Enriching numeracy learning using digital tools – sharing stories from teacher researchers

Date: Thursday 1 October 2015

ACSA: 2015 Biennial Curriculum Conference
Context

Association of Independent Schools, SA

- 95 Independent member schools
- Educational consultant
Session learning objective

We will share teachers’ provocations and ensuing classroom research as they investigated the connections between:

• **numeracy**
• **digital tools**
• **and teacher pedagogies**

that underpin deep student learning.
Purpose

• Improve teaching and learning

• Respond to and anticipate individual student need

• Creating rich numeracy experiences as citizens of the 21st Century
Session overview

Why action research?

Implementation

Case study 1

Case study 2

Case study 3

Reflection
The provocations

• iPad policy and school investment
• Personal growth
• Pedagogical growth
Why an action research model?

- Cyclic
- Participatory
- Flexible
- Allows learning and responsiveness
- Conclusions are data based
- Conclusions emerge during the study
- Can be strength and growth based
- Leads to transformative actions
What did the children do?

What were they learning?

How worthwhile was it?

What did I, the teacher do?

What did I learn?

What do I intend to do now?

Open University "Curriculum in Action", quoted in Action Research, Principles and Practice, McNiff, 1988, 47-48
“Outside research cannot be installed like a car part - it has to be fitted, adjusted, and refined for the school contexts we worked in.”

Mike Schmoker
Implementation

1. Initial: Identifying and establishing the ‘question’
2. Mid point: Reflection, analysis and next steps
3. Final: Identifying patterns, sharing & next steps
Case study 1

• An Independent F-12 College, Rural

• Year 1 and Year 3
• Mathematics
School research context:

Mathematics learning: How can we most effectively engage students in mathematical concept development and optimise learning potential?
The teacher questions

- Does the use of an iPad create a high level of engagement in mathematics learning?
- When investigating graphs, does embedding C&CT skills and the use of digital tools improve the depth of understanding?
- When investigating fractions, does embedding critical and creative thinking tools and ICT improve outcomes for students?
The action research
Before

Does the use of an iPad create a high level of engagement in mathematics learning?

Prior to action research, teacher 1:
- saw iPads as being a distraction from learning
- and as taking away from students talking and developing oral language skills
PADLET – social media technology

- Video
- Images
- Puppet pals
- PADLET
After

The use of iPads which meant that I approached the learning differently really engaged students and allowed them to be independent.

I was amazed at what the students could do. I realise I have not been allowing them to show the scope of what they can do.

I still find iPads frustrating but I can see how they are effective in learning experiences.

Perfect assessment opportunity – show and hear student thinking.
Before

When investigating graphs, does embedding C&CT skills and the use of digital tools improve the depth of concept understanding?

Prior to action research, teacher 2:
- only used iPads for game / rote learning apps
- keen to know more
Tellagami – animation technology

- Tellagami
- Numbers
- Safari
Students were able to show more of their understanding and were a lot more on task when using a familiar app... If they knew the app really well then they just focussed on the maths. Choosing just a few really good apps is better.'

I was really excited by the depth of knowledge and the increase in maths language. The children really enjoyed sharing their understanding. – it is deeper than last years students.

After

Students that traditionally struggled were more engaged, worked collaboratively and showed more understanding than I expected.
Before

When investigating fractions, does embedding critical and creative thinking tools and ICT improve outcomes for students?

Prior to action research, teacher 3:
- only used iPads for students needing support
- doubted their function in fractions learning beyond rote recognition games

Teacher 3 – Yr. 3
Book Creator—whiteboard technology
After

The teacher’s role was more flexible to guide and monitor and teach small groups of children when they needed it.

High achievers struggled with this whereas the students usually requiring support demonstrated ‘unexpected’ knowledge and understanding.

Showed thinking, reasoning and understanding of the concept of half using a wider variety of strategies!
The findings – the teacher’s voice

Redefinition

Modification

Augmentation

Substitution

“Students that normally excelled didn’t really change their outcome. But I wonder if it is because the task didn’t challenge them, maybe the iPad just substituted what I would normally do…”

Dr. Ruben Puentedura
The findings – student’s voice

• ‘It was good sharing the iPads because my friend could show me what I had to press.’

• ‘It was really exciting and I like to show my work on the Apple TV, it makes me proud.’

• ‘Mum looked at what we were doing on Padlet at home – that was really good.’

• ‘I could change what I didn’t like and that’s was better because I don’t like changing it on paper, it is too hard.’

• ‘I learnt lots more than I normally do because I didn’t have to wait for everyone else or wait for my teacher to get to me.’
Case study 2

• An Independent F-12 School
• Foundation, Year 2 and Year 5
• Mathematics and Geography
School research context:

Mathematics learning and numeracy capabilities:
• How can iPads enrich and enhance learning in the mathematics classroom?
• What pedagogical approaches underpin the effective integration of digital technologies in teaching and learning?
The teacher questions

- Does the use of iPads help children **understand and engage** in learning about number?

- Does the use of iPads **improve learning**: direction and location?

- Does the use of iPads **increase student engagement** and knowledge of geographical locations and their characteristics?
The action research

- observe
- plan
- act
- reflect
Before

Does the use of iPads help children understand and engage in learning about number?

Prior to action research, teacher 1:
• favoured a reasonably teacher directed approach
• used iPads for games and practice / fast finishers / support

Teacher 1 – Yr. F
• Video
• Puppet pals
• Explain Everything
Students have different learning styles and the iPad is yet another way to support students.

Students learn best when they actively involved.

Students engaged with the action of take away. The used role play and explained the ‘story’ using video. Used language. Collaborated. Assessment.
Before

Does the use of iPads improve learning: direction and location?

Prior to action research, teacher 2:
- could see potential but had not had time to engage in using iPads.

Teacher 2 – Yr. 2
Google maps
Edu Creations
After

Students loved looking at the maps and zooming in and out to find and locate. The language of direction seemed to flow ...

The students took an image of the map and pasted it into Edu Creations where they then annotated it showing directions.

Transferred iPad skills into other learning
- Explain and hear thinking
- Assessment record
- Deep learning (talking, thinking and reflecting which allows for better connections in the brain).
Before

Does the use of iPads increase student engagement and knowledge of geographical locations and their characteristics?

Prior to action research, teacher 3:

• was unsure about the impact of numeracy within another learning areas

Teacher 3 – Yr. 5
Open ended investigation

- What is the quickest way to get to Paris?
- What is the slowest way to get to Paris?
- What is the most economical way to get to Paris?
- What is the most expensive way to get to Paris?
Collaboration was increased – they had to share iPads and they were working on projects together. Learning from each other (Different strategies) Learning with a purpose (The iPad becomes the ‘audience’).

Open-ended tasks allow the iPad to be used well, otherwise they are just replacing worksheets.

Clear learning intentions - the students need to know what is expected of them when they are using the iPads – or doing any learning.
The findings – student’s voice

I thought it was fun when we found our houses on google maps. I didn’t know about East and West and North and South but now I do.

This was a great geography unit. I feel like I am really going away. I realised I did all this multiplication stuff, which I hate, without thinking, and I did ok?

It was fun using the iPads. I liked showing everyone what I could do.

I found it made me cross when I had to share my iPad – I hadn’t finished.
Case study 3

- A co-educational Primary School, rural
- ICT teacher and Year 5 Mathematics
School research context:

Mathematics learning and numeracy capabilities:
• To what extent does teaching decimals through the general capability of numeracy and embedding digital tools impact on student engagement and learning.
School research context:

What is the best digital/iPad implementation to improve student learning F-5 for our school?

The question of access:
- ratio
- 1:1 or shared
- location
Productivity apps

- Poll Everywhere
- QR codes
- Simple Mind
- Pic Collage
It made more sense to work like this. It doesn’t feel bad when you make a mistake because you can fix it.

Not like doing work – it is more like the real world stuff we do!

It is good working with friends but I like having my own iPad – we share ideas but we don’t lose our own work.

Student’s voice
Teacher’s voice

- Sharing iPads disengages students – it becomes group work not collaboration.
- 1:1 encourages collaboration
- Student work samples reflected a higher quality of work.
- It can remove stressors and distractors
- Student work samples reflected a higher quality of work.
- Sharing iPads disengages students – it becomes group work not collaboration.
Pedagogical implications for mathematics learning

TEACHER DIRECTED ➔ STUDENT-CENTRED

• Opened new ways of recording thinking and showing strategies.
• **Empowered student learning.**
• An engaging and motivating tool for reasoning and explaining thinking.
Pedagogical implications for mathematics learning

Does not and should not replace concrete materials and active learning.

Broadened mathematics vocabulary.

Promoted reasoning.

Encouraged collaborative problem solving.
Pedagogical implications for mathematics learning

- Assists deep learning (thinking, reflecting, connecting and applying).
- The importance of the partnership of learning.
- The need to be discerning in choosing apps for learning.
- The need for teacher learning teams to continue this action research and support further learning.
- The potential for rich assessment data.
  - Promotes interaction, communication and collaborative problem solving.
The power of action research

It provided such a great opportunity to work with colleagues on a mutual goal, sharing ideas and encouraging one another. It allowed for the focussed time needed to make significant changes and explore new ideas.

Action research influenced my approach to teaching maths. I now try and get the children involved in a more hands on way where they can problem solve and explore throughout their learning. I have found the children are much more excited to learn. The action research process guided me in a way that I needed.
The power of action research

Through the process we were really encouraged to think deeply about the task and assessment that was to follow.

The action research project also helped me critically reflect on how the unit actually worked. It made me think deeply about improving practice in the classroom and whether the task actually achieved its learning intentions.
I would do action research again because of the way it helped me improve my teaching practice in the classroom. The coaching and peer support enabled me to develop, teach and assess an interesting unit of work.

The discussion and conversation around creating a quality learning task was highly beneficial. The coaching and support allowed me to feel confident and inspired to create and teach an interesting Maths unit that successfully integrated ICT.
Thank you

The gardener does not make a plant grow. The job of a gardener is to create optimal conditions.

Sir Ken Robinson

The process of action research navigated me through uncharted waters. Although daunted at first, I pushed my boundaries and have learned so much about myself and how I can improve student outcomes.

Teacher
References

- Australian Curriculum; Mathematics Content Strand & General Capabilities
- Clarke, S.  Formative Assessment in Action, Hodder Education, 2005