



Case Study 5: Daisy Hill Secondary School

There are two sections in this case study:

- A. The Case Study
- B. Deconstructing this case study

Section A. The Case Study

John is a mathematics teacher and has been teaching at Daisy Hill Secondary School for the last 4 years.

Background

Daisy Hill is a secondary school, on the outskirts of Woodlawn town. A relatively rural area of the country with a population of 6000 Woodlawn residents are mainly middle class with an active local industry in manufacturing. Catering for the town and the local catchment area, Daisy Hill is the only school in the town and 850 students attend. The school provides a range of subjects to the boys and girls with many extra-curricular activities such as a musicals, sports and environmental projects.

The team of five teachers are the Mathematics Department team and they have decided to embrace more technology in their teaching and classes. This is partly due to the a post-Covid life, but also because there is a need to broaden the use of computers in mathematics lessons. The team have decided to introduce electronic assessment to the non-examination class groups. The 4th year class group have not excelled at mathematics, the class have low academic results and when asked, the seem to 'fear' technology.

John is the youngest member of the Mathematics Department and the other teachers look to him for inspiration and leadership in technology. John also teaches the 4th year mathematics classes.

Pedagogical Focus

The planning grid for the year has been defined by Mathematics Department team. The topic of coordinate geometry forms part of this years work and John hopes to teach it in the coming weeks. Rather than 'teaching from the book' John has decided to embrace technology and use Geogebra to teach the equation of a line. He will develop a web interface and then provide a webpage/Google form to the students as a form of assessment at the end of each lesson for the 4 weeks.



Research Question

In John's Postgraduate Masters in education teaching qualification, he studied Action Research. For the teacher researcher, self-study Action Research can constitute a living, authentic form of continuing professional development (CPD) that has the potential to change both the practice and the practitioner irrevocably. McNiff (2002) emphasises the centrality of self-reflection to action research – because, she argues, 'Action research is an enquiry conducted by the self into the self.'

John remembers that in AR each practitioner (teacher) uses this research approach to think about their own life and work, asking themselves why they do the things that they do, and why they are the way that they are (McNiff 2002).

John has identified the following as a possible research question to focus on:

Are open ended or closed ended questions preferable for students in online assessment for a 4th year mathematics class?

Cycles of Action and Data Collection

The action research plan which John has developed looks something like the following:

- Reflect on what is happening, think critically and identify values. Record my thinking
- Read critically, discuss, think critically and record my thinking with the other teachers in the Mathematics Department
- Find a focus, make a plan, take action, be aware of my values and record
- Reflect on the work, evaluate my actions, review how I see my values in my practice and record again
- Make a claim of my learning, establish criteria, present evidence, show rigour and validity
- Tell the story of my research to the Department, explain my new educational theory, show the potential significance of my work – and begin again.

In Action Research there are a variety of sources of data collection. Data sources are the following:

- Yourself – using reflective journals, video, planning and assessment review documents



- Pupils – using photographs, students' journals, students' work, audio files, student questionnaires, digital camera and assessment results
- Other educationalists – from critical colleague(s) and triangulation.

John aims to keep a reflective journal. This self-reflective journal will collect his thoughts on the lessons and the assessment he has designed. At the end of the start and at the end of this particular topic John will circulate a validated questionnaire to the young people. John is incorporating the four main stages of an action research plan for Continuing Professional Development within his Action Research cycles, that is:

- Thinking professionally and reflecting on how we, as teachers, inform our practice
- Critically questioning why we teach as we do and identifying areas of concern, or areas of practice - or of understanding of practice - that we felt could be explored
- Deciding what we can do about the questions we identify - making a plan and carrying it out, collecting data to describe what we have done
- Interpreting data and understanding the significance of what we have found out. This final section included practical strategies to enable us to disseminate the new ideas developed to others involved in education (McDonagh et al. 2012).

Data Analysis

Although John had been reflecting on what had been taking place all the way through the term. The quantitative data he has collected from the young people in his class will be analysed using excel or a similar tool.

Making Claims

Having analysed the data in this way, John has asked the other teachers in the Mathematics Department to read his report and reflection on the use of Geogebra in class. John remembers from his postgraduate programme, that action researchers need a system for judging the quality of their inquiries that is specifically tailored to their classroom-based research project, so research validity will be of concern and something this will be mindful of.

Conclusion

In concluding John certainly feels that although his aim was to explore the effectiveness of using technology for assessment purposes, he has enhanced his



own CPD and he has embraced technology in his class and also embraces assessment as a key form of pedagogy.

Section B. Deconstructing this case study

Background

One of the biggest barriers to teachers' implementation of effective assessment strategies is that they are perceived of as being too resource-intensive and time-consuming. Assessment need not be seen in this way if it is understood as an intrinsic part of teaching and learning. Indeed, it is often only through assessment that a teacher can be aware of whether a particular sequence of activities has resulted in the intended learning outcomes. Assessment is one of several elements of effective pedagogy

Pierce and Stacey (2010) proposed a taxonomy of the pedagogical opportunities that are afforded by mathematics analysis software as a way of drawing attention to possibilities for lesson design, of mapping current practice, or tracking professional growth. There are many opportunities for incorporating technology in the mathematics class and several can be utilised for assessment purposes.

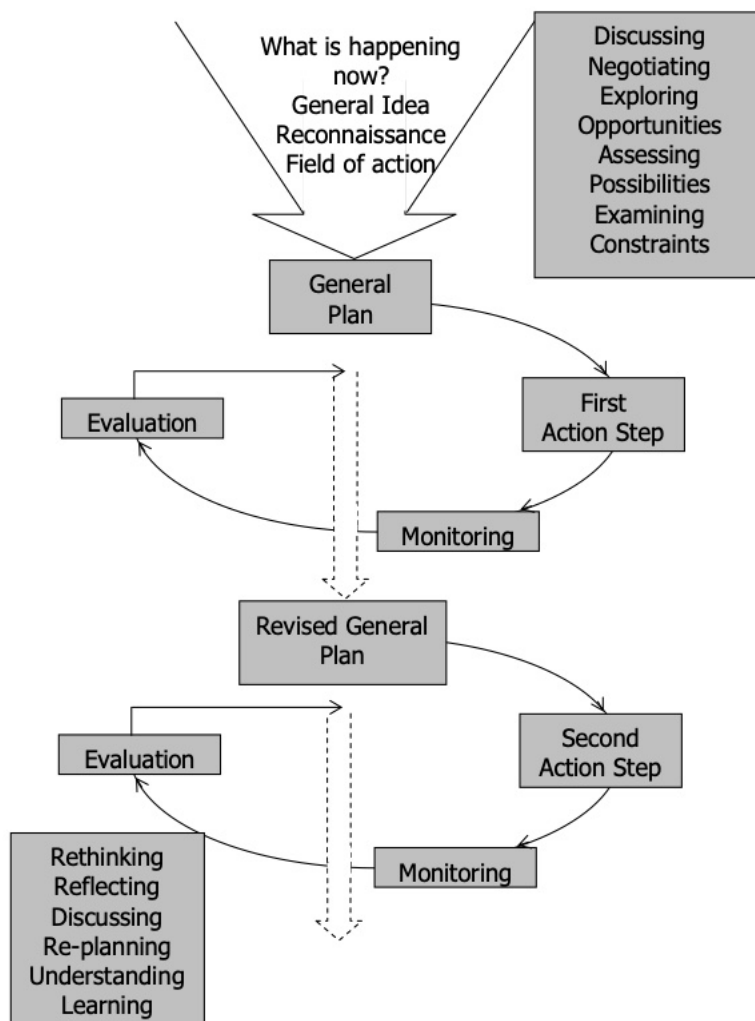
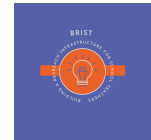
Pedagogical Focus

In incorporating technology in the mathematics class, John recognises that dynamic mathematical technology allows co-action between student and software and gives instant feedback to the student, enabling students' conjectures to be confirmed or refuted.

In reality, dynamic mathematical technology offers a substantial benefit: multiple representations – and different and linked representations of maths offered through technology can support students with accessing mathematical ideas at different levels.

Students can learn about geometric properties through tangible actions on dynamic shapes rather than merely 'naming of parts', leading to higher levels of engagement with the mathematical ideas. Graphing software can help shift focus to underlying concepts and allow for easier use of real-life data instant feedback and dynamic action on mathematical objects like shapes can allow students to engage with ideas at a higher level.

The Action Research cycles in John's work follows the following representation of Lewin's (1946) Action Research Cycles:



Cycle 1

Pedagogical Focus: facilitating the class and assessment in online electronic form.

Actions: using a google form assessment at the end of the topic with open ended questions.

Cycle 2

Pedagogical Focus: making learning more engaging for students by getting students to learn the content in their own time with the teacher facilitating the lesson or assisting when required.

Actions: Students access content and quiz in own time, with the support of a video tutorial. Assessment is a multiple choice form with only two open ended questions.

Cycle 3

Pedagogical Focus: student responsibility for learning by making tasks more collaborative, personalised and authentic. Assessment is multiple choice with negative marking.



Research Question

John identified the following as the research question to ponder on and deliver results of his research to the Department team:

Are open ended or closed ended questions preferable for students in online assessment for a 4th year mathematics class?

By altering the negative cycle these students encounter in regard to technology and mathematics, and placing them in an encouraging and supportive learning environment, the research will investigate whether the technology will improve student learning will affect their performance. It is envisaged that in creating a learning strategy and assessment for students learning coordinate geometry, we will facilitate understanding and learning.

Data Collection

John chose to collect two types of data - qualitative and quantitative. The self-reflective journal he kept was qualitative, whereas the survey given to students was quantitative data. The student assessment was also a form of data collection.

Qualitative research uses narrative, descriptive approaches to data collection to understand the way things are and what it means, from the perspectives of the research participants. Qualitative data, whether words or images, are the product of a process of interpretation, the data only becomes data when they are used as such. The data does not exist 'out-there' waiting to be discovered, as would be the case if a positivistic approach were adopted, but are produced by the way they are interpreted and used by researchers.

Quantitative research focuses on controlling a small number of variables to determine cause-effect relationships and/or the strength of those relationships. John realises that this type of research uses numbers to quantify the relationship, and takes an analytic approach to understand a number of controlled variables.

Data Analysis

Using both types of data collection allows John and the Mathematics Department in reviewing the work, view the changes in different ways.

Making Claims

When a dominant theme is in relation to student perceptions and beliefs there may be a certain degree of bias, therefore specific attention must be paid to the issues of



reliability and validity. The researcher should evaluate whether subsequent findings will demonstrate internal and external validity, as well as reliable.

Anderson et al argues that action researchers need a system specific to their classroom-based research project (Anderson et al 1994)

“If practitioner researchers are to be accepted in a larger dialogue about education, they much develop some inquiry criteria for their research... This conception of validity should respond to the purposes and conditions of practitioner research and the uniqueness of its contribution to the dialogue. (p.29)”

There is a challenge with regard to action research is in defining credible and impartial evidence. However due to the context of action research, manipulating cultural contexts may not be possible and it becomes difficult to replicate others' findings (Hoadley 2002).