Promoting the Use of Educational Technology in Learning and Teaching in Science

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Content

- How do my practice and beliefs about teaching change before/after the project?
DragGame e-Learning activities designed and implemented

Construct a model to propose how the food is formed in photosynthesis by dragging the atoms provided below.

Materials used in photosynthesis
- Carbon dioxide (CO₂)
- Water (H₂O)

Food made in photosynthesis
- Glucose (C₆H₁₂O₆)

Guiding questions:
1. How does your model help you to make sense of how food is formed in photosynthesis?
2. How does your model help you to explain the source of mass of a plant?

DragGame e-Learning activity for Photosynthesis
DragGame e-Learning activities designed and implemented

Drag the arrows to show the horizontal forces acting on the fan cart and the air.
For simplicity, neglect the forces acting on the wheels of the fan cart.

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DragGame e-Learning activities for Action and Reaction
DragGame e-Learning activities designed and implemented

DragGame e-Learning activity for Neutralization
How do my practice and beliefs about teaching change after the project?

- Alternative conceptions
- Design of scientific inquiry activities
- Teacher’s assumptions and scaffolding
What would you do after a student has presented an incorrect answer?
Alternative conceptions

Construct a model to propose how the food is formed in photosynthesis by dragging the atoms provided below.

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Since there’s 12 H, 6 C and 6 O in the left side, so I think the other side should be equal.

- Encourage students to **elaborate**
- Invite other students to **comment** (strength and growth opportunity)
- Ask students to **propose** a modification

**Raw materials do not match**

**Number of atoms conserved**
Welcome and recognize alternative conceptions

Understand how students think

Use these alternative ideas as learning opportunities

Alternative conceptions

A fixed amount of acid is added to a conical flask containing alkali for three times.

- At start
- After adding acid
- After adding acid
- After adding acid

pH: 12345678
9 10 11 12 13 14

Volume of Acid Added /cm³

pH

0 1 7 14

Volume of Acid Added /cm³
Design of scientific inquiry activities

How would you **sequence** the following activities?

A. Daily life experience

![Image of pushing the wall](image1)

Pushing the wall - how do you feel?

Force on you by wall
Force on wall by you

Compare the size of these two forces.

B. Unexpected observation

![Image of action-reaction pair](image2)

Action-reaction pair or not? Why?

Features of action-reaction pairs:
- Equal in magnitude (same size)
- Opposite in direction
- Between two objects

(Force on A by B and Force on B by A)

C. Introducing a concept

![Image of force and weight](image3)

D. Application of a concept

\[ F_A = \text{force acting on the ball by the player} \]
\[ F_d = \text{tension in the string that holds the object} \]
\[ F_B = \text{weight of the ball} \]
\[ F_y = \text{weight of the object} \]
Design of scientific inquiry activities

How would you **sequence** the following activities?

1st:

**Unexpected observation**

As an **anchoring phenomena**, instead of a verification of a concept

Arousing students’ interest and motivate them to ask **why**
Design of scientific inquiry activities

Pushing the wall - how do you feel?
Compare the size of these two forces.

Features of action-reaction pairs
- Equal in magnitude (same size)
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(Force on A by B and Force on B by A)

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For simplicity, neglect the forces acting on the wheels of the fan cart.

Action-reaction pair or not? Why?

\[ F_A = \text{force acting on the ball by the player} \]
\[ F_B = \text{tension in the string that holds the object} \]
\[ F_C = \text{weight of the ball} \]
\[ F_D = \text{weight of the object} \]
Design of scientific inquiry activities

Conditions necessary for photosynthesis

Verification of the fact

Consolidation / Extended understanding

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Guiding questions:
1. How does your model help you to make sense of how food is formed in photosynthesis?
2. How does your model help you to explain the source of mass of a plant?

Introduced as a fact

carbon dioxide + water $\xrightarrow{\text{light}}$ chlorophyll $\rightarrow$ carbohydrate + oxygen
Design of scientific inquiry activities

Investigating the conditions

Conditions necessary for photosynthesis

- Presence of light
- Water (H₂O)
- Carbon dioxide (CO₂)
- Variegated leaves
- No carbon dioxide

Making sense with the investigation results

Construct a model to propose how the food is formed in photosynthesis by dragging the atoms provided below.

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- Glucose (C₆H₁₂O₆)

Guiding questions:
1. How does your model help you to make sense of how food is formed in photosynthesis?
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Reaching a consensus

carbon dioxide + water \(\overset{\text{light}}{\rightarrow}\) chlorophyll \(\rightarrow\) carbohydrate + oxygen

6CO₂ + 6H₂O \(\rightarrow\) C₆H₁₂O₆ + 6O₂
Teacher’s assumptions and scaffolding

- Are students able to consider the cart, the fan, and the board as one system?
- Do students really understand what “From cart” and “From air” mean?
- Do students remember/understand that at rest means no unbalanced force?
- Are students confused with the terminology “cardboard” and “cart”?

A student work
## How do my practice and beliefs about teaching change before/after the project?

<table>
<thead>
<tr>
<th>Category</th>
<th>Before the project</th>
<th>After the project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>My view toward alternative conceptions</strong></td>
<td>Ideas to be <em>corrected</em> and <em>clarified</em></td>
<td>Opportunities for understanding and learning</td>
</tr>
<tr>
<td><strong>My design and sequence of scientific inquiry activities</strong></td>
<td>Practical work and scientific inquiry activities mainly as <em>verification</em> of concepts</td>
<td>Make use of <em>anchoring phenomena</em> and <em>inquiry-based approach</em></td>
</tr>
<tr>
<td><strong>My assumptions in teaching and scaffolding for students</strong></td>
<td>May have wrongly assumed students have certain understanding → become <em>obstacles</em> to learning</td>
<td>More <em>attention</em> to and <em>prediction</em> of the obstacles that student may face</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide <em>appropriate scaffolding</em> and <em>instructions</em> to students</td>
</tr>
</tbody>
</table>
Thank you!

Please feel free to contact me at:

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