

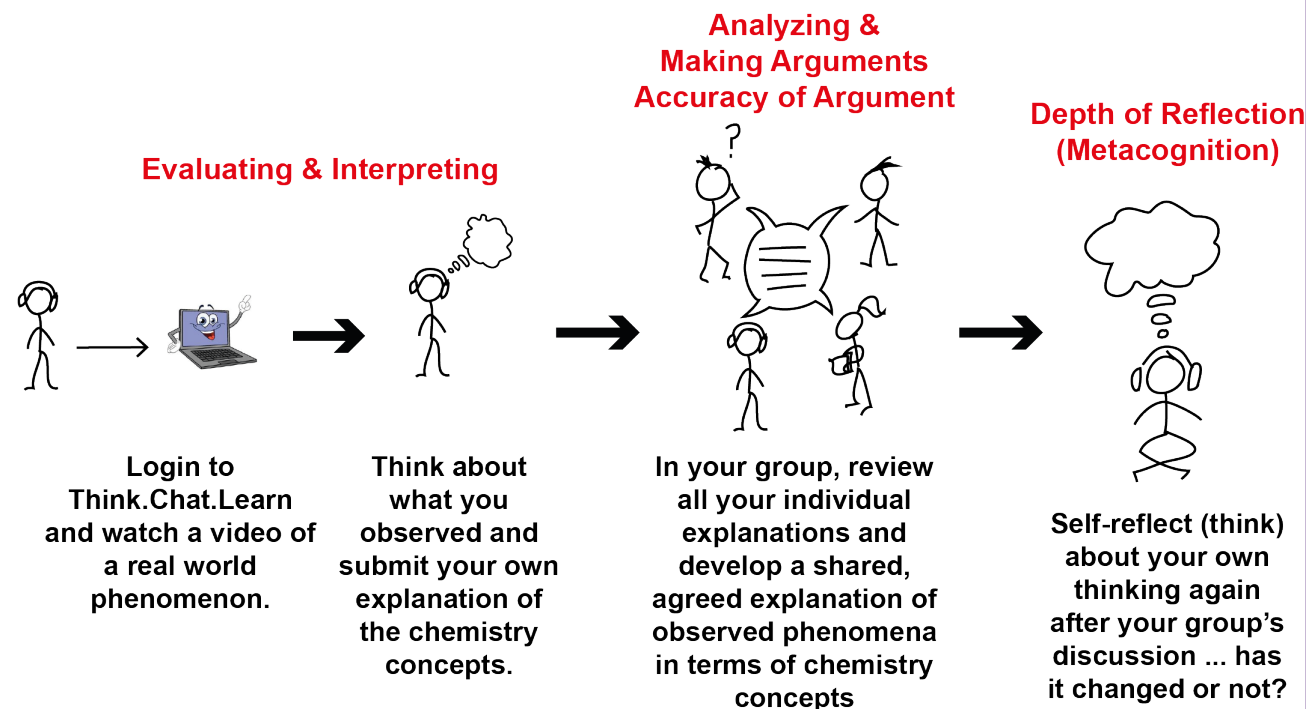
Assessing Disciplinary Discourse & Explanations

Intended LOs: *Metacognition, communication of concepts*

Task design:

- Stimulus videos of real-world **complex** systems introducing cognitive conflict.
- Students propose an individual explanation, discuss in a group to find a consensus explanation then reflect on their individual thinking.
- Interdependency introduced through shared explanations.

Assessment Criteria for Think.Chat.Learn



Week 6



Week 10



THINK.CHAT.LEARN

Marking & Feedback Panel (T.C.L. Platform)

Example of one student's engagement in a task

Question

Dead Sea Equilibria

SHOW QUESTION >

Response

The dead sea is the saltiest body of water on Earth. This is due to the high number of sodium and chlorine ions that are present within the water. The cubes that the tourists found are most likely results of temperature, pressure, and volume that forced the state of the ions to change. In this case, sodium and chlorine ions would have bonded and become solids that the tide of the sea shaped into cubes. The remaining ions would most likely have experienced a similar phenomenon however, may have been heavier and remained at the bottom of the sea.

Confidence: 1/5

Discussion

- 1 I had thought it was the cube lattice structure of NaCl
- 2 cause you aren't going to always have a perfect cube
- 2 yeah most will be cubes but not 100% of the time
- 4 Oh okay, so the shape is purely a molecular thing?
- 1 yeah I think it depends on the lattice layering and the other ions in the solution
- 2 yeah that would make sense student 1
- 1 What did everyone think about the remaining ions in the dead sea?
- 2 I really like student 4 answer how they are heavier and more dense. I hadn't thought about that
- 4 Would they experience something similar but they might be heavier and may not be able to make it to shore? Maybe there are solid ions on the bottom of the sea?

Dead sea equilibria - Reflection

SHOW QUESTION >

Response

I think my original answer was close but not 100% correct. I now know that the shape of the cubes would be formed due to the lattice of the ions, therefore meaning that this is a molecular structure and not something that has been physically shaped. I would also condense my answer to make it more concise by simply saying that evaporation lessens the volume of the body of water, therefore meaning that the water becomes over saturated and ions are forced to react and change forms. We also agreed that a similar occurrence would happen with other ions, however these ions may be heavier or more dense and may not make it to the shore of the sea. We also said that this process could be undone through interactions between the polar water molecules and the ions should the saturation decrease. Overall, I am just much more confident in my response to the scenario.

Confidence: 5/5

Individual Explanation of Thinking

Collaborative Peer Discourse (extract)

Individual Reflection on Thinking

Instructor/Tutor Marking & Feedback Panel

TCL Session 2.4 (Thursday May 14th) (9:30 - 10:00 am)

Available Start: 14/05/2020, 9:26:26 am Available End: 14/05/2020, 10:00:32 am

Search for student by ID or name in session

The student being marked is assigned an ID and highlighted in a colour code to enable easy visual of discrimination of contributions

Easy access tab to move between each group for marking

1 s4641367

2 s4583126

3 s4585542

4 s4642001

Question

Discussion

- 1 That's true
- 2 yeah i think maybe it is more a solid lattice rather than an actual cube shape
- 1 I had thought it was the cube lattice structure of NaCl
- 2 cause you aren't going to always have a perfect cube
- 2 yeah most will be cubes but not 100% of the time
- 4 Oh okay, so the shape is purely a molecular thing?
- 1 yeah I think it depends on the lattice layering and the other ions in the solution

The student's individual pre-chat response & post-chat reflection (not shown) are easily accessible in drop-down fields

Scroll down view of the chat

Rubric criteria Click on bubble to score and open pop up feedback panel to enter comments

Rubric - s4641367

- evaluating
- interpreting
- identifying/reflecting
- analysing
- making arguments
- accuracy/arguments
- expressing/developing

General feedback

SAVE

Evaluation Rubric:

Analysing student discourse to evidence their reasoning about chemical concepts:

- *Evaluating*
- *Interpreting*
- *Depth of Reflection*
- *Analyzing*
- *Making Arguments*
- *Accuracy of Argument*

... Informed by the critical thinking framework (Ellerton & Brown, UQ)

...adapted Ruder, Lantz & Cole rubric (<http://elipss.com/index.html>)

Moon, A., Stanford, C., Cole, R. and Towns, M. (2016) The nature of students' chemical reasoning employed in scientific argumentation in physical chemistry. *Chemistry Education Research and Practice*. 17, 353-364.

Ellerton, P. (2015). Metacognition and critical thinking: Some pedagogical imperatives. In *The Palgrave handbook of critical thinking in higher education* (pp. 409-426). Palgrave Macmillan US.

Ellerton, P. (2016). The Critical Thinking Matrix. From: <http://www.ctp.uq.edu.au/content/resources-and-pedagogical-framework>

Online Rubric Scoring:

5 = Completely 4 = Mostly 3 = Good Attempt 2 = Some Attempt 1 = Minimally 0 = No Evidence

Marks for Individual Reasoning and Reflection Activities

Information Processing <i>Evaluating, interpreting, and manipulating or transforming information</i>	
Evaluating <i>The extent to which you evaluate information for relevance or importance to the task.</i>	Observable Student Behaviors
	Raise a question to help analyse the information
	Indicate what information is NOT important
	Indicate what prior knowledge is important
	Verbalize why certain information is important or not
Things to do to Improve:	
a) Carefully review all information, and identify its main purpose	
b) Write down a question that identifies additional information that is needed to solve a problem.	
c) Write down any prior knowledge that you need and is not provided to you.	
d) Consider whether your argument is sound or claim is justified	
Interpreting <i>The extent to which you correctly interpret observations.</i>	Observable Student Behaviors
	Assign meaning to observation (phenomena, images, changes) that is not explicitly stated
	Determine links between observations
	Extract specific details from information
	Explain observations in your own words - not repeating textbook definitions
Things to do to Improve:	
a) Identify key information from phenomena observed.	
b) Verbalize what variables, relationships, etc mean using complete sentences and in your own words.	
c) Explain observations and discuss information with others to develop a shared understanding of the information	

Metacognition <i>Thinking/reflecting about one's thinking and how one learns, and being aware of one's knowledge.</i>	
Depth of Reflection <i>The extent to which you authentically and accurately consider your performance.</i>	Observable Student Behaviors
	Comments about differences between your initial ideas and group consensus
	Discussion of scientific accuracy/inaccuracy of initial ideas
	Discussion of how ideas have changed, incorporation of new ideas
	Discussion of confidence in understanding and reasons for it
Things to do to Improve:	
a) Make explicit comparisons between your ideas/answers and those of your peers	
b) Consider alternative perspectives presented by others to broaden your awareness of alternative views	
c) Critically evaluate what aspects of your ideas were correct and what needs to be modified	
d) Consider if your understanding is complete or if you now have questions regarding the depth and accuracy of your understanding	

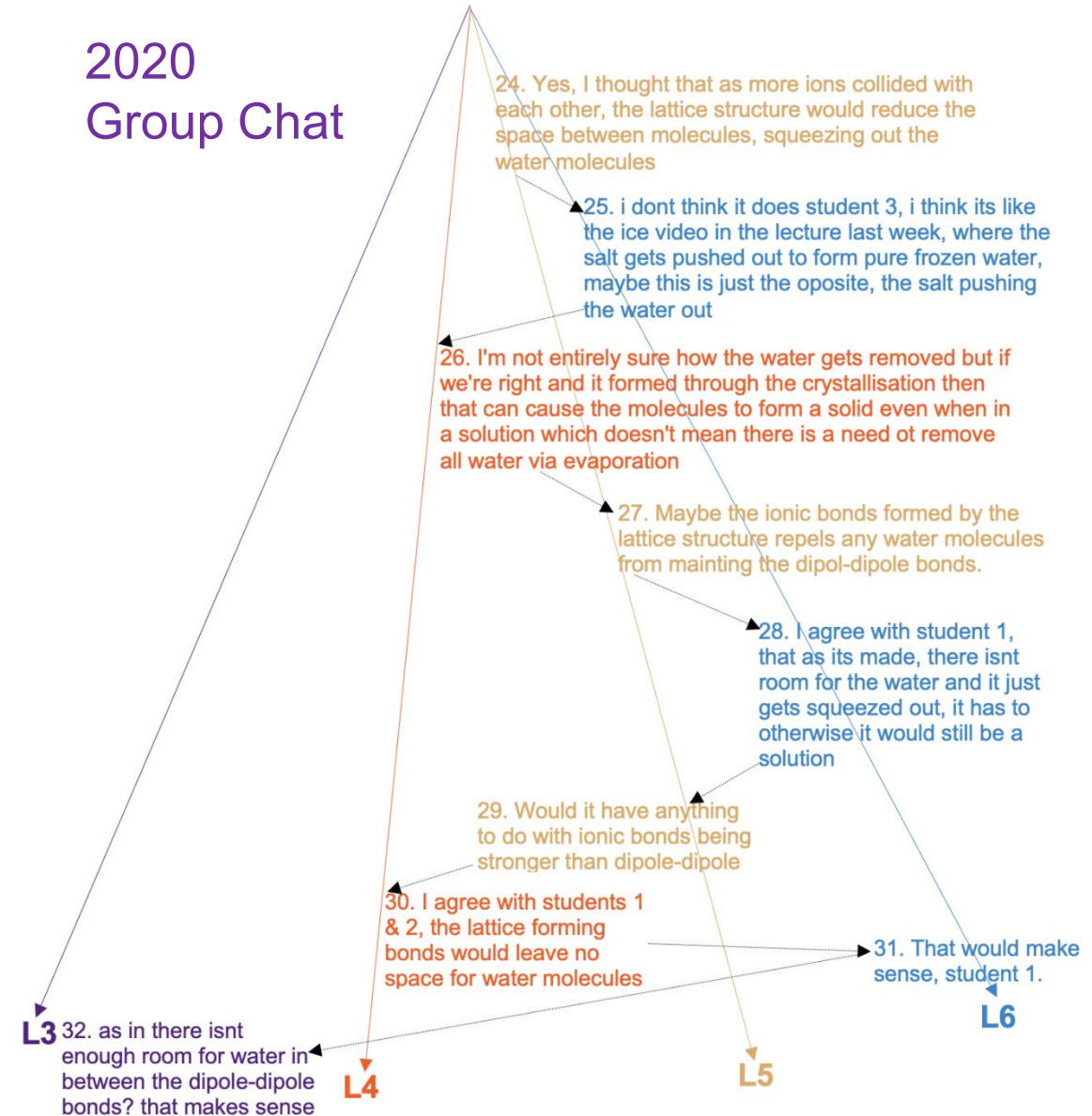
Developing Connectivity Between Levels of Thinking



Dead sea amazing natural phenomenon - DeadSea salt cubes

The overall quality of the argumentation	2019 (%)	2020 (%)
Macroscopic	8.60	2.44
Microscopic	-	-
Symbolic	-	-
Bridging between Macro and microscopic	20.43	17.68
Bridging between macro and symbolic	4.30	2.44
Bridging between macro, micro and symbolic	66.67	77.44

2020 Group Chat





- **Instructional scaffolding** in the LMS is required to set expectations and successfully engage students in *constructive* discourse and to increase the quality of the exchanges between students.
- **Feedback is critical:** Analysis of student chat entries enables instructors to identify significant *alternate conceptions* and incorrect explanations which can be addressed in lectures. Students find it difficult to analyse real world contexts (+ + + systems thinking)
- **Peer discourse** supports student engagement in *authentic reflection* on their own thinking of concepts.
- **Resource intensive** for large classes - takes time to mark groups even with online click rubric (this semester, just me, 500+ submissions ~20 hours)

