

Get SMART*: Student-Generated Videos in Organic Chemistry Laboratory Instruction



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Introduction

Instructional videos are a widely used teaching tool in the organic chemistry classroom. The use of multimedia presentations as a supplement to labs and lectures can be seen as lackluster, a passive form of instruction and a bland way of delivering information; however, videos can have certain advantages, with the ability to be viewed at the student's convenience, and the ability for their content to be vetted by the instructor. Additionally, video presentations, which display the techniques in practice, have been shown to raise the level to which manipulative skills are developed by students.

This study was designed to evaluate the effectiveness of SMART (Student Made Audio-visuals Reinforcing Techniques) videos as a supplement to teaching assistant (TA) instruction in undergraduate organic chemistry laboratories at NC State. Three videos covering different aspects of lab instruction (experimental technique, use of instrumentation, and calculations) using student-generated scripts were produced in collaboration with DELTA.

Methods

A laboratory was outfitted with video cameras and sound recording that allowed the research team to monitor all TA/student and student/student interactions. Control groups had their TA conduct the lab briefing and supervise the lab. Treatment groups had videos available to supplement the TA lab briefing but were otherwise identical to the control groups. Both control and treatment groups of students were given a questionnaire that contained two questions per video category before performing the lab. Treatment groups also received a follow-up survey the week after their lab was completed.

Results

Analysis of the questionnaire administered during the lab shows significant improvement in the treatment groups that watched the videos provided. Statistical analysis of the questionnaire results and effect size calculation using Cohen's *d* shows that the instrumentation video had a large positive effect on the treatment groups. An effect size of 0.80 is considered a large effect size. Small effects were found for the technique (0.22) and calculation (0.26) videos.

A review of the lab footage showed that treatment groups invariably completed the lab in less time than the control groups and were, in most cases, less dependent on explanations from their TAs in the subjects covered by the videos.

Follow-up survey results show that most students (80% of respondents) found the videos to be valuable when completing the lab, with the technique video being generally ranked as most helpful.

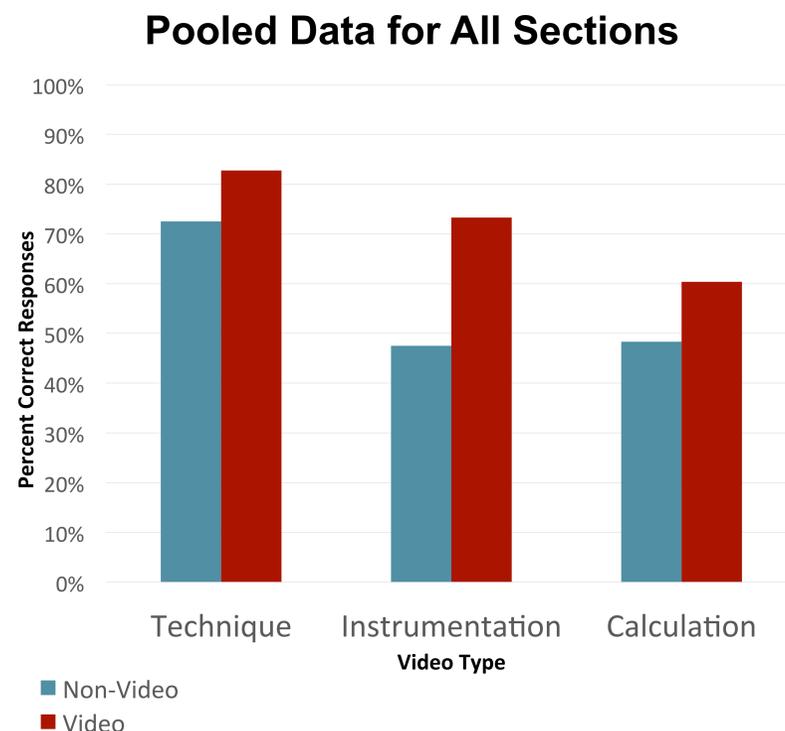


Figure 1. Composite Pre-Experimental Questionnaire Results

Correct Responses	Video	No Video	Comparison			
	Mean	Mean	t-value	p-value	Cohen's <i>d</i>	Effect size (<i>r</i>)
Calculation	23.33 ± 2.30	19.33 ± 10.26	2.8977	0.0045	0.54	0.26
Instrumentation	28.33 ± 3.78	19 ± 3	14.868	<0.0001	2.76	0.81
Technique	32 ± 1.73	29 ± 9.16	2.4506	0.0158	0.45	0.22

Table 1. Questionnaire results and statistical analysis

Teaching Assistant	Teaching Assistant #1		Teaching Assistant #2		Teaching Assistant #3	
	No Video	Video	No Video	Video	No Video	Video
Time to Complete Lab (min)	110	99	123	93	94	73

Table 2. Time necessary for each lab to be completed

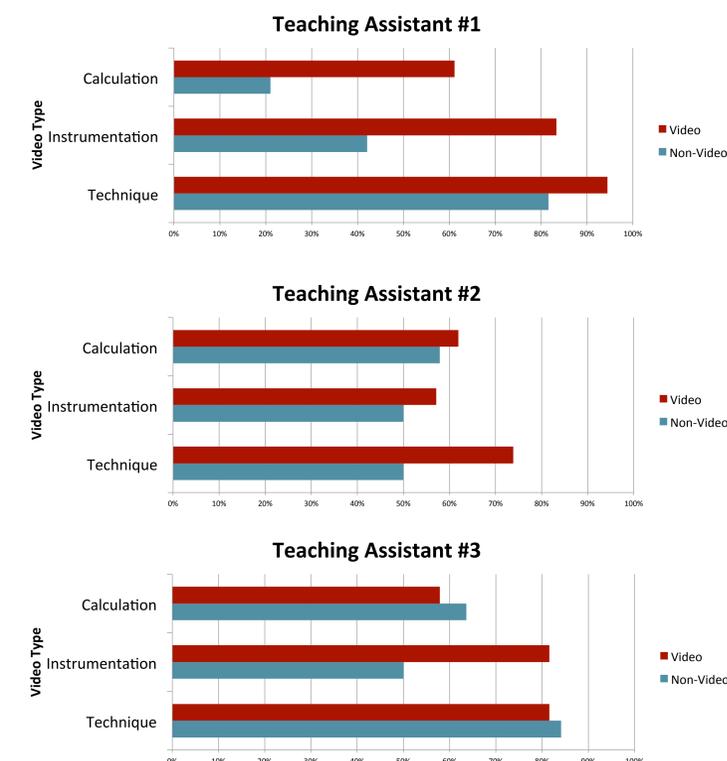


Figure 2. Pre-Experimental Questionnaire Results by TA

Representative Student Comments from Follow-Up Survey

"The videos showed me exactly what I needed to be doing physically in the lab. It showed me the right way to complete the lab safely"

"They showed me what to do, how to assemble the equipment, and how the experiment was supposed to proceed."

"Seeing the procedure done made it more understandable"

"I am a visual learner. Seeing exactly how to perform certain procedures from the lab instructions helped me understand how to conduct the lab safely"

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*S.M.A.R.T. Student-Made Audiovisuals Reinforcing Techniques