What do the learner know about clouds, precipitation, wind and greenhouse effect; a short review of research from 1883 to 2009

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Motivation for the research question:

David Ausubel (1968)

Educational Psychology:
A Cognitive View

If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.
Start: Clouds, Rain, Wind, …

Granville Stanley Hall (1883)

The Contents of Children's Minds

- 200 Boston children, age 4 to 8
- explanation “in its own word” of 112 different objects and concepts:
  - Per Cent Children ignorant of it:
    - Dew 78 %,
    - What season it is 75.5%,
    - Seen hail 73%,
    - Seen rainbow 65%,
    - Seen clouds 36%.
The Contents of Children's Minds

Citations:

God keeps rain in heaven in a big sink, rows of buckets, a big tub or barrels, and they run over or he lets it down with a waterhose through a sieve, a dipper with holes, or sprinkles or tips it down or turns a faucet. God makes it in heaven out of nothing or out of water, or it gets up by splashing up, or he dips it up off the roof, or it rains up off the ground when we don't see it.

The clouds are close to the sky; they move because the earth moves and makes them. They are dirty, muddy things, or blankets, or doors of heaven, and are made of fog, of steam that makes the sun go, of smoke, of white wool or feathers and birds, or lace or cloth.
The Contents of Children's Minds

Hall’s advise:

>The best preparation parents can give their children for good school-training is to make them acquainted with natural objects<
J. Olsen (1900)

Children’s ideas – (Denmark)

- 5600 pupils at Varde, 1898-1900, age 6-7
- Percentage of children having *somewhat clear idea* of the thing in question:

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thunder</td>
<td>72</td>
<td>85</td>
</tr>
<tr>
<td>Hail showers</td>
<td>81</td>
<td>93</td>
</tr>
<tr>
<td>Moving clouds</td>
<td>81</td>
<td>46</td>
</tr>
<tr>
<td>The rainbow</td>
<td>90</td>
<td>78</td>
</tr>
<tr>
<td>The dew</td>
<td>30</td>
<td>46</td>
</tr>
</tbody>
</table>
Children’s ideas – (Denmark)

Olsen’s closing remarks, like Hall’s, go to the parents:

In this respect we cannot too urgently say to the parent: - Converse with your children!
Jean Piaget (1896 - 1980)

*La représentation du monde chez l'enfant* (1926)

1. **stage (5 to 6 years):** Clouds are solids made by men or God (realism). Clouds move because men or God or the clouds themselves want to (animism); or move when we move (participation).

2. **stage (6 to 9 years):** Clouds are made from smoke, dust, earth or stone (causality).

3. **stage (9 to 10 years):** Clouds are of entirely natural origin: condensed air or moisture, or steam or heat, etc. (real causality). The development from stage 2 to 3 is influenced by teaching.
1. stage (to 7 years): Rain is made by men or God and comes from buckets of water, taps, pipes, sinks, fountains, … in the sky or in the clouds.

2. stage (7 to 9½ / 10 years): Rain comes from human activity, the clouds move about intentionally to wherever rain is necessary and transform themselves into water or melts.

3. stage (from 10 years): A mix of learned explanations and more original: clouds are heat, wetness, perspiration, mist … and rain explains itself
La causalité physique chez l'enfant (1927)

1. Stage (average age 6 years): Wind is breath of men or God, or made by men or God by fans, machines, bending trees …

2. Stage (average age 8.3 years): Objects that moves are believed to cause wind and the wind can accelerate itself; wind comes from the sky, sun, moon. Trees, dust, waves and clouds are setting themselves in motion to produce wind – which makes the trees, dust, waves and clouds move (!).

3. Stage (average age 9.6 years): The air sets itself in motion in virtue of its own force, the air behind pushing that which is in front
support and critic of Piaget’s stage theory on clouds, rain, wind ++

What do you think a cloud is? What does it contain?

- Percentage of children’s answers by age, before instruction, some weeks after, 2 years after instruction

<table>
<thead>
<tr>
<th>Children’s conceptions of clouds (Piaget stage P1, P2, P3)</th>
<th>13 years Before in. (n=464)</th>
<th>13 y After (358)</th>
<th>15y (354)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misconceptions (P1)</td>
<td>25</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Mix (P2-3)</td>
<td>60</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td>Satisfactory (P3- …)</td>
<td>15</td>
<td>43</td>
<td>24</td>
</tr>
</tbody>
</table>
“Everybody talks about the weather …”

Why do you think it’s **raining** from some clouds, but not from all?

- Percentage of children’s answers by age, before instruction, some weeks after, 2 years after instruction

<table>
<thead>
<tr>
<th>Children’s conceptions of <strong>rain</strong> (Piaget stage P1, P2, P3)</th>
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<tr>
<td>Misconceptions (P1)</td>
<td>40</td>
<td>32</td>
<td>41</td>
</tr>
<tr>
<td>Mix (P2-3)</td>
<td>45</td>
<td>57</td>
<td>42</td>
</tr>
<tr>
<td>Satisfactory (P3- ...)</td>
<td>5</td>
<td>11</td>
<td>8</td>
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"Everybody talks about the weather …”

What is **wind**? Why does it start to blow?

- Percentage of children’s answers by age, before instruction, some weeks after, 2 years after instruction

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<td>Misconceptions (P1)</td>
<td>86</td>
<td>55</td>
<td>75</td>
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<tr>
<td>Mix (P2-3)</td>
<td>12</td>
<td>30</td>
<td>14</td>
</tr>
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Start: The Greenhouse Effect, …


Spørsmål om vær … [Questions about Weather …]

Norwegian pupils 15 years, n=348, responses to statement:

The greenhouse effect is necessary for life on the Earth

Agree: 23.3%

Responses to 7 other statements about greenhouse effect and ozone layer (% response)

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<th>Statement</th>
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<td>Exchange greenhouse effect with effects of the ozone layer.</td>
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<td>18.1</td>
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<td>Sum of Exchange and Confusion</td>
<td>44.5</td>
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</table>
Edward Boyes and Martin Stanisstreet (1992)

*Student’s Perceptions of Global Warming*

- Constructed a scheme of 36 statements about
  - consequences (12), causes (12), action to reduce (12)
  - also to be used in 1993 and so on …
- 218 first-year British undergraduate students in biology, age 18-20 years
- Confusion of global warming and ozone layer depletion (ca. 60%)
  - also found in secondary school pupils (1993)
1990 two new reports;
1993 – 2009 support and development of Boyes and Stanisstreet’s works ++

Norwegian pupils 15 years, responses to statement:

*The greenhouse effect is necessary for life on the Earth*

Agree: 1989 23.3%, 1993 30.5%; 2005 *75.0%

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<th>Responses to 7 other statements about greenhouse effect and ozone layer (% response) (*Significant increase (α&lt;0.5%) 1993-2005.)</th>
<th>1989 (n=348)</th>
<th>1993 (n=354)</th>
<th>2005 (n=440)</th>
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<td>Exchange greenhouse effect with effects of the ozone layer.</td>
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<td>18.1</td>
<td>32.8</td>
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<td>Sum of Exchange and Confusion</td>
<td>44.5</td>
<td>50.3</td>
<td><em>70.4</em></td>
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</table>
Jean Piaget (1896-1980) was one of the most influential researchers in the area of developmental psychology during the 20th century. Process of Cognitive Development. As a biologist, Piaget was interested in how an organism adapts to its environment (Piaget described as intelligence.) Behavior (adaptation to the environment) is controlled through mental organizations called schemata (sometimes called schema or schemes) that the individual uses to represent the world and designate action. David Paul Ausubel (October 25, 1918 – July 9, 2008) was an American psychologist. His most significant contribution to the fields of educational psychology, cognitive science, and science education learning was on the development and research on "advance organizers" (see below) since 1960. He was born on October 25, 1918 and grew up in Brooklyn, New York. He was nephew of the Jewish historian Nathan Ausubel. Ausubel and his wife Pearl had two children. Educational psychology: a cognitive view. This book is out of print. Add to My Bookmarks Export citation. Type. Book. Author(s). Ausubel, David Paul, Novak, Joseph Donald, Hanesian, Helen. Setting a reading intention helps you organise your reading. You can filter on reading intentions from the list, as well as view them within your profile. Read the guide. —. Reading intentions. Your reading intentions are private to you and will not be shown to other users. What are reading intentions? Setting up reading intentions help you organise your course reading.