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Acquisition of mathematical skills: A test of the effectiveness of a computer maths game

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Acquisition of Mathematical Skills: A test of the effectiveness of a computer maths game



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Introduction



Research conducted by the ABS (2009) reveals that math performance of students in Australia is not at the level it could be

Look to area of skill acquisition research in psychology to find a solution to this problem

- ACT-R Theory (Anderson, 1992)
- Instance Theory (Logan, 1988)
- Component Theory (Speelman & Kirsner, 2005)

Educational computer games (based on psychological theory) may be a way to implement changes in order to raise achievement levels

Research Design



Participants:

- 218 students from four schools
- 159 students with valid data
- 8 – 9 years of age

Design:

- A repeated measure multivariate design
- Two independent variables:
 1. Type of condition
(‘Numbeat – full version’; ‘Numbeat – limited version’; ‘Maths Drills’; ‘Control group’)
 2. Type of test
(Pre-Test; and Post-Test)
- Two dependent variables:
 1. Accuracy
 2. Speed

Research Design



Materials:

- Computers
- Pre-Test and Post-Test (counterbalanced)
- Qualtrics
- Three computer-based conditions
- Internet Access

Procedures....

- Approval and Consent
- Pre-test to determine existing level of mathematical skill
- 2 week trial of computer conditions
- Post-test to determine the amount of improvement

Findings



A significant difference between the Pre-test and Post-test was found for:

- speed $F(1, 155) = 9.977, p = .002, \text{partial } \eta^2 = .060, 95\% \text{ CI} = .001 \text{ to } .005$;
- accuracy $F(1, 155) = 5.769, p = .017, \text{partial } \eta^2 = .036, 95\% \text{ CI} = -.039 \text{ to } -.004$

A significant difference between conditions was found for:

- speed $F(3, 155) = 9.912, p = .000, \text{partial } \eta^2 = .161$;
 - accuracy $F(3, 155) = 8.127, p = .000, \text{partial } \eta^2 = .136$
- The 'Numbeat – limited version' was significantly faster than all other conditions
 - The 'Numbeat – limited version' was significantly more accurate than the 'Control group'
 - 'Maths drills' was also significantly more accurate than the 'Control group'

Findings



A significant interaction was found between the type of test and the condition in regards to

- speed $F(3, 155) = 7.819, p = .000, \text{partial } \eta^2 = .131$

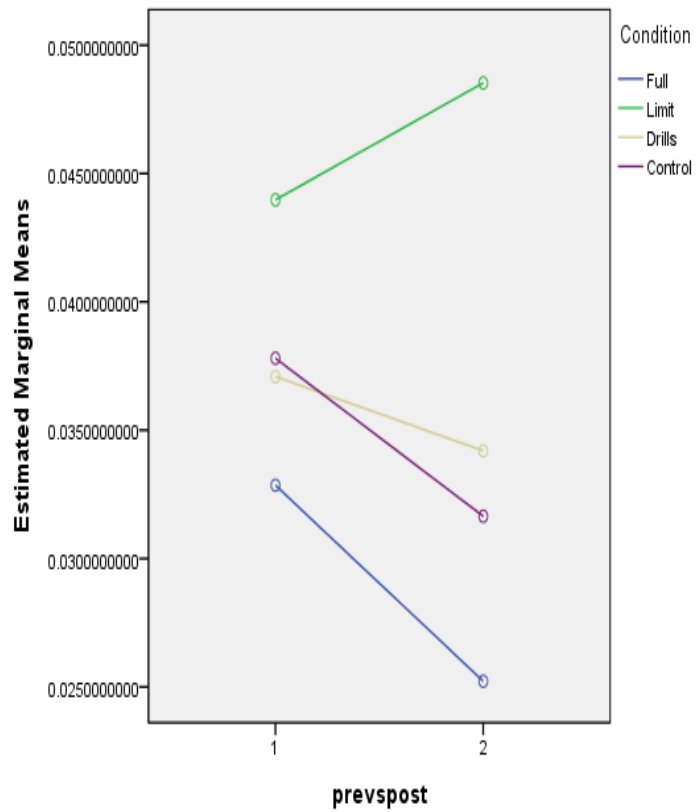
The significant interaction was investigated further with Tukey's HSD and found that:

- For 'Numbeat – full version' the speed of performance significantly declined from pre-test to post-test
- For 'Numbeat – limited version' the speed of performance significantly increased from pre-test to post-test
- For 'Maths Drills' there was no significant difference in the speed of performance from pre-test to post-test
- For 'Control group' the speed of performance significantly declined from pre-test to post-test

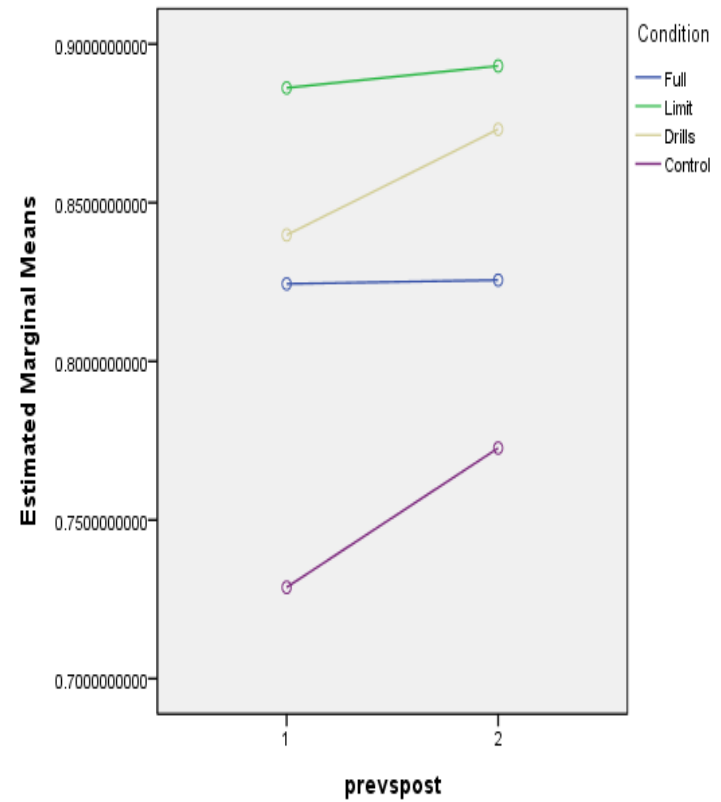
Results



Estimated Marginal Means of Speed



Estimated Marginal Means of Accuracy



References



- Anderson, J. R. (1992). Automaticity and the ACT theory. The American Journal of Psychology, 105 (2), pp. 165 – 180. Retrieved from: <http://www.jstor.org/stable/1423026>*
- Australian Bureau of Statistics. (2009). Student achievement in maths and science. Australian Social Trends, 4102.0, June, 2009*
- Logan, G. D. (1988). Toward an instance theory of automatization. Psychological Review, 95 (4), pp. 492 – 527. doi: 10.1037/0033-295X.95.4.492*
- Speelman, C. P. & Kirsner, K. (2005). Beyond the learning curve: The construction of the mind. Oxford ; New York : Oxford University Press, 2005.*