iCommunication and Participation Framework: Teacher actions to engage students in mathematical practices

Developing conceptual explanations including using the problem context to make explanation experientially real				
Model providing a mathematical explanation. Use the context of the problem not just the numbers.	**Re-voice, and extend an explanation using the problem context. Expect mathematical reasons not "tidying" 19+7=20+6 because 6+1=7 and 19+1=20**	**Question to scaffold students to extend their explanations to include the problem context and what they did to the numbers mathematically.**	**Model and support the use of questions which clarify an explanation. What do you mean by? What did you do in that bit? Can you show us what you mean by? Could you draw a picture of what you are thinking?**	
Have the students develop two or more ways to explain a strategy solution which may include using materials	Compare explanations and develop the norm of what makes an acceptable explanation. Reinforce what makes it mathematical	**Launch the problem and have the students read it as a group, discuss, interpret, reinterpret collectively using student voice.**	Shortly after the small groups begin to solve a problem as a large group have them describe their different starting point. Reinforce acceptability of multiple ways. Support them to make connections to other or previous problems.	
Ask the students in small groups to examine their explanations and explore ways to revise, extend and elaborate on sections they think others might not understand			Have students examine their explanation, predict the questions they will be asked and prepare explanations.	
Active listening and questioning for sense-making of a mathematical explanation.				
Discuss and role-play active listening. Use inclusive language "show us", "we want to know", "tell us".	**Structure the students explaining and sense making section by section.**	**Emphasise need for individual responsibility for sense-making**	**Provide space in explanations for thinking and questioning**	Affirm models of students actively engaged and questioning to clarify sections or gain further information
Collaborative support and responsibility for the reasoning of all group members: Use core Pasifika values				
Provide students with problem and think-time then discussion and sharing before recording	**Establish use of one piece of paper one pen. Explore family structures where everyone participates**	**Establish expectation that students agree on construction of a solution strategy that all members can explain.**	**Explore ways to support students indicating need to ask a question during large group sharing. Use no hands up or the use of koosh balls, or pegs, or beany toys**	

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Explore ways for the students to support each other using a range of cultural models e.g. all in the same waka paddling together, or a kapa haka group which requires the expert to be responsible to bring the group up to their level of expertise		Select a different member of the small group to explain than the recorder	During large group sharing change the explainer mid explanation	When questions are asked of the small group select different members to respond (not the recorder or explainer)
Developing justification and mathematical argumentation				
Require that students indicate agreement or disagreement with part of an explanation or a whole explanation	Ask the students to provide mathematical reasons for agreeing or disagreeing with an explanation. Vary when this is required so that the students consider situations when the answer is either right or wrong.		Model and support the use of questions which lead to justification like 'How do you know it works?', 'Can you convince us', 'Why would that tell you to', 'why does that work like that', 'so what happens if you go like that', 'are you sure it's', 'so what happens if', 'what about if you say…does that still work', 'so if we	
Ask the students to be prepared to justify sections of their solution strategy in response to questions.	Require that the students analyse their explanations and prepare collaborative responses to sections they are going to need to justify	Model ways to justify an explanation "I know 3 + 4 = 7 because 3 + 3 = 6 and one more is 7".	Structure activity which strengthens student ability to respond to challenge	Encourage the use of 'so if', 'then', 'because' to make justifications. Use this format to validate an explanation
Expect that group members will support each other when explaining and justifying to a larger group	Explicitly use wait time or think time before requiring students to respond to questions or challenge	Require that the students prepare ways to re-explain in a different way an explanation to justify it.	Provide wait time to allow students to prepare questions which lead to justification	

Developing representing as part of exploring and making connections (How can I/we make sense of this for my/ourselves). Communication and justification (How can I explain, show, convince other people)			
Expect the use of a range of representations including acting it out, drawing a picture or diagram, visualising, making a model, using symbols, verbalising or putting into words, using materials.	Expect the students to explain and justify using the representation as actions on quantities not manipulation of symbols (use context)	Require that the students compare and contrast representations and evaluate for efficiency	Ask students to re-represent their thinking in different forms in response to questions or for clarification

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Developing the use of mathematical language			
Expect the use of mathematical language to describe actions while making mathematical explanations	Expect the use of correct mathematical terms. Ask questions to clarify terms and actions on symbols (using the context).	Require the use of mathematical words to describe actions. Reword or re-explain mathematical terms and mathematical explanations. Use other examples to illustrate meaning.	Require students that the students pose questions using appropriate mathematical language.
Developing generalisations: Representing a mathematical relationship in more general terms. Looking for rules and relationships. Connecting, extending, reconciling.			
Ask the students to consider what steps they are doing over and over again and begin to make predictions about what is changing and what is staying the same.	Ask the students to consider if the rule or solution strategy they have used will work for other numbers. Consider if they can use the same process for a more general case. (e.g. what happens if you multiply any number by 2)	Model and support the use of questions which lead to generalisations like 'Does it always work?', Can you make connections between', ' Can you see any patterns? Can you make connections between', How is this the same or different to what we did before', Would that work with all numbers',	

- Affirm examples of social risk taking
- Affirm examples of intellectual risk taking
- Affirm persistence
- Affirm effort over ability
- Actively seek ways to reposition and promote the intellectual contributions of the less able in small group work
- Support individual students to access the reasoning of an explainer
- Re-explain, reword but do not repeat to make the explanation accessible to all the listeners
- Check back to explainer that that was what they meant.
- Attribute thinking and explanations to the groups
- Reword names for correct mathematical terms
- Allow students space to withdraw but indicate that they will be asked questions within the next few minutes

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