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Introduction

Year 1 students often struggle when entering the laboratory for the first time. Many complex factors may contribute to the challenges faced by students, including:

- **Safety** – dangerous chemicals, apparatus, working with others [1]
- **Recognition of space** – spatial awareness, physical environment
- **Chemical knowledge** – how this relates to the experiment at hand
- **Problem-solving** – problems/challenges associated with the lab
- **Social stress** – anxiety, confidence, large lab cohorts [2]
- **Learning styles** – students respond differently to support resources

Resources already available to aid transition into the Year 1 Synthesis Lab included:

- Lab Manual (written)
- Demonstrator supervision (in-lab face-to-face)
- Online Learning Science pre-lab simulations (active)

Cognitive Overload?

In *Cognitive Load* theory, three types of information “load” exist, that require working memory capacity:

- **Extraneous** (how information is presented to learners)
- **Intrinsic** (inherent difficulty level associated with a task)
- **Germane** (processing required to think through a problem)

Load makes demands on **working memory** – with working memory itself being of **limited capacity** [3]. Johnstone and Wham summarise the concept of Cognitive Load as shown in **Figure 1**. This demonstrates the **volume of new learning environments** encountered in the laboratory, particularly when students transition to a university setting and encounter labs for the first time.

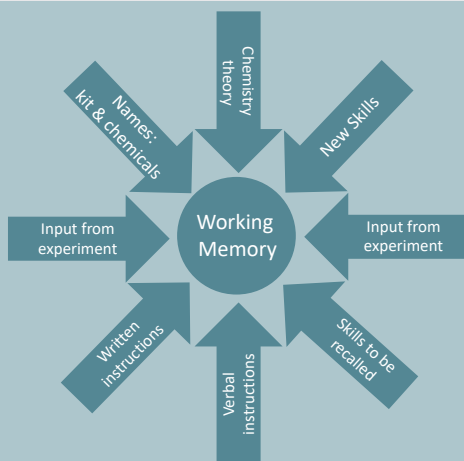


Figure 1 – Load on working memory associated with a science lab, demonstrating the challenges introduced to students during practical experiments. Adapted from Johnstone and Wham [3].

Project Aim

1. Design, produce and deliver pre-lab **technical videos** and associated **Moodle quizzes** to further support transition into Year 1 Chemistry labs.
2. To **broaden** the type of support resources offered and **increase accessibility**.
3. Investigate the impact of new resources. Do students find them **informative, accessible**? Do they decrease student **anxiety** and increase lab **confidence**?

New Support Resources

1. Two short (5 minute) technical films – Vacuum Filtration and Reflux (animated **Figure 2** below).
2. Two associated Moodle quizzes with 5 MCQ each, and instant feedback.



Figure 2 – Reflux technical film (excerpt) with audio (Jarrett Gray), showing subtitles and tip / safety call-outs to draw student attention to potential challenges and safety issues.

Data Gathering Methodology

- **Anonymous online questionnaires:** All Year 1, 2, 3, 4 students invited to explore new film and Moodle quizzes and evaluate these *via* an online survey. Demonstrators and technicians also surveyed.
- **Focus groups:** Anecdotal evidence gained during three focus groups; two Year 2 students, six Year 4 students, and three technicians (& one post-grad demonstrator) attended the sessions.

Results Online Questionnaires

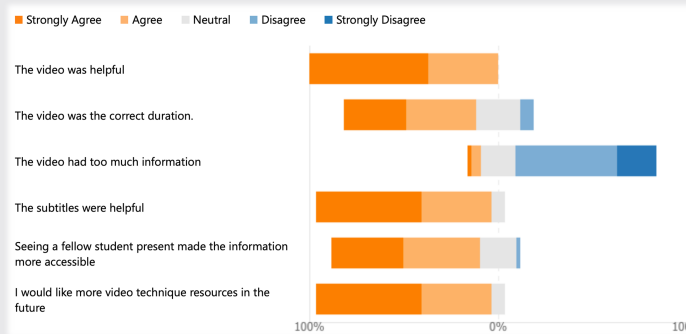


Figure 3 – Results from anonymous online questionnaire (n=44 Chemistry students), relating to the Reflux Film. These data were very similar to those gathered for the Vacuum Filtration Film.

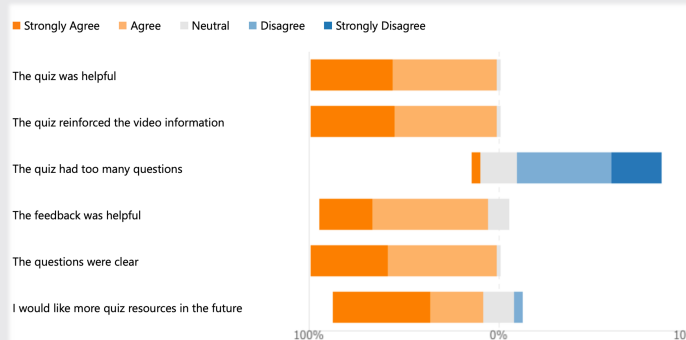


Figure 4 – Results from anonymous online questionnaire (n=44 Chemistry students), relating to the Reflux Moodle Quiz. These data were very similar to those gathered for the Vacuum Filtration Moodle Quiz.

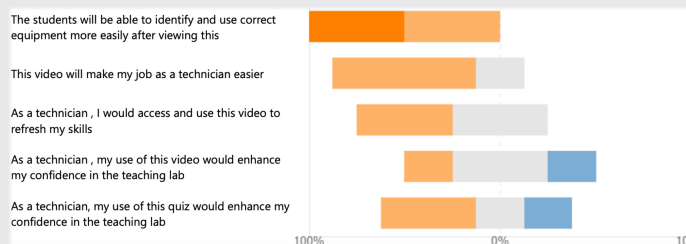


Figure 5 – Results from anonymous online questionnaire (n=3 technicians, n=1 demonstrator), relating to the films and associated Moodle quizzes.

Results Focus Groups

- “Labels work very well...to make association, which is hard from just the manual.” *Student*
 “Learning from failure is not a bad thing. The idea of failure in the videos was helpful.” *Student*
 “Have only positive things to say about the videos! Takes away shyness and so makes our job a lot easier. More would be useful, including on safety.” *Technician*
 “It [the video and quiz] is very good to refresh chemistry, gives a lot more confidence before demonstrating.” *Demonstrator*

Conclusions

- Student/staff feedback **positive** to films and Moodle quizzes as a pre-lab resource.
- Feedback suggests respondents **want more** films and Moodle quizzes, across other techniques and labs.
- Results show that the resources **boost confidence, reduce anxiety, and reduce cognitive load**.
- Films and Moodle quizzes also **alleviate concerns over safety** in the lab.

Future Work

1. Expand films and Moodle quizzes to develop a **suite of support resources**
2. Make **accessible** across Chemistry years and labs
3. Possibly embed in demonstrator training course
4. Expand films to **support transition into Year 1** (welcome, introduction, theory, safety)

[1] Johnstone A. H. and Wham A. J. B. (1982) *The demands of practical work*, Educ. Chem. 19(3), 71–73.

[2] Johnstone, A. H. (1991) *Why is science difficult to learn? Things are seldom what they seem*, Journal of Computer Assisted Instruction, 7, 75-83.

[3] Alaimo P. J., Langenhan J. M., Tanner M. J. and Ferrenberg S. M. (2010) *Safety teams: an approach to engage students in laboratory safety*, J. Chem. Educ., 87(8), 856-861.