complete maths questions *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

g. Students have more difficulties in their learning of maths when they are using computers

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

h. I have had to reorganise my classroom to accommodate using computers *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

i. Students engagement in maths has increased since we started using Sumdog *

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- N/A

Part 2

Please provide more details about your experience with Sumdog by answering the following questions

2 Overall, do your students enjoy learning with computers? *

[Dashed text box for answer]

3 How have your students' attitude towards maths changed since they started using Sumdog? *

[Dashed text box for answer]

4 How has your enjoyment of or success in teaching maths changed as a result of using Sumdog with your students? *

[Dashed text box for answer]

5 How easy is it for your students to access ICT while at school? Are there any particular issues that may prevent you from making more use of computers? *

[Dashed text box for answer]

6 How have you had to undertake changes to classroom organisation and management as a result of using Sumdog? *

[Dashed text box for answer]

7 Compare the type of homework you assigned before using Sumdog to the type of homework you assign now. How have your maths homework assignments changed as a result of using Sumdog? *

[Dashed text box for answer]

8 Full Name

[Dashed text box for answer]

9 School name *

[Dashed text box for answer]

10 Please add any additional comments about Sumdog

[Dashed text box for answer]