Action Research Plan (1 per group)
Facilitation and Evaluation of Action Learning Projects in Literacy and Numeracy BCE Schools 2014

Please use this template to provide details of your Action Research Plan and email the completed Action Plan to:

Janelle Young  janelle.young@acu.edu.au

Please send me your plan at least two working days before the second full day session.

Name of your school: Southern Cross Catholic College - Kipparing Campus

Name/s of Team members: Julie Hall, Sue Abel, Lauren Keenan, Luke Grosjean

Name of your Action Research Project: Mathematical Modelling and ambitious instructional Practice in the primary classroom.

Aim of the Inquiry:

Reverse “standard” mathematical teaching approaches and implement a pedagogical approach, which sees students start with the problem rather than receive instructional teaching beforehand. Students will be provided with a problem and work their way to a solution, using their mathematical knowledge, making models, comparing reasoning with other students and explaining their findings, using mathematical language.

List some key features of the context surrounding your inquiry project.

Janeen Lamb to model teaching and learning process with teaching team first.

Teachers need to know and understand the mathematical concepts required to solve the problems.

Decide on chosen problem and open ended questions

Quantitative and qualitative data collection methods required:

✓ Checklists
Visible Learning for teachers and students:

- How am I going?
- Where am I going?
- Where to next?

Teachers reflect on evidence of their teaching and student learning. Students reflect on their chosen strategies, as well as areas of success and challenge. They will be guided to use mathematical language to express their findings.

Why is this particular project of interest to the team?

Linked to College “Vision for Learning”, which sees students engaged and owning their learning.

Fostering an environment of visible learning, whereby students come to understand themselves as individual learners and ask questions to help guide this process:
1. How am I going?
2. Where am I going?
3. Where to next?

Raise the bar of student learning standards and expectations – “Every student can succeed!”

Create an awareness of differing learning styles of students

Guide for developing questions and planning for the data collection.

<table>
<thead>
<tr>
<th>Background Questions</th>
<th>Project Questions</th>
<th>Data Collection Strategy</th>
<th>Dates for the Data Collection</th>
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<tbody>
<tr>
<td>(for increasing teacher knowledge about the area of interest). These are linked to seeking knowledge via the scholarly literature.</td>
<td>1. What successes and challenges did teachers face during the</td>
<td>1. Feedback from project teachers (surveys etc.) and</td>
<td>1. Upon project completion October</td>
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<tr>
<td>a. What can we learn from research about best practices for</td>
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<td>(for increasing teacher knowledge about the area of interest). These are linked to seeking knowledge via the scholarly literature.</td>
<td>“ambitious instructional mathematical practice”, and what successes/challenges were observed by outside parties? Eg open-ended questioning</td>
<td>observation of practice from outside parties</td>
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<td>enhancing students’ mathematical thinking and working?</td>
<td>2. In what ways do students make connections with previous knowledge, engage with the “ambitious instructional practice” and apply various mathematical methods to problem-solve?</td>
<td>2. Questionnaire Observations of students’ approaches</td>
<td>2. Collected during and after lessons July, August, September</td>
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<td>b. What mathematical “inquiry” knowledge and understanding of “ambitious instructional practice” will assist teachers in guiding the open-ended discussions and problem-solving?</td>
<td>3. How can the project results inform the planning of future teaching and learning, so as to cater for students who experienced success (growth mindsets) and support students who experienced challenges (fixed mindsets)?</td>
<td>3. ipad data Student interview Class discussions Results Observations of students’ approaches Teacher observations</td>
<td>4. During and end of project July - October</td>
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<td>c. What information will help guide both teachers and students to understand the differences between working at a fixed vs growth mindset?</td>
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<td>d. What daily practice can teachers begin to implement into their pedagogy to begin the process of “ambitious instructional practice”?</td>
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<td></td>
<td>4. Before commencement of project and continuing.</td>
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LEARNING FROM SCHOLARLY LITERATURE

Provide at least four sources of scholarly information (e.g. reports, academic papers, journal articles, text books) that provide background relating to your inquiry. Provide a concise summary paragraph concerning each of your sources of information and include how this source of information impacts on your particular area of interest.

Source 1: Smith et al Discussions

Summary: Five practices for orchestrating mathematical discussions.

Discussion give students the opportunities to share ideas, clarify understandings, developing convincing arguments, develop language for expressing mathematical ideas and to learn how to see things from other perspectives.

These strategies give teachers control over what is likely to happen in a discussion.

1. Anticipating – consider how students might mathematically interpret a problem, the array of strategies they might use and how these strategies might relate to mathematical ideas the teacher would like the students to learn.
2. Monitoring – paying close attention to students mathematical thinking and solution strategies as they work. Teacher can circulate around the classroom and create a list of solutions before teaching the lesson. Teacher should also ask questions that will make the students thinking visible and help clarify their thinking.
3. Selecting – Select students to share their work who will help contribute to the goal of the lesson. Keep track of who is selected so all students have a go at presenting.
4. Sequencing – By making purposeful choices about the order in which students work is shared, teachers can maximize the chances that their mathematical goals for the discussion will be achieved.
5. Connecting – the teacher helps students to draw connections between their solutions and other students solutions as well as the mathematical ideas in the lesson. The goal is to have student presentations build on each other to develop powerful mathematical ideas.

Source 2: Professor Carol Dweck (https://www.youtube.com/watch?v=kXhbtCcmsyQ)

Fixed Mindset

• It should come naturally
• Look smart at all costs
• If you have to apply effort you are not smart
• Hide mistakes and deficiencies
• Get defensive
• Poor scores
• No way to handle difficulty - give up
• Effort and difficulty make you feel “dumb”

**Growth Mindset**

• Jump in - no risk!
• Learn at all costs
• Work hard, effort is the key
• Even geniuses had to work hard!
• Effort makes them feel that they are learning
• They capitalise on mistakes and learn
• Love challenges...risk takers
• GRADE..NOT YET! They are on the curve but not at the finish line!
  “I tried but it didn't work YET”
  I'm not good at it YET!
  I can't do it YET!
• Faith in their ability to learn over time
• Growth mindsets builds personal qualities and GROWS the BRAIN
• Effort and difficulty take on a new meaning- they help you make a new connection .. become smarter and more resilient- embrace growth
• Praising student’s ability often backfires - *Intelligence V Process*
• Praising progress students learn more

**HUMAN ABILITIES CAN BE GROWN... THIS IS A HUMAN RIGHT**

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**Source 3:**
*Orchestrating Productive Mathematical Discussions: Five Practices for Helping Teachers Move Beyond Show and Tell*
Mary Kay Stein a; Randi A. Engle b; Margaret S. Smith a; Elizabeth K. Hughes c
a University of Pittsburgh, b University of California, Berkeley, USA c University of
Summary:

Facilitating discussion requires an extensive network of content knowledge, pedagogical knowledge, and knowledge of students as learners.

Practices for discussions

- Anticipating student responses
- Monitoring student responses to the task during the exploration phase
- Selecting particular students to present their responses
- Purposely sequencing student responses that will be displayed
- Helping the class make mathematical connections

Focus on using student developed work as a launching point for whole class discussions in which the teacher actively shapes the ideas that students produce to lead them towards more powerful, efficient and accurate mathematical thinking.

Teachers who attempt to use inquiry based student centred instructional tasks face challenges that go beyond identifying well designed tasks and setting them up appropriately in the classroom.

Students approach them in unanticipated ways – paths not specified. Teachers have to look at:

- How students are making sense of the task
- Align student’s ideas and approaches with appropriate understandings about the nature of mathematics. (this is difficult for most teachers)

Shouldn’t be “show and tell” – where students with correct answers each take turns sharing their solution strategies

Students are presented with realistic complex problems and use each other as resources for working through the problem and then share strategies and solution in whole class discussions, orchestrated by the teacher.

Source 4: Elwanger.
Summary

Elwanger looks at a mathematical instruction program called Individually Prescribed Instruction, or IPI. IPI was designed for students to "proceed through sequences of objectives that are arranged in a hierarchical order so that what a student studies in any given lesson is based on prerequisite abilities that he has mastered in preceding lessons". To measure that mastery, IPI relied heavily on assessments that were checked by the teacher or an aide, who would then have the opportunity to conference with the student and check for understanding. Erlwanger, however, saw many conflicts inherent in the program.

Benny had been in the IPI program since 2nd grade, and the teacher identified Benny as one of her best students. By sitting down and talking to Benny about the math he was learning, Erlwanger discovered that Benny's conception of math was not only very rule based, but in many cases Benny's rules yielded wrong answers. It's clear that Benny isn't simply guessing and getting wrong answers -- his methods are consistent and he can confidently explain his reasoning. Because Benny's teacher/aide is only looking for answers that match the key (and trying to do so quickly), the emphasis is on the answer, not the reasoning. It was only Benny's persistence that resulted in him mastering more objectives than most of his classmates.

Benny's misconceptions indicate that the weakness of IPI stems from its behaviorist approach to mathematics, its mode of instruction, and its concept of individualization. The insistence in IPI that the objectives in mathematics be defined in precise behavioral terms has produced a narrowly prescribed mathematics program that rewards correct answers only regardless of how they were obtained, thus allowing undesirable concepts to develop.

Erlwanger was able to demonstrate how Benny's understanding of mathematics conflicted with any "common sense" understanding of what would be regarded as "good mathematics." Prior to Benny, the large majority of research in mathematics education depended on quantitative methods -- using statistics to summarize and compare the performance of treatment and control groups. Erlwanger had opened the door to qualitative research, which essentially meant that researchers could now see the value of interviews, case studies, and similar methods. In other words, Benny showed researchers that they can, and should, talk to children.

Source 5 Mathematical Strategies (Peter Sullivan)
Good Questions for Math Teaching (Peter Sullivan & Pat Lilburn)

- Explicit – focussed experiences that engage children in developing and consolidating mathematical understanding
- Emphasis methods rather than answers
- Facilitate connections between topics
- Support cooperative group work
- Build on what the students already know
- Explore common misconceptions
- Focus on different representations of the same idea – solution can indicate to teachers what students already know.
- Structure your lessons LAUNCH - EXPLORE- SUMMARISE-REVIEW
- Challenge learning through good questioning.
- Teacher needs to be giving feedback and making observations that can inform subsequent phases in the next lesson.
- Encourage students to reflect on their learning and to describe their strategic thinking.
- Students need to be able to think, to learn, to analyse, to criticize, and to be able to solve unfamiliar problems.
- They require more than remembering a fact or reproducing a skill.
- They learn by answering the questions, and the teacher learns about each student from the attempt.
- There may be several acceptable answers.
- “Good Questioning” supports higher level thinking, cooperative problem solving, and communication.