Independent analysis of the relationship between Sparx Maths and maths outcomes

Sparx Maths Key Findings Report

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Background

The use of digital tools and practices in education – also known as Educational Technology (EdTech) – is undergoing a period of unprecedented growth in the UK, with schools increasingly looking to EdTech to support teaching and learning in the classroom.[1] In 2019, the Department for Education in England signalled its commitment to such technologies through its EdTech Strategy seeking, for instance, to reduce teacher marking workload and increase accessibility for students with special educational needs and disabilities.[2] In recent months, this growth has been intensified due to the unprecedented need to move to online modes of teaching, as a means of containing the spread of COVID-19. To many, EdTech is noted to be at the fore of this adaptation and plays a role in hastening the digitisation of education[3].

Evidence from over 40 years of research has shown the potential for EdTech to support learning, when implemented effectively.[4,5] For instance, reviews by the Education Endowment Foundation (EEF) suggest that the use of technology in maths is usually more effective when simulations, scaffolding and/or intelligent tutoring systems are used.[6] Such technology is also shown to be most effective where it supplements, rather than replaces, other forms of instruction.[7]

Researchers from RAND Europe and the University of Cambridge were commissioned by Sparx, a socially focused learning technology company, to explore how usage of their flagship Sparx Maths learning platform is associated with student outcomes.

Sparx Maths

Sparx Maths is an electronic, personalised learning platform developed to aid the delivery of lessons and homework for Key Stage 3 and GCSE students (ages 11 to 16) in the UK. The platform contains over 38,000 questions and over 9,000 video tutorials, delivered to students through a tailored and personalised learning platform. Sparx Maths strives to be an evidence-based system and was developed in line with published evidence of effective approaches in education.[8]

There are currently two versions of Sparx Maths: a *classroom plus homework* version; and a *homework only* version. In both versions, students receive personalised homework assignments of appropriately challenging questions delivered through a spaced repetition algorithm delivered in interleaved order. Students receive instant feedback and can access help through support videos, while teachers receive insights from homework. For the *classroom plus homework* version, teachers also have access to lesson plans and teaching materials. In addition, as students complete their classwork, teachers receive real-time insights, and can interact with the whole class or individual students throughout the lesson, controlling the progression of the lesson. In practice, the implementation of the two versions is similar, with schools integrating either version into their teaching.

Sparx recommends that schools use Sparx Maths consistently and repeatedly over time to achieve impact, ideally for one hour of homework every week (39 hours over an average school year) for both versions, in addition to regular use of the classroom component in the *classroom plus homework* version (up to four hours every week). In line with this, Sparx helps schools and trusts to actively monitor weekly implementation at school and class level by reviewing homework and lesson completion rates, and supporting schools with best practice suggestions if usage falls below recommended levels.

Approach

Researchers from RAND Europe and the University of Cambridge undertook an analysis of data collected in 2019 by Sparx from 3,956 Year 7 and Year 8 students across 14 schools in the UK, following a study plan published ahead of the analysis.[9] Schools included a mix of those that used the *classroom plus homework* version and the *homework only* version. Schools were also mixed in their familiarity with Sparx Maths, with some schools having used it previously, while others had only recently started implementing it in January or Easter of that same year (i.e. 2019). Students included those who had access to Sparx Maths and spent time on the platform, those who had access to it but spent no time on the platform, and those who had no access to it at all. Students sat a written assessment of maths using the PUMA test[10] – a reliable and valid measure of maths attainment.

RAND Europe supported the development of a Sparx Maths Theory of Change to provide a shared understanding of how Sparx impacts on learning outcomes of interest. Researchers asked the Sparx team to identify key elements of Sparx Maths delivery and contextual factors, as well as isolate key impacts and outcomes (see Appendix A technical report[11]). This report provides an overview of the research findings, starting with an overview of the Sparx Maths programme, followed by the key findings from the analyses. Supplementary details on the technical aspects of the research, including underlying data, methodology and analyses, can be found in the technical report.[12]

Summary of Key Findings

1. Time spent using Sparx Maths is positively and significantly associated with higher outcomes in maths

A key aspect of the primary outcome analysis was identifying which students had used Sparx Maths. The first analysis used *time spent using* Sparx Maths (in hours) as an indicator of usage, based on the time students received access to Sparx Maths. This includes time spent actively working on set tasks and time watching educational videos. On average, students used Sparx Maths for 36.9 hours, with a range between zero hours (no use at all) and just over 256 hours. The analysis indicates that *time spent using* Sparx Maths is positively associated with maths outcomes, as measured with a popular maths test (PUMA).

Specifically, more *time spent using* Sparx either in the classroom or for homework was associated with better maths outcomes. When PUMA scores are converted into (predicted) GCSE grades, the use of Sparx Maths for the recommended one hour of homework per week was associated with an increase of almost 20 per cent of a (predicted) GCSE grade. This indicates that students who used Sparx Maths made significantly more progress than students without Sparx Maths (i.e. those taught through regular teaching) and indicates that time spent using Sparx Maths is beneficial to student maths outcomes.

2. Time spent actively working in Sparx Maths is positively and significantly associated with higher outcomes in maths

Sparx Maths records time spent *using* Sparx Maths (i.e. overall time spent on the platform, including working time and time spent watching tutorials), as well as time spent *working* on Sparx Maths (i.e. active working on the platform, solving set problems). Findings from the analyses additional to the initial study plan suggest that there is a positive and statistically significant association between time spent *working* on Sparx Maths and outcomes in maths. This suggests that time spent *working* on Sparx Maths in the classroom or for homework is a particularly important mechanism for driving improvement in maths outcomes.

Actively working on Sparx for the recommended one hour of homework per week for one whole school year was associated with an increase of almost 30 per cent of a (predicted) GCSE grade. As before, this indicates that students using Sparx Maths make significantly more progress than students without Sparx Maths (i.e. those taught through regular teaching).

These findings emphasise that it is the way in which Sparx Maths is used that is essential. Specifically, active engagement with Sparx Maths is more strongly associated with maths outcomes than overall time spent on the platform. This is also in line with previous evidence reviews around the effectiveness of technology-enabled interventions.

3. There is no evidence that access to Sparx Maths alone (regardless of usage) is associated with maths outcomes

Also of interest in the primary analysis was the relationship between student *access to* Sparx Maths and maths outcomes, regardless of how much students engaged with the platform. This approach mirrors evaluation approaches commonly used in education, by looking at the relationship between the availability of an intervention and outcomes (even if the intervention is not used as intended). The analysis therefore compared the 61 per cent of students in the sample who had access to Sparx Maths (with different levels of time spent on the platform) to students without access to Sparx Maths, controlling for a range of demographic and background characteristics (fully explained in the technical document). The analysis did not find evidence of differences in maths outcomes by access to Sparx Maths when accounting for students' backgrounds.

This analysis is supported by findings from a supplementary analysis using propensity score matching (PSM) – an approach used by the researchers to generate a more robust comparison group by controlling for background characteristics. Despite difficulties generating this group due to overlaps between early attainment and other student background characteristics, the results of the PSM analysis mirror those of the primary analysis above. There is no evidence that access to Sparx Maths alone is associated with different outcomes in maths, even compared with the more similar comparison group.

When reviewed in comparison to the previous findings (see Key Finding 1 and Key Finding 2) this suggests that a key driver of impact is how technology is used, and in particular how much it is used. Variation in usage across the sample is likely to have been driven by the fact that schools began using Sparx Maths at different time points in the year, with some having started using Sparx Maths early in the academic year and others much later, at Easter.

This mirrors much of the existing evidence on digital learning, where the mere presence of a technology-enabled intervention is not necessarily sufficient to achieve desired impacts.[13] This is also one of the key principles underpinning Sparx Maths (see Theory of Change in Technical report) and is why schools are monitored and supported to use Sparx Maths consistently and repeatedly over time.

4. Outcomes for specific sub-groups of students follow the same trends as their peers.

Data were also available on students' memberships of specific sub-groups, in particular English as an Additional Language (EAL), eligibility for free school meals (FSM) and KS2 attainment. Findings from the subgroup analyses mirror the primary outcome results. These findings are not surprising given they mirror what was found for the general population of students (see Key Finding 1 and Key Finding 3), emphasising that access to digital learning tools is not synonymous with use of the tools or impact on desired outcomes.

This finding also suggests that the impact of Sparx Maths is similar across different subgroups and does not exacerbate any existing gaps for disadvantaged or lower pre-attainment students, although it is also not able, on its own, to close these gaps. This aligns with broader evidence that digital tools cannot, in isolation, address substantial socio-economic attainment gaps.[14]

Conclusion

The above analysis finds that *use* of Sparx Maths is associated with higher outcomes in maths, even if access to Sparx Maths alone (i.e. regardless of usage) is not associated with differences in maths outcomes. In line with broader findings in the EdTech space, findings suggest that the *time spent using* Sparx Maths, and particularly time spent actively *working on* Sparx Maths, are each positively associated with maths outcomes, with active work in Sparx at recommended levels associated with almost a third of a GCSE grade difference. This is in line with existing evidence that suggests how technology is used to support learning is more important than the presence of technology alone. More broadly, this study also adds to evidence that researchers studying digital learning should avoid confounding access to digital learning with usage, and instead focus on collecting and analysing active usage (e.g. time spent working on problems compared to time spent watching educational videos) as part of their research.

Finally, this study suggests that more work could be done to strengthen understanding of how Sparx Maths works in practice, including how teachers and schools select students and why schools choose to start Sparx at different times in the year. A study using a pre-established comparison group (such as a randomised controlled trial) would further enhance the robustness of future conclusions.

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