

Research into Playing Maths Games in the KS2 Classroom:

Race To Infinity!



Jenny Field and Grace Olugbodi discuss their research, which took place in nine schools, focussing on **Games Based Learning in Lower KS2**

Main Types of Games in the Classroom

- Traditional Games

For example Board games, Card games, Puzzles

- Real life Games (role play, physical games)
- Digital/Video Games (electronic)

GBL or Gamification: What's the difference?

Games Based Learning can be confused with Gamification

Gamification: (starts with the learning objective)

[EdTechReview](#) defines it as *'the application of game elements to non-game problems'*.

Gamification inserts some elements of a game into traditional learning activities.

Game Based Learning: (starts with the game)

The games is the main activity.

The learning process comes from playing the game, as part of a non- traditional activity.

Game characteristics and principles are embedded within learning activities, including strategies, rules and the social experiences of playing a game

Previous Research into Games Based Learning

In 2016 Hainley et al conducted a meta-analysis of empirical evidence from 45 high quality research papers into Games Based Learning (GBL) in primary education.

The key findings were that GBL develops knowledge acquisition and content understanding, alongside positive motivational and social skill outcomes.

Although many similar studies have also provided powerful arguments for incorporating games into the maths curriculum, there is little evidence of any structured inclusion of GBL.

Oldfield (1991) argues that games are not taken seriously and seen as ‘wet play’ activities and that the word ‘game’ is often associated with ‘play’, creating a non-serious connotation.

Hainley, T., Connolly, T., Boyle, E., Wilson, A., Razak, A. (2016) *A Systematic Literature Review of Games Based Learning Empirical Evidence in Primary Education* Vol. 102 p202-223

Oldfield, B (1991) *Games in the Learning of Mathematics*; *Mathematics in School* Vol. 20 (1), p42-43

Dr Grace Olugbodi

In 2019, Grace won the 'Micro to Small Business' category in the *Best of Greenwich Business Awards*, as founder of her company BeGenio, specialising in maths education.



She had also received a prestigious honorary doctorate from London Metropolitan University in recognition of her work in helping young children love mathematics.

Grace first approached me in 2020; some years earlier she had invented the highly successful board game *Race To Infinity!* It had received much national/international acclaim and publicity; she had even been interviewed by *BBC News*, *Business Live* ... so why had she approached me at this point?

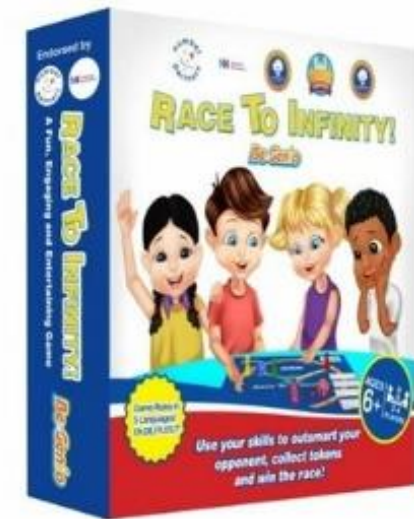
As an ethical businesswoman, interested in research, Grace wanted to know more about the efficacy of this game – she wanted to know more about its strengths and limitations... what was the learning processes, as a result of playing the game?

I was struck by her passion for maths and her genuine wish for all children to enjoy it!

The Game

- *Race To Infinity!* is a board game. Children take turns to roll two 12-sided dice and choose whether to add, subtract, multiply or divide their values in order to move around the board, based on where it is strategically best to land.
- The objective of the game: to be the first to land on the *Race To Infinity!* space in the centre on the board. Before this, children need to move around the outside circular path, collecting 200 credits in money.
- If they wish, they can collect mathematical *Luck Cards*; this might indicate willingness to take risks; for example, it might state that you can only move forward if you throw an even number.

You will have an opportunity to play the game in a short while 😊



Our Research

It aimed to contribute to current pedagogical research into GBL, as an Exploratory Case Study, taking place in nine Greenwich and Lewisham primary schools in 2022.

Early Considerations:

- Inventor bias (separate inventor from research). I had not seen the game before and had no opinion of it- unbiased.
- Deciding exactly what would be researched and the parameters of this research
- Deciding the Key Research Questions
- Deciding the most rigorous methods of data collections
- Applying to the University Research Education Committee for ethical approval

Parameters of research and research questions



Research took place in nine schools: nine groups of lower KS2 children
Each group of children played the game, at least once a week, over one term

Research Questions:

Focussed on 3 aims of the National Curriculum for maths (statutory content)

Covid-19 'catch-up' - a pertinent question during the pandemic

Q1-3. Perceptions of the progress (or lack of progress) that children have made in FLUENCY, PROBLEM SOLVING and REASONING as a direct result of playing this game? (*this was presented as three separate questions*)

Q4. As a result of COVID-19 many children have faced the prospect of needing additional support to 'catch-up' with their learning. Do you believe that regularly playing this game could have a role in that 'catch-up' programme?

Q5. Any other notable findings?

Data were gathered through teacher observations of children playing the game, and were recorded via '*Teacher Questionnaires*', '*Teacher Interviews*' and '*Transcripts*' of children's conversations.

I believe what we discovered is of interest, not only to this specific game, but also to the efficacy of GBL in general.

Research Findings Q1-3



Perceptions of progress in the aims of the NC: Fluency, Problem Solving and Reasoning:

89% of participants felt children made at least *'some'* progress against all three aims. Fluency was most efficacious, with the highest percentage of participants perceiving progress to be *'good'* or *'exceeding'* expectations.

'children's fluency has definitely improved over the course of the term, especially with regards to four operations'

'fluency, yes fluency was the thing ...definitely see them getting better with that and quicker at working things out'

'some children improved at problem solving, they were able to reason and decide where to move and why'

These findings concur with research by Russoa et al (2021), conducted with 248 teachers in Australia, which found that traditional games were highly effective in developing the key proficiencies highlighted in the Australian Curriculum: fluency, understanding, problem solving, and reasoning.

Russoa, J., Leicha, A., Bragg, B., Russoc, T. (2021) *How Primary Teachers use Games to Support their Teaching of Mathematics*; The International Electronic Journal of Elementary Education Vol. 13, (4) p407-419

Research Findings Q4

Role in Covid 19 'catch up':

100% of participants perceived that, as one of several measures, it could provide additional support for Covid-19 'catch-up', specifically for practice of four operations in ways that might reduce anxiety:

33% felt this could be a 'good' role and 67% perceived it could provide 'some' role.

'It provides the opportunity to continually use their core number skills- adding, subtraction, sometimes multiplying and dividing'

'could be useful as a tool to engage those pupils who experience anxiety in maths, as it is a non-threatening way of developing maths skills, with low risk'

Although there is no previous research on GBL and Covid-19, a recent study by Alanazi (2020) also found a positive correlation between GBL, reduced anxiety and improved performance in children

Alanazi, H., M. N., (2020) *The Effects of Active Recreational Maths Games on Maths Anxiety and Performance in Primary School Children*; An Experimental Multidisciplinary Journal for Education Vol. 7 (1)

Research Q5

Additional Notable Finding: The Development of Social Skills and Oracy:

Although not our key focus, the strongest evidence was actually related to this finding; teachers were highly positive about the development of general social skills, including oracy, communication, collaboration, and enjoyment without pressure:



‘Children used their oracy skills to discuss through problems they faced ... there were great discussions developed through talk, working out how to travel around the board when calculating larger numbers’

‘Children became better at helping each other and exploratory talk’

‘Through teamwork children were able to support each other when they encountered difficulty’

‘It also develops oracy, pushing them to use terminology that they may not already know or need support with using’

‘they were definitely verbalising better ... that was a new thing...really helpful for maths ...you could hear them talking through their thought processes’

Research conducted by Mani (2015) concurs with this finding, stating that GBL had many additional benefits, including increased engagement, motivation and learning through social skills.

Mani, A., (2015) *Maths Games: An effective pedagogical tool to enhance learning*; Scholarly Journal of Scientific Research and Essay (SJSRE) Vol. 4(5), p74 -76

Inconclusive Evidence on Grouping

Free text included teachers' comments on whether it was best practice to put children in similar attainment or mixed attainment groups.

There was no clear consensus and further research is needed in this area.

'It was useful to pair more able children with those less confident, this in turn improved fluency and confidence from both groups'

'those pupils with quite secure knowledge did become increasingly frustrated when playing with other players that were not so secure and this led to a lot of pauses in the game'

Limitations

In relation to ‘calculation’, some participants felt that although it was an effective way ‘*to practise*’ what was already known, **unless teachers provide scaffolding**, they felt there was less likely to be ‘*new learning*’ in the four operations.

‘It hasn’t directly taught them methods... but it has provided them with opportunities to put their knowledge into practice’

Time to facilitate GBL within a highly prescriptive curriculum was cited as a limitation.

‘you’ve got to set time aside to do it... curriculum is already jam packed’

One participant cited a possible issue for EAL / SEN children, around reading *Luck Cards*.

Why are these research findings of value?

1. Opportunity to celebrate ethical approaches, where business meets educational research, and actions are based on findings.
2. Findings support Grace— both in knowing what to celebrate, and considering what might be further honed, particularly with her new digital version of the game.
3. **After the pandemic it has become increasingly clear that social skills, including oracy, have been significantly affected by reduced contact with peers.** Based on the outcomes of research, there is evidence that GBL in general would be a valuable addition to the curriculum and/or to take home to use with parents.

‘they don’t really play games very often ... they were learning about turn taking and all sorts!’

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Field, J. and Olugbodi, G. (2023) *Research into Playing Maths Games in the KS2 Classroom: Race To Infinity!* Primary Mathematics Journal Vol. 28 Summer 2023



Grace's Story



Time to play ...

DISCUSSIONS AND QUESTIONS

Thank you for listening 😊 Our contact details Jenny: j.field@gre.ac.uk Grace: etogun@yahoo.co.uk