2020 cohort

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What is the difference in understanding between using videos or demonstrations in science lessons?

Introduction

During 2020 and 2021 much of the UK was in lockdown and school pupils had no access to science labs or practicals, instead they only had online learning or at home experiments.

Whilst this was (hopefully) a once in a lifetime event, it has inspired some questioning of what to do when a student practical would be impractical. A lot of the literature expounds how important practical study is (Abrahams et al., 2013; Millar, 2010; The Royal Society, 2014). This can, however, be difficult due to shortages in equipment, time, money, or expertise. In these scenarios teachers may still want to exhibit the practical side of the science as much as possible. Two viable options are the demonstration and the video.

Pro Video:

The time required to plan, risk assess, set up and carry out a demonstration can be prohibitive. This often involves a large amount of time in and out of the classroom. This is in comparison to finding a video online, which could take just a few minutes.

The reliability of video can be persuasive. The risk of a demonstration going awry is sometimes enough to put off teachers. A video won't send the whole school out of the building by triggering the fire alarm.

Videos can ensure the best camera angle, be paused and re-watched and use slow-motion (Watters & Diezmann, 2007). Much of this, however, relies on the quality of the video.

Pro Demo:

The only control a teacher has over a video is the play and pause button. In a demonstration, the teacher can alter the set up themselves. They can self-sabotage and ask what went wrong. They can slow down or speed up depending on the students understanding or time allowances. The teacher has much greater control over a demonstration.

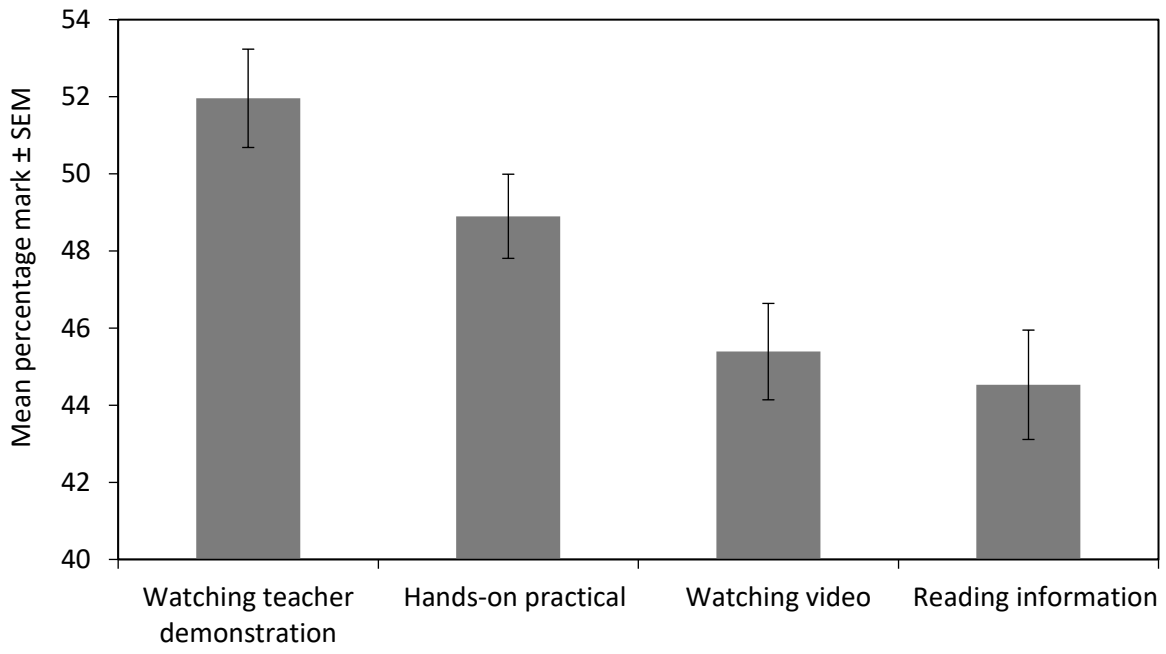
Quality of the teacher-led discussion is seen as very important in the literature. In particular the use of questioning as the demonstration unfolds (Chin, 2007; Moore et al., 2020).

Many teachers would also say "there's no substitute for the real thing".

The literature

Some literature showed no difference in enjoyment from the students watching a video or demonstration (Kestin et al., 2020; Sever et al., 2010). The literature here, however, is of relatively small number of university students in a lecture setting.

One study by Moore *et al.* was more relevant to the modern classroom context (Moore et al., 2020). Groupings were made from 1252 students who either watched a video, watched a teacher demonstration, read about the experiment in a textbook format or performed the practical themselves. They then answered GCSE exam questions on the experiment.



The groups that watched the demonstration scored higher (52.0 ± 17.2%; mean ± standard deviation) than those who watched a video (45.4 ± 20.2%), with statistical significance (p=.002, effect size=0.35).

Given access to only a small sample size I attempted to qualitatively ascertain how video or demonstration affected motivation and interest in the topic. More specifically how much the student enjoyed the overall experience of the lesson and their opinion on the effectiveness of the demonstration/video.

Project plan and rationale

The preparation of a soluble salt from an insoluble oxide or carbonate was chosen as the experiment that was demonstrated or shown as a video. The participants for this work were two groups of year 11 children studying for AQA GCSE.

The demonstration was given to a class studying for GCSE Chemistry, whilst the video was show to a class studying GCSE Combined Science. Both groups were then split into pairs and completed the practical. Both groups were given the same exam questions upon completion of the practical.

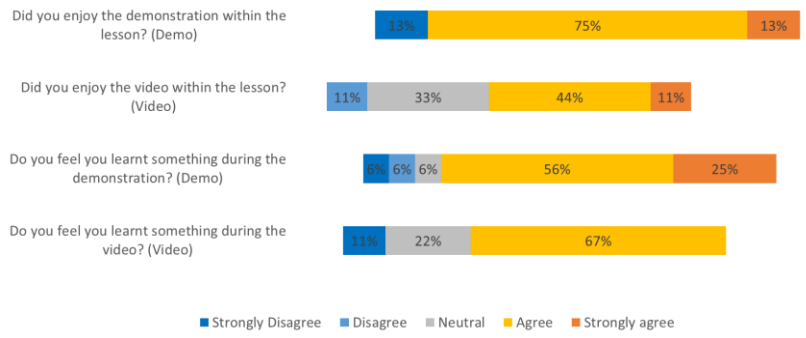
Data collection

A Likert scale was used to ascertain the students' feelings on how they enjoy the subject, the lesson, the demo/video and the practical. They were also asked how useful each section was in terms of answering the exam questions.

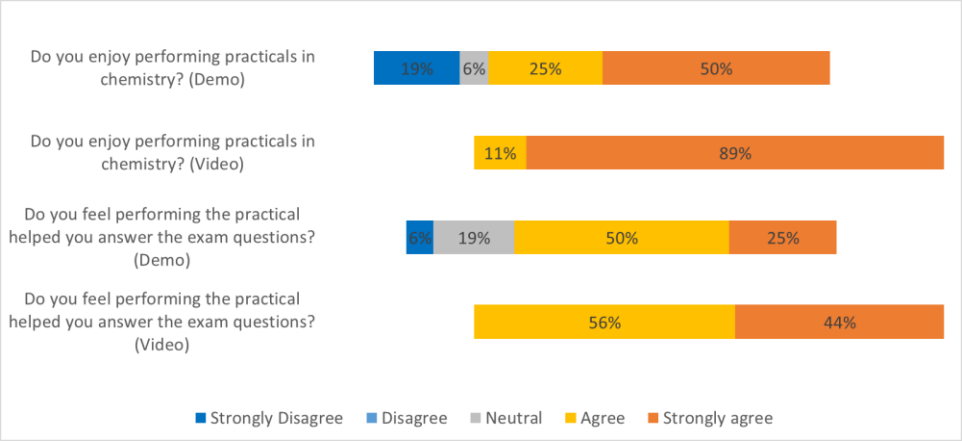
Findings

The number of total responses was 17 across the two groups: 16 from the Demo group, 9 from the Video group.

The difference in attitudes between how the two groups saw the video or demonstration was not particularly strong either way. The opinions expressed on the usefulness and interest of both video and demonstration were relatively similar and did not hint towards much of a difference. The demonstration was slightly more well received but this group had already expressed a greater like of chemistry in general.



The most marked difference shown between the groups was the enjoyment of the practicals and how practicals helped students answer exam questions. The Demo group showed less enjoyment and less correlation between doing the practical and their ability to answer exam questions.



As previously higher attaining the Demo group may be more exam-orientated than the Video group. The Demo group may have seen the time performing a practical better spent practicing exam questions.

The Video group clearly enjoy practicals to a far greater extent, this could be for a number of reasons. These could range from novelty, autonomy, satisfaction of a positive result, or simply an opportunity to talk to their friends (Abrahams, 2009; Toplis, 2012). It could also be the fact that they see practicals as a useful way to obtain better marks on the exam questions, given they see this has a greater correlation.

Conclusions

As a whole this project showed there was no great differing in opinions on the use of video or demonstration. This may be due the number of participants being too low to discern any slight difference of opinions.

The clearer result was the difference of opinion in use of practicals in class; both the enjoyment of practicals and their usefulness in answering exam questions. The Combined Science group showed much greater appreciation for the practical compared to the higher attaining Chemistry GSCE group.

It has previously been recommended that practicals are used more heavily at earlier age groups and less as the students become more exam orientated (Sharpe, 2012). Could this also be applied to different attainment groups? The answer that most literature gives is that all groups benefit from practicals at all stages (Abrahams et al., 2013; Millar, 2010; The Royal Society, 2014). However, given the shortage of science teachers, technicians, equipment and technical know-how, there may be times in schools where one group will be unfortunately prioritised over another. Which group would gain the most from the practical may be a question asked all too often, some research-based guidance could be beneficial.

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