Promoting the Use of Educational Technology in Learning and Teaching in Science (S1-3)

Teacher Sharing

Bonnie

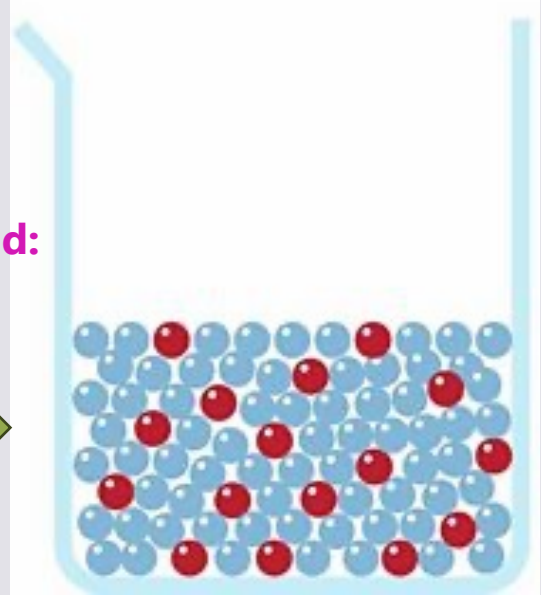
YLMASS, EMI school

Before using DragGame e-Learning activities

- More proportions of direct teaching of the abstract concept
- Hard to organize discussion (students had a huge variety of thoughts)
- Could not visualize their thinking (ideas about how particles look like and how they are arranged)
  - *E.g. do they misunderstand "one sugar powder" = "one sugar particle"?*
  - *Do they think that "particles become smaller when the sugar grain is cut into smaller pieces"?*
- No "common language" (in terms of a universal system in expressing own ideas and understanding others' ideas)
  - *E.g. meaning of particles, understanding how particle models are used for explanation and predictions*

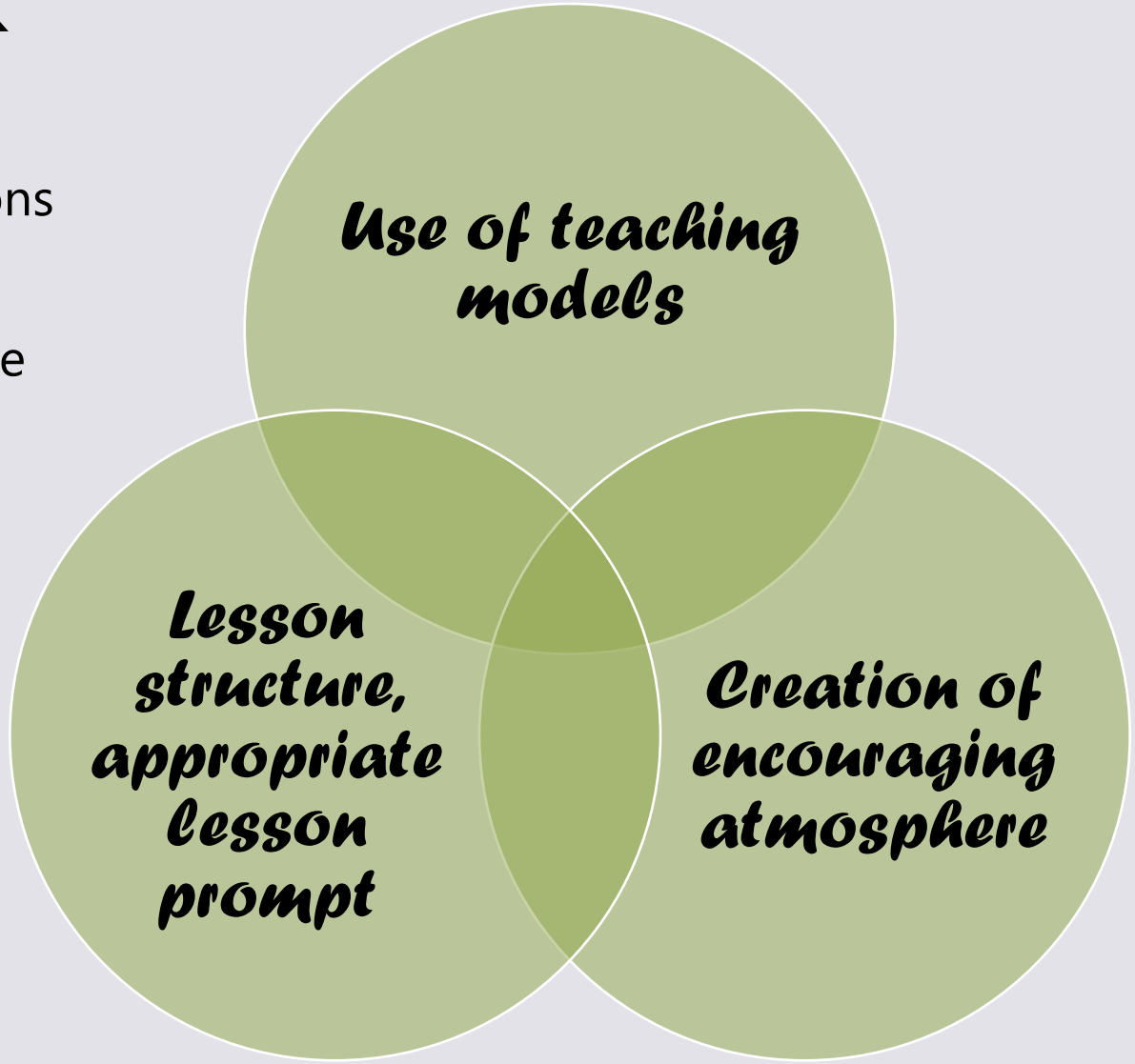
In some students' mind: the sugar "particles" (powder) can be "cut" into smaller pieces

In teachers' mind:



After using DragGame e-Learning activities: Enhancement in PCK

- Working on ss generated representations to develop students' scientific ideas
- Create a context which favours dialogue & controversy
- Conditions of efficient implementation:
  - *Adaptation of teaching models*
  - *Creation of appropriate context*



Create a context which favours dialogue & controversy

1. Cognitive
   1. ***Structure of lesson: P → O → E :*** ***<u>What problem should teachers create in order to arouse dialogue & controversy?</u>***
   2. *(a) A situation which* ***is surprising and arouses*** *students' need of learning / (b) elicits a large variety of ideas.*
      - <u>A daily-life phenomenon with thought-provoking focus for discussion</u>
        - *Predict what will happen when a wet room is closed for 2 hours. Why would the floor get dried? Where does the water go? Do they disappear?*
      - <u>A simple experiment with (surprising) observation for students to explain</u>
        - *Dissolving dye in water / Thermal expansion and contraction with syringe*

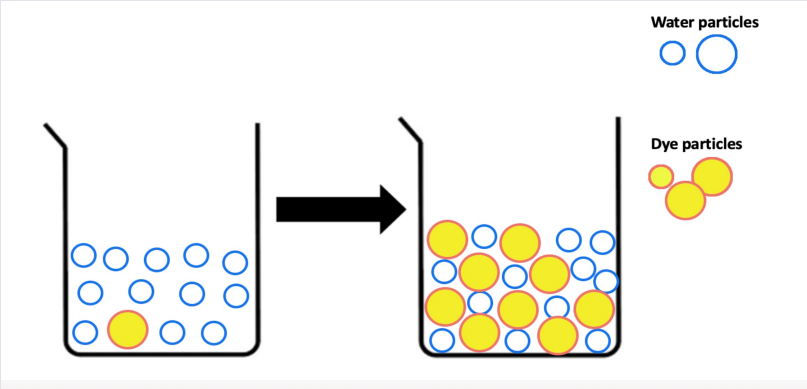
Create a context which favours dialogue & controversy

2. Psychological / Social

1. *Friendly, encouraging atmosphere which provides equal opportunity for students to share their ideas and listen to (understand) others' ideas*

- **Teacher's vocal encouragement :** Praise on behaviour; appreciate the progress → provides extrinsic and intrinsic motivation
- **Teachers' techniques in facilitating the discussion**, e.g.
  - *initiate a discussion*
  - *ensure students have listened to others ("Can you use your own words to repeat….")*
  - *encourage students to respond to others as a way to interpret students' understanding ("What is the difference between your idea and ____'s ?)*
  - *provide feedback to students' understanding and deepen the discussion ("After listening to …., would you change your idea?)*

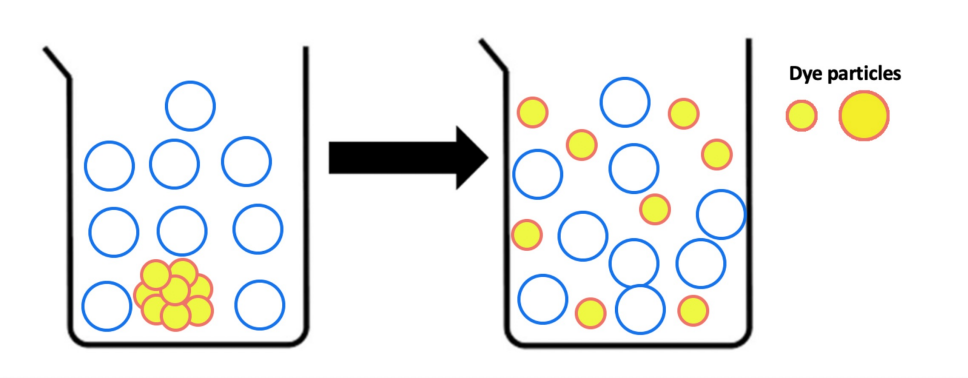
Examples



Macroscopic situation → Explained by → Microscopic Interpretation (particle model, DragGame) → Predict → Another macroscopic situation

Controversy: A wide range of ideas → Focus on → One discussion point:
→ Bring out the controversy
→ Listen to different ideas
→ Reflect and evaluate
→ (possibly) bring a change in idea
→ Go to another point

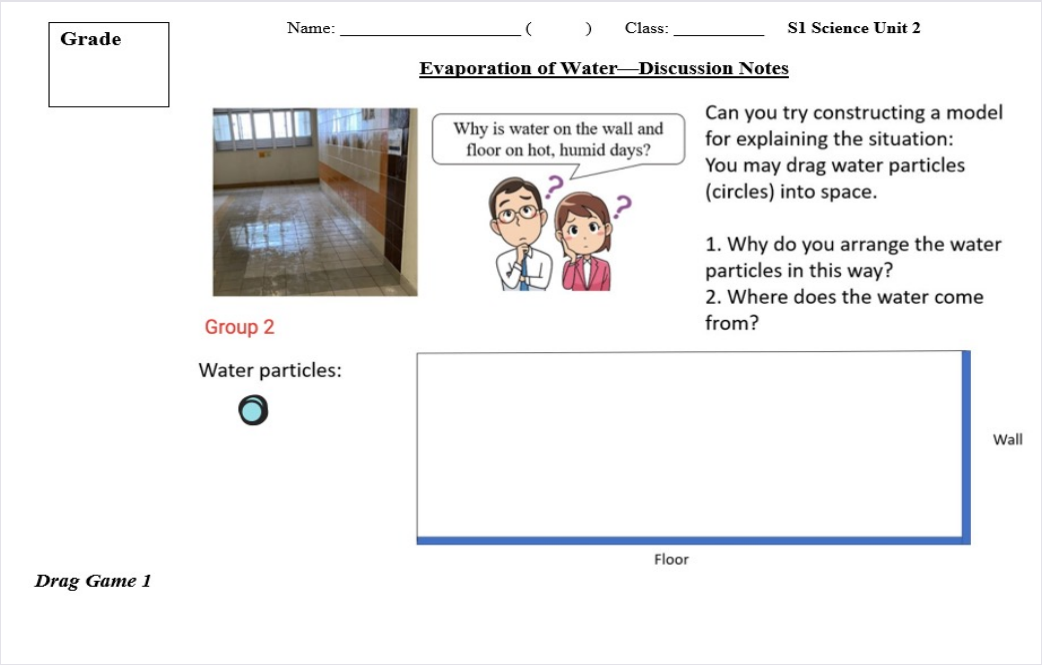
Think → Pair → Share



Water Cycle

Macroscopic situation → Explained by → Microscopic Interpretation (particle model, DragGame) → Predict → Another macroscopic situation

Controversy: A wide range of ideas → Focus on → One discussion point:
→ Bring out the controversy
→ Listen to different ideas
→ Reflect and evaluate
→ (possibly) bring a change in idea
→ Go to another point



Grade

Name: _____ ( ) Class: _____ S1 Science Unit 2

Evaporation of Water—Discussion Notes

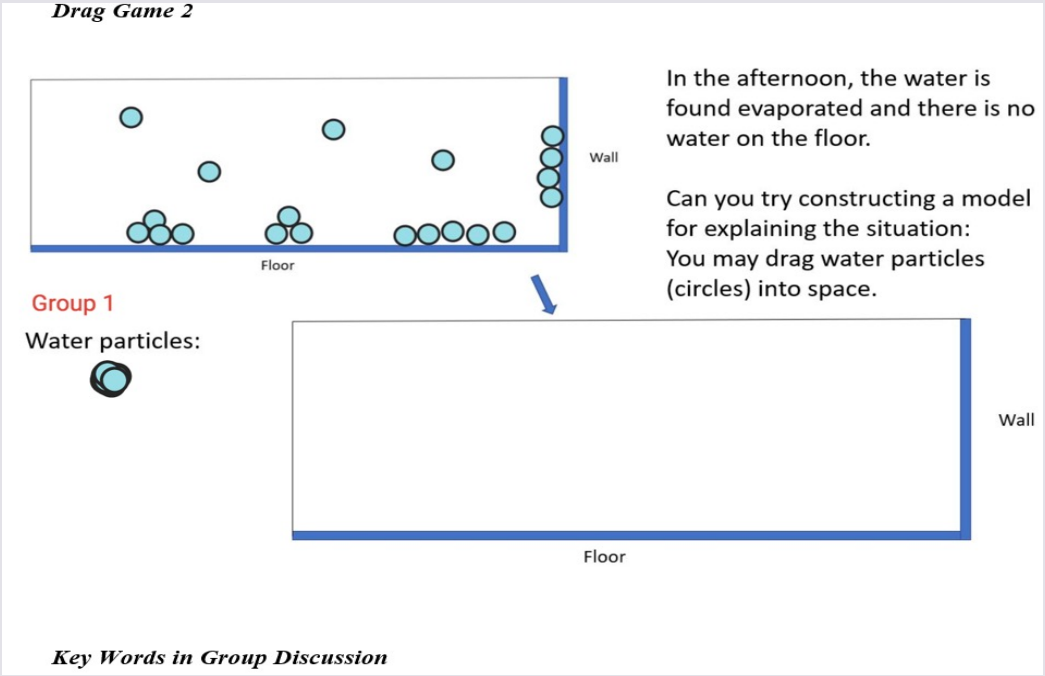
Can you try constructing a model for explaining the situation:
You may drag water particles (circles) into space.

1. Why do you arrange the water particles in this way?
2. Where does the water come from?

Group 2

Water particles:

Drag Game 1



Drag Game 2

In the afternoon, the water is found evaporated and there is no water on the floor.

Can you try constructing a model for explaining the situation:
You may drag water particles (circles) into space.

Group 1

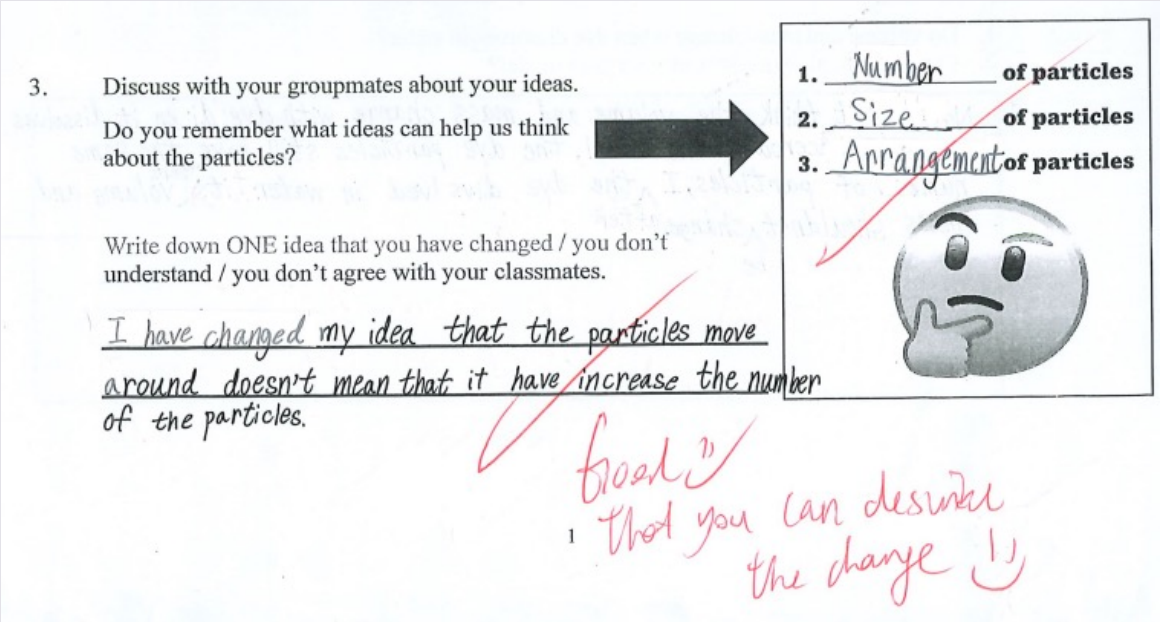
Water particles:

Key Words in Group Discussion

Particle model: Water + Dye

Macroscopic situation → Explained by → Microscopic Interpretation (particle model, DragGame) → Predict → Another macroscopic situation

Controversy: A wide range of ideas → Focus on → One discussion point:
→ Bring out the controversy
→ Listen to different ideas
→ Reflect and evaluate
→ (possibly) bring a change in idea
→ Go to another point



3. Discuss with your groupmates about your ideas.

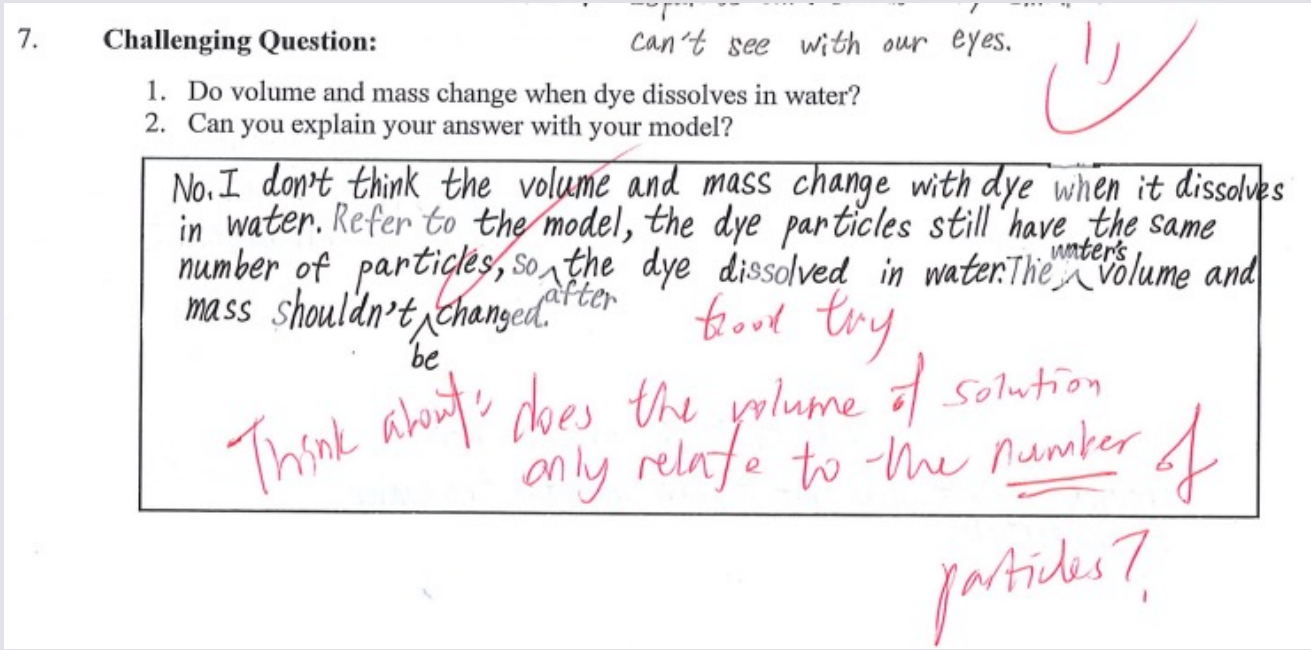
Do you remember what ideas can help us think about the particles?

1. Number of particles
2. Size of particles
3. Arrangement of particles

Write down ONE idea that you have changed / you don't understand / you don't agree with your classmates.

I have changed my idea that the particles move around doesn't mean that it have increase the number of the particles.

Good! that you can describe the change



7. **Challenging Question:**

1. Do volume and mass change when dye dissolves in water?
2. Can you explain your answer with your model?

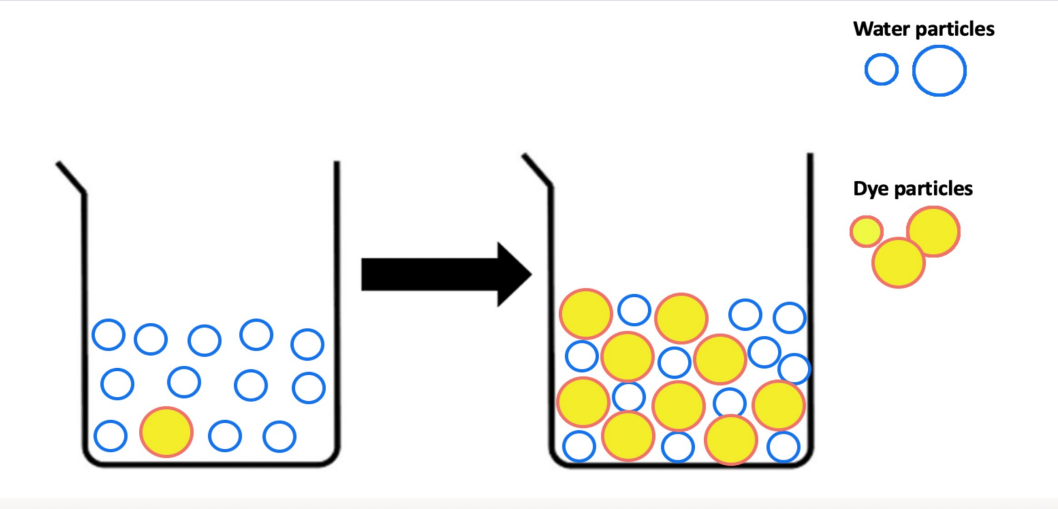
No. I don't think the volume and mass change with dye when it dissolves in water. Refer to the model, the dye particles still have the same number of particles, so the dye dissolved in water. The water's volume and mass shouldn't be changed after.

Good try

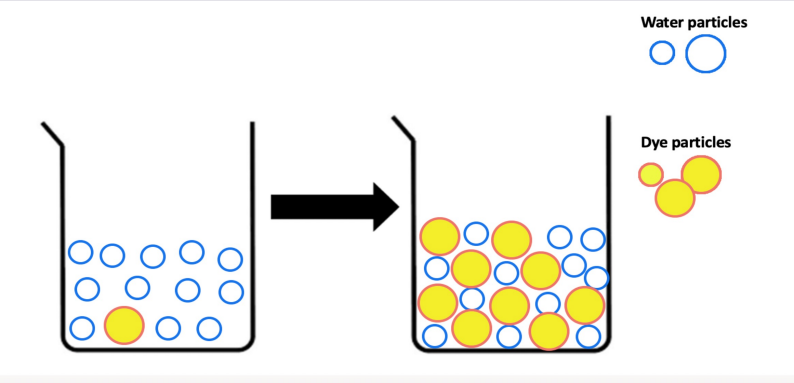
Think about: does the volume of solution only relate to the number of particles?

Summary

- Could explicitly lead students think about the importance of using models in Science
- Guide them to adopt a model in predictions and explanations of scientific phenomenon
- The particle representations provide support for students to articulate their ideas)



Personal insights

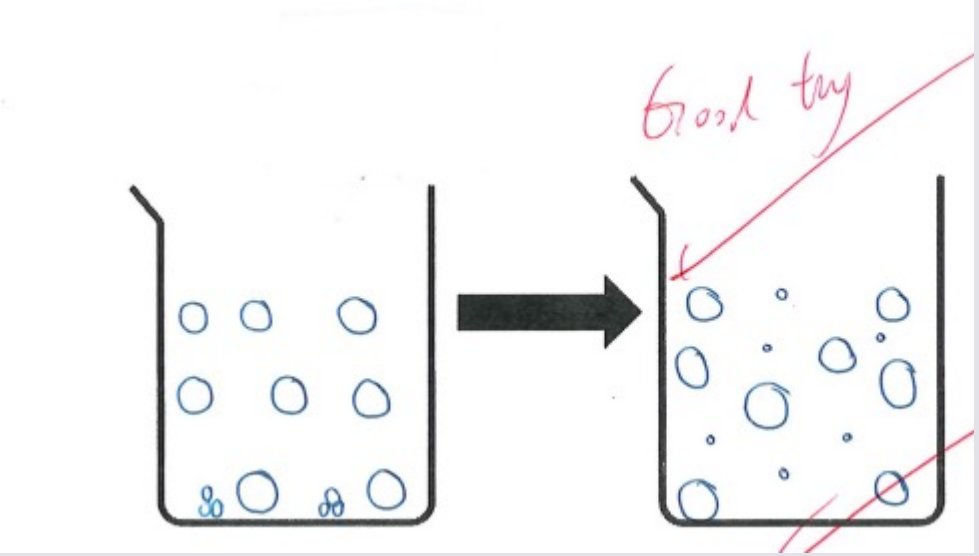


- **Benefits of using DragGame for Teachers–**
  - *Elicit students' ideas: in a way that can engage all students*
  - *Organize discussion: quick analysis of students' responses, make on-the-fly decision on what to discuss first (e.g. which "alternative conception" to tackle first)*
  - *Give feedback in a more efficient way*
    - Teacher → student: on the basis of the same "common ground"
    - Peer feedback (formative / informative): encourage them to understand, interpret and evaluate on others' ideas

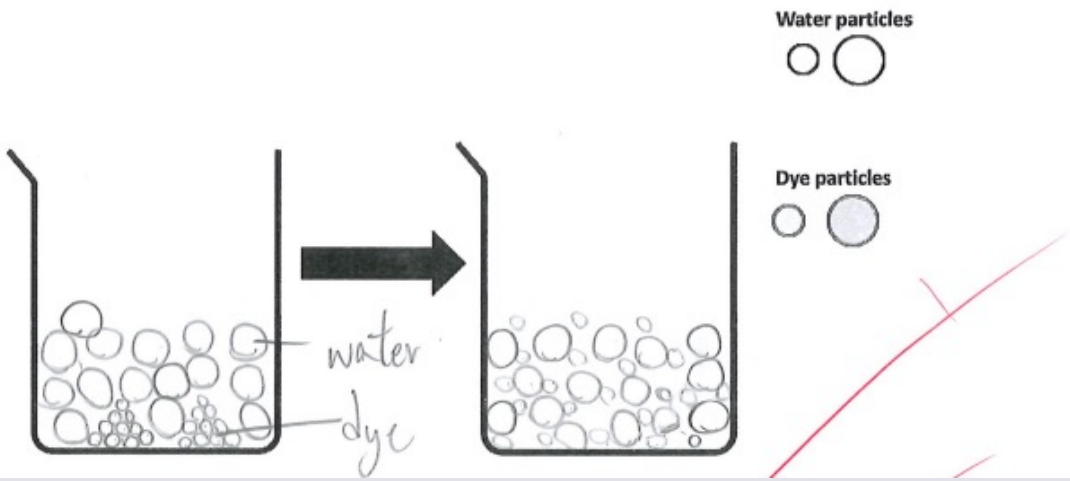
Food for thought

- **How do we evaluate the effectiveness of our lessons?**
  - *Based on the number of "correct answers"?*
  - *based on how may students changed their minds?*
  - *based on how many misconceptions are tackled?*
  - *based on the long-term skill about students' discussion and ability to construct their own understanding?*

- **Quantitative evidence: performance in summative assessment**
  - Draw particles to explain ……
  - Use words to explain ….



5. After class discussion, draw a model that can better explain dissolving.



7. **Challenging Question:**

1. Do volume and mass change when dye dissolves in water?
2. Can you explain your answer with your model?

Good

Volume will change but mass will not.

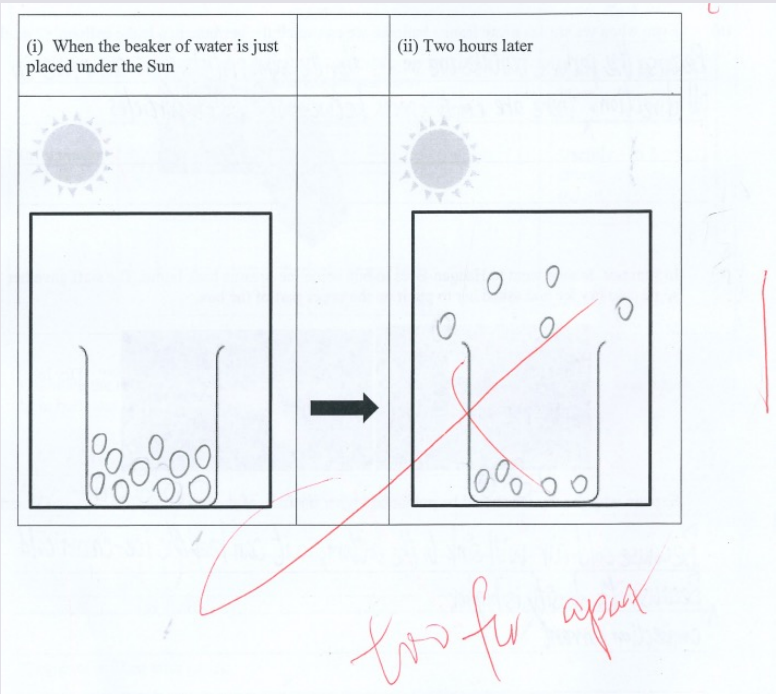
The dye particles will go inside the spaces between the water particles. Therefore, the volume of solution will less than the total volume of dye and water before dissolving

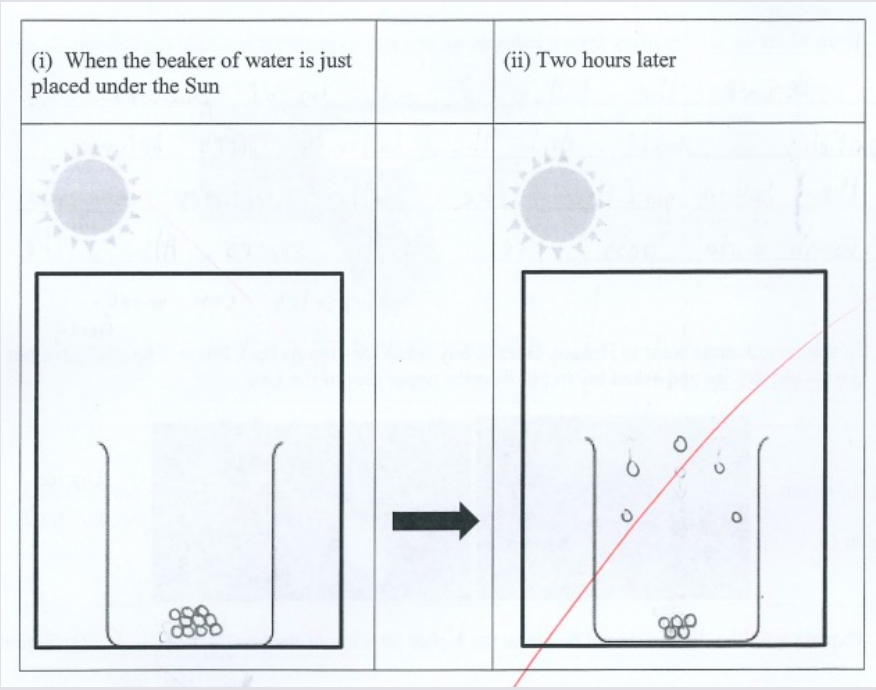
The total number of particles remains unchanged in dissolving so the mass is conserved.

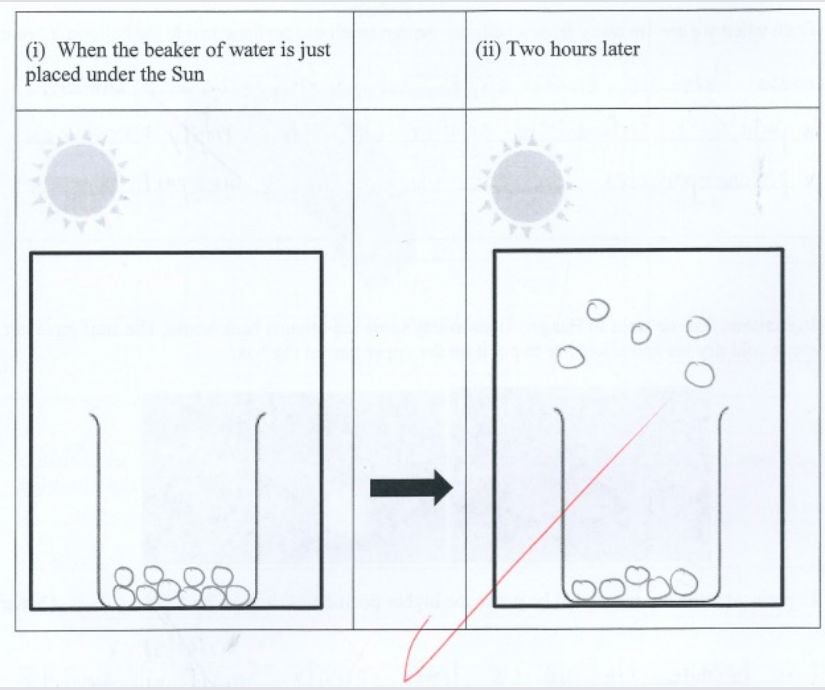
Final Exam (two weeks ago)

On a summer day, a beaker of water is placed inside a box and under the Sun. The volume of water changes from 100 mL to 50 mL in two hours.

(b) Draw water particles to show the change you named in (a). (2 marks)







Common mistake:

- Arrangement of liquid particles

- Correct arrangement of particles, correct proportion of particles evaporated
- Mass conservation principle applied

How to reflect on my lessons…

Self-Audit: Supporting development of dialogue in the classroom

T-SEDA Professional Learning Pack editable template

Reflect on learning and teaching in your classroom and rate each statement in the table below using: (1) rarely, (2) sometimes, (3) usually

In my teaching, do I…?	My rating	In our classroom, do we…?	My rating
Value student talk in my lessons and plan for it to take place in groups and whole-class situations		Create an inclusive classroom conversation	
Ensure that everyone participates sometimes in classroom dialogue, including myself		Trust and listen to each other	
Take account of children's individual needs and interests when developing dialogue		Express a range of views	
Encourage children to be responsible for their own learning (individually and collectively)		Challenge each other respectfully	
Invite children to elaborate and build on their own and others'		Explain our reasoning clearly	
Invite children to give a reason for their ideas and opinions		Have the willingness to sometimes change our minds	
Invite children to ask each other questions about their ideas		Sometimes come to agreement	
Support children in a range of ways to enable them to share their ideas, views and feelings		Help each other to understand things in a new way	
Build on children's contributions to advance the dialogue using my own subject knowledge and understanding		Build new knowledge and improve our ideas together	
Take risks and experiment by trying out new dialogic teaching approaches		Extend and refine what we already know	
Listen to students, give feedback and respond in a constructive way		Continue a dialogue over time, from lesson to lesson	
Use classroom resources, including technology, in dialogic ways to help children in their learning		Realise what we still need or want to learn and how we might like to do it	

Thank you!

I would like to express my greatest gratitude to Dr. Anthony Cheng;

Ms CHAN, Annie K. L.; and Dr CHAN, Kennedy K. H. for their continuous support

As well as my senior colleagues for incorporating the project to my school