

Fostering Interaction and Opening Up Talk to Support Learning in Primary Science

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Overview

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Focus of Study

How fostering interaction and opening up classroom talk can support students' learning, and sharpen accuracy and precision in their reasoning in primary Science

Specifically, the interest is on **how teachers co-construct knowledge with students** through strategic questioning and active engagement with students through productive academic discussions.



Theoretical Underpinnings

- Study adopts Vygotskyan (1981) principles: Learning & meaning develop through **interaction** between learners, teachers & peers
- How classroom talk can support student meaning-making to generate **productive academic conversations** that are **'sustained and purposeful'** (Zwiers & Crawford, 2011, p.1) & facilitate the joint knowledge construction, extension & transformation through 'chains of questioning, responding and feedback' (Alexander, 2008, p. 113)
- An 'integral part of **communicating** the knowing and doing science' is through 'participating and expressing science understanding through talk' (Tank & Coffino, 2014, p.195).



Why Teacher Questioning Matters

Builds conceptual understanding (especially abstract ones such as Heat & Electricity)

- Rich discussion leads to deepening understanding of concepts
- Convergence of the divergent ideas

Makes meaningful cognitive connections

- From **Exploring** ideas to **Explaining** concepts
- From **Knowing** some knowledge to **Enhancing** students' existing knowledge
- From having '**No idea**' to **Co-constructing** new knowledge together



Method

- Subjects
 - Science Upper Primary students in two P5 classes (High Progress and Middle Progress): 78
 - 2 teachers with 12 and 8 years of Science teaching experience
 - Mainstream school, average to high socioeconomic background
- Data sources
 - Teachers' instructional materials
 - Students' written work
 - Transcripts of recorded lessons
 - Teachers' feedback from semi-structured interviews
 - Students' feedback from focus group discussions



Method

Curriculum context:

Four cycles of Science lessons, applying input from Question-Based Instruction (AST) and the use of Talk Moves (ELIS)

Each cycle consists of:

- Pre-lesson conference (*Planned and framed the learning*)
- Lesson observation (*Made use of Swivl & AST Master Teacher sat in to observe, recordings sent to ELIS staff for input*)
- Post-lesson observation conference (*Reflected upon input on teacher questioning provided by ELIS & AST*)



Talk Moves

Talk Move	Frames for Prompting	Frames for Responding
Elicit students' views on other students' ideas	<ul style="list-style-type: none">• What do you think about what X has just said?• Who has a similar / different view about how this works?	<ul style="list-style-type: none">• I agree / I don't quite with X because...• I have a similar / different view on this because I think...
Probe for reasoning or evidence	<ul style="list-style-type: none">• What's your evidence for that?• How did you come up with that answer?	<ul style="list-style-type: none">• The data that shows me...• In the text here, it says that...
Challenge students' statement or assumption	<ul style="list-style-type: none">• I'm not sure whether I'm convinced by...• How does that link to what we said earlier?	<ul style="list-style-type: none">• I guess another way to look at / explain it is...• A possible connection is...

(Adapted from Michaels & O'Connor, 2012 and Zwiers & Crawford, 2011)



Mediating The Learning Using Talk: Teacher 1

Speaker	Utterance	Teacher's Talk Moves
T	<p>Based on what we know about the seed dispersal methods so far, this far, which one do you think will allow the seed to travel the furthest? I want you to rank these according to ascending order. Do you know what ascending order is? Starting from the what? Starting from longest to shortest or shortest to longest? Ah yes, from the shortest distance to longest distance. (students started to write on their bubble map)</p>	Elicit information
	<p>Ah S1 said it depends. What do you mean by it, S1?</p>	Probe for reasoning
S1	<p>Depends on how long the river is.... For example when the bird flies... they can fly very far.. but then if it's an animal with very little population and the habitat is low, then the animal cannot bring the seeds very far. For water, sometimes the seed can move from one side of the pond to the other side of the pond or can be in the river that is many kilometres long so it all actually depends.</p>	



Mediating The Learning Using Talk: Teacher 1

Speaker	Utterance	Teacher's Talk Moves
S2	Ok I agree with the water part. But the bird, they have continuous motion of the wings. So the seeds can fall off even if just a short distance. So it does not matter. For example, if it is a long distance bird, when they keep on flapping the wings, the seeds will loosen and fall off. So the seeds won't be travelling that far.	
T	So that means, even if I'm able to cling onto a bird, I (seed) can travel a shorter distance or longer distance? Is that what you are trying to say?	Revoice for verification
S2	Somewhere there is...Deep inside the bird or there is something that won't make it drop off that easily. The bird could fly a long distance and the seed is still there but the continuous motion of the wings, can cause the seeds to drop off.	
T	Ok, anyone of you agree or disagree with S1 or S2?	Elicit students' views on other students' views

Mediating The Learning Using Talk: Teacher 2

Speaker	Utterance	Teacher's Talk Moves
T	What is the main important purpose of seeds?	Elicit information
S1	The method of dispersal.	
T	Yes the method of dispersal of seeds. And when we talk about the methods of dispersal of seeds. What did we talk about? Why do seeds need to be dispersed. What did we say the last time? Why is it a must or why is it a normal thing? Why do you think seeds need to be dispersed? S2?	Probe for reasoning
S2	So that a plant can grow.	
T	So that a new plant can grow. So the seeds can grow into a new plant but why is it that these seeds have to be dispersed?	Probe for reasoning
S2	So that the plant won't be extinct.	Elicit students' views on other students' views
T	So that the plant will not be extinct. Do you agree with her?	



Mediating The Learning Using Talk: Teacher 2

Speaker	Utterance	Teacher's Talk Moves
T	Anybody else would like to add on , anything else that you think is important to add on to this.. The third part. The one on, energy is not a matter	Guide students to build on other student's views
T	No? First one anything to add on? Joann?	
S1	Energy is ... (Students read definition from textbook)	
T	So what is in summary ... what does that sentence tell you that. Can you summarize that sentence?	Get students to summarize and consolidate
S1	About energy that have different forms of energy.	
T	What do you mean about the different forms of energy?	Seek clarification
S1	What it does.	
T	So are you saying that the different forms of energy helps us to work?	Revoice for verification



Students Engaging In Extended Discussion

T: Ok, anyone of you agree or disagree with S1 or S2?

S3: I agree with S2 but sometimes they might fly over the river and the seeds will just drop into the river .

T: So what happens to the seed?

S3: They cannot grow.

T: Any other views?

S4: I neither agree nor disagree but then it depends on the situation of the plant. If the plant is on the Pacific Island they can't travel very far when disperse any methods on land but on water, it travel long distances, depending on the environment around it

S5: I agree with S1. Sometimes it depends on the plant because water is at that place so can only disperse seed at that place but then coconut can float far distance.



Teachers' Perspectives

Then	Now
Mostly teacher-dominated classroom talk	More interactive and dialogic communication
Pose questions to students but answer teachers' own questions almost immediately	Use of strategic Talk Moves to invite other students for their views More effective use of wait time: Increase of wait time from 1 to 3s-5s

Teachers' Perspectives

Then	Now
Limited teacher questioning repertoire: Use only 'Why' type of question repeatedly	Extended teacher questioning repertoire: Use of specific Talk Moves to open up classroom talk for various purposes
Accept answers too quickly	Engage students to respond to each others' points in a discussion

Teachers' Perspectives

Then	Now
Focus only on targeted content to be disseminated as lesson outcomes	Expand lesson outcomes to include: <ul style="list-style-type: none"><li data-bbox="948 486 1818 694">• <i>Why are we learning what we are learning? (keep the end in mind)</i><li data-bbox="948 715 1846 843">• <i>What is the big idea behind this concept?</i>
Got carried away in a stretch of discourse and not able to manage diverging ideas	Use whiteboard to write crucial points raised by students and help to make connections visible

Students' Perspectives

How opening up talk helped students	Example of student response
Understanding demands of given tasks	<i>I think I am now better in answering science questions as my teacher went through detailed discussions of tasks by questioning us.</i>

Students' Perspectives

How opening up talk helped students	Example of student response
Deepening conceptual understanding	<p><i>You can dive more deeply into the concepts. We can then get the concepts better for further interpretation and understanding.</i></p> <p><i>Your questioning techniques are good. You asked us based on the concept that you need to teach us and you test our understanding based on the concepts to see if we really understand or not.</i></p>

Students' Perspectives

How opening up talk helped students	Example of student response
<p>Sharpening explanations through peer critique and feedback class discussion</p>	<p><i>During the class discussion, you let us try to answer a question. Then you ask us whether we agree or disagree. Then, we edit the sentence; help change the sentence (improved version) so that we can use it as an answer that everyone understands.</i></p> <p><i>My teacher got all of us to comment on each other's answers in the classroom by using hand signs and commenting on answers. I find that I could better understand what I was learning in this way.</i></p>

Students' Perspectives

How opening up talk helped students	Example of student response
Reinforcing key ideas through making the necessary conceptual links and connections	<i>The way you questioned is very good. Although you talk about a lot concept (points), you always relate to the main concept.</i>

Pedagogical Implications

- Providing stimulating and conducive environment for high student engagement in class
- Deliberate planning of time and space for students to voice their views
- Designing of learning activities that open up talk to support learning in class
- Crafting of key questions to expand the dialogic space for learning in class





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