Knowledge and memory: a study of what students remember about chemistry experiments

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Hi, I'm Cerys and I'm a part-time PhD student at University of Southampton. I'm interested in how we can make ELNs better for students and researchers.
Capturing the experiment record

We want to understand what students remember about experiments and whether the use of questionnaires improves or impairs the quality of information they capture.
It’s not about the procedure..

- What did I do?
- Why did I make that decision?
- What did I see?
- Why do I think that happened?
- How does it relate to my knowledge in chemistry?
- What might I forget to record that is important?
- Will what I capture help me when I come to look up the experiment in the future?
ELNs can provide a structured environment for recording information

But is that good or bad?
The way we recall information is dependent upon the knowledge in our memories and the conditions under which we recall the information.
Memory and knowledge structures

Schemas

Scripts
Remembering

Cues

Perspectives

Photo credit: Jack Zalium

Anderson and Pichert (1978)
Using templates

- Structured
- Provides cues
- Potential problems
Study aimed to find out:

• What knowledge students might have about a chemistry experiment

• What differences using a template makes to the information students record
Pre-experiment questionnaire

• Free recall
• Complete a reaction scheme
• Name the chemicals and identify safety information
• Identify equipment required for the experiment
• Identify measurements and observations that might be used in the experiment
• Describe step-by-step experiment instructions
Thinking about experiments

• >90% statements relate specifically to steps in the experiment

• >85% of students recalled steps in the correct order

• Equipment, chemicals and “actions”

• Some general “experiment” steps are recalled, but most are the specific to the experiment
Although 35% mention hazards or safety specifically, more than 90% mention using an inert atmosphere or nitrogen bubbler, and 65% mention using heating to dry the flask.
35% mention safety specifically, but the use of the flask wrapped in foil and the use of light/lamp is more significant in this experiment. 50% use the term “radical”
Other pre-experiment questions

- Reaction schemes
- Chemicals
- Safety
- Equipment
- Observations and measurements
And step-by-step experiment instructions

High-level experiment script

- “Do safety”
- Set up equipment
- “Weigh out” reagents (calculate RMMs)
- “Do reaction”
- “Get” product
- Analyze product
Post-experiment questionnaires

**Template condition**

1. Name of experiment
2. Aim of the experiment
3. Balanced equation with relative molecular masses
4. Step-by-step experiment procedure
5. Results
6. Discussion
7. Conclusions

**No Template condition**
Study findings

Templates (cued)

• Give us information we ask for: reaction schemes, RMMs, results, details of the analysis
• Fewer observations and explanations
• Learning and theory

No Templates (free)

• Give more of the personal experience: observations and explanations
• Fewer reaction schemes, no RMMs, fewer results and analysis, much less learning and theory
Unexpected findings

A change in the style of reporting

“What I Did”

90% used this style with no template

Do this

More than half of those students switched to this style when they used the template
Summary

• Students tend to remember “procedure” information, especially unique aspects

• Using cues encourages students to record additional information

• But, need to make sure personal experiences are not lost

• Cues can be provided for information they might forget

• Cues can be provided to encourage discussion

• More to be done on cues and changing perspectives
Acknowledgements

Metadata Study
http://sites.google.com/site/cmetastudy/