Computer game improves primary pupils' arithmetic

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[INSIGHTS]

COMPUTER GAME IMPROVES PRIMARY PUPILS' ARITHMETIC

Much has been written about the benefits of using computer games in school. Many teachers have been won over, but there has been little hard evidence to back up their enthusiasm. Until now. Our rigorous research shows that a commercial game, *Dr Kawashima's Brain Training*, can improve the speed and accuracy of primary children's number work.

KEY POINTS

1. Children's number skills improved as a result of playing a computer game for 20 minutes a day.
2. Game-playing children became more accurate, increasing their number of correct answers by 50 per cent more than control group.
3. Game-playing children became faster at doing the sums, improving at twice the rate of control group.
4. Game-players were also highly motivated and teachers reported a range of other benefits.

MAJOR IMPLICATIONS

1. Teachers now have reliable evidence that this game can bring real benefits in terms of number work.
2. The research focused on key skills in relation to a child's development; confidence with number bonds is a fundamental building block for future learning.
3. The improvements in speed and accuracy of number work may have implications for other areas of learning.
4. Feedback suggests there are many other social and personal benefits.

[INSIGHTS]

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THE RESEARCH

More than 600 10 to 11-year-olds from 32 primary schools in Scotland were randomly assigned to one of two groups: an 'experimental' group which used computer games and a control group which served as a comparison.

Each child in the experimental group classes was given a Nintendo DS Lite games console. For nine weeks, they played *Dr Kawashima's Brain Training* for 20 minutes each day, first thing in the morning. The control group classes continued with their normal routine.

We investigated the impact of game playing on:

- children's arithmetic skills – both accuracy and speed;
- children's perceptions of themselves and their attitude to school;
- the performance of boys and girls;
- the performance of children of different ability;
- the performance of children who had the game at home and those who didn't.

Pupils' arithmetic skills were tested both before and after the trial using a 100-item 'number challenge'. Set at the appropriate level of the Scottish mathematics curriculum, it included addition, subtraction, multiplication and division, from simple two-digit calculations to more advanced sums involving three two-digit numbers testing the associative property. Answers were marked simply as correct or incorrect, with the range of scores being from 0 to 100. Time taken to complete the challenge was also recorded. The maximum time allowed was 25 minutes, and this time was given to any child who had not finished at the end of the test.

WHAT WE FOUND

We found significant improvements in the maths test scores – that is, children's performance in accuracy and speed of calculations. Interestingly, we found these improvements in *both* experimental and control groups; all children improved their arithmetic skills over the nine weeks of the trial. However, the improvements in the game-playing group were 50% higher than those of the control group in terms of accuracy, and twice those of the controls in speed.

In terms of correct answers, the least able children in the game-playing group improved the most. The most able gained the least, but then they had scored so highly on the pre-test that they had little scope for improvement.

Table 1: Changes in accuracy (number of sums correct)

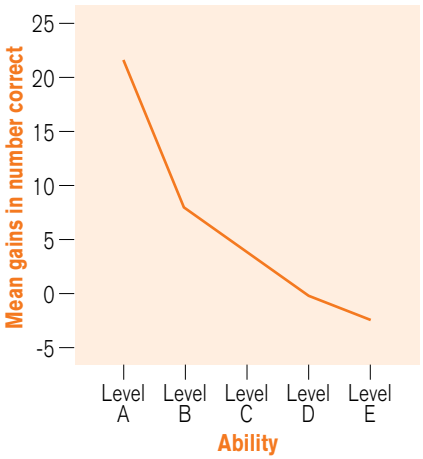
Group	N	Scores	Mean scores
Game console	326	Pre-test	78.56
		Post-test	83.04
		Improvement in score	4.48
Control	309	Pre-test	78.74
		Post-test	81.65
		Improvement in score	2.91

Table 2: Changes in speed (time taken)

Group	N	Scores	Mean time taken (min:sec)
Game console	326	Pre-test	18:32
		Post-test	13:29
		Difference in time taken	-05:03
Control	309	Pre-test	17:54
		Post-test	15:34
		Improvement in score	-02:20

Figure 1: Improvement in scores according to ability (game-playing group)

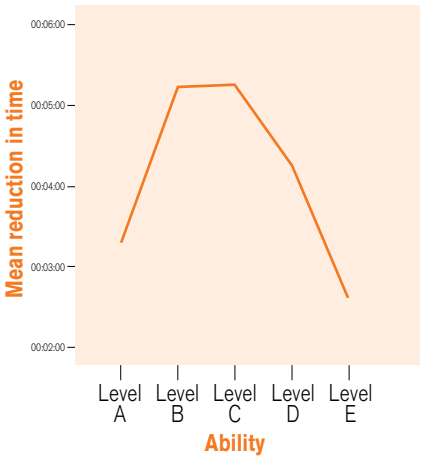
Note: Level A is the lowest ability; level E the highest.



Similarly, the most able children improved the least in terms of speed. Middle ability pupils gained the most (fig 2), while the least able children appeared to be concentrating on getting the sums correct, rather than on speed. We suspect many teachers might be happy with this trade-off!

Figure 2: Improvement in speed of calculation (game-playing group)

Note: Level A is the lowest ability; level E the highest.



Neither gender nor playing the game at home appeared to make any significant difference to the results.

Surprisingly, the children's confidence and self-esteem did not appear boosted by their success at sums. Perhaps the trial was too short to make an impact in this respect. Certainly it is an area which calls for more research. However, the game-playing children did show a small but significant improvement in their attitude toward school – unlike the control group.

Finally, teachers reported that not only had the game-playing pupils' number work and times-tables improved, but also that they were more motivated, more responsible and better at working together. In addition, teachers said that truancy and time-keeping had improved in some classes.

MAJOR IMPLICATIONS

We now have evidence that playing an engaging, enjoyable game boosts children's number skills. This is a significant finding – and one of relevance to many schools across the country.

Our work focused on key skills for development; competence and confidence in basic arithmetic are fundamental building blocks for future learning. Many teachers know that uncertain number bonds can hinder progress in other areas of mathematics and may result in more wide-ranging problems when children's sense of efficacy is threatened.

Using *Dr Kawashima's Brain Training* with the whole class first thing every morning also has the significant benefit of liberating teachers to deal with routine admin or to catch up on pupils in need of extra attention.

The improvements in number work may have implications for other areas of learning. At one level, this seems obvious. Children who are 'sharpening up' their cognitive processing by constantly racing to find the correct answer, may well become 'sharper' or more alert and engaged in other activities too. They may also benefit from the feel-good factor which accompanies success. We hope next to investigate if what seems obvious is in fact true.

Finally, a set of 30 Nintendos and games does →

not come cheap. On the other hand, once bought they could, with careful timetabling, be shared between many classes and used throughout the whole school over a term. Of course, not all children prefer to practise tables and mental computation on a games console, but probably most do. The benefits for the less able are likely to be a decisive factor here, as is the likelihood that the consoles will appeal to disaffected pupils. Winning them over can, as teachers know, work wonders for a school.

FURTHER INFORMATION

FOR RESEARCH PAPERS:

Miller, D.J & Robertson, D.P. (2011) Educational benefits of using game consoles in a primary classroom: a randomised controlled trial. *British Journal of Educational Technology*, 42 (5), 850-864.

Miller, D.J & Robertson, D.P. (2010) Using a games-console in the primary classroom: effects of 'Brain Training' programme on computation and self-esteem. *British Journal of Educational Technology*, 41 (2), 242-255.

Miller, D.J., Robertson, D.P., Hudson, A. & Shimi, J. (2012) Signature pedagogy in the early years: the role of COTS game-based learning. *Computers in the Schools* (in press)

FOR MORE PRACTITIONER-FOCUSED MATERIALS:

Sharing practice – a summary of our initial case study with video footage: http://www.ltscotland.org.uk/sharingpractice/i/improvingmentalmaths/introduction.asp

Games in Schools report (a project undertaken by the European Schoolnet – Footee, the IMAGINE project and a study funded by the Interactive Software Federation of Europe): http://games.eun.org/2009/05/research_results_released.html

Cisco Strategy Paper looking at games and learning, and exploring how computer games can enhance learning in classrooms: http://www.cisco.com/web/strategy/docs/education/Consolarium.pdf

ABOUT THE AUTHORS

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