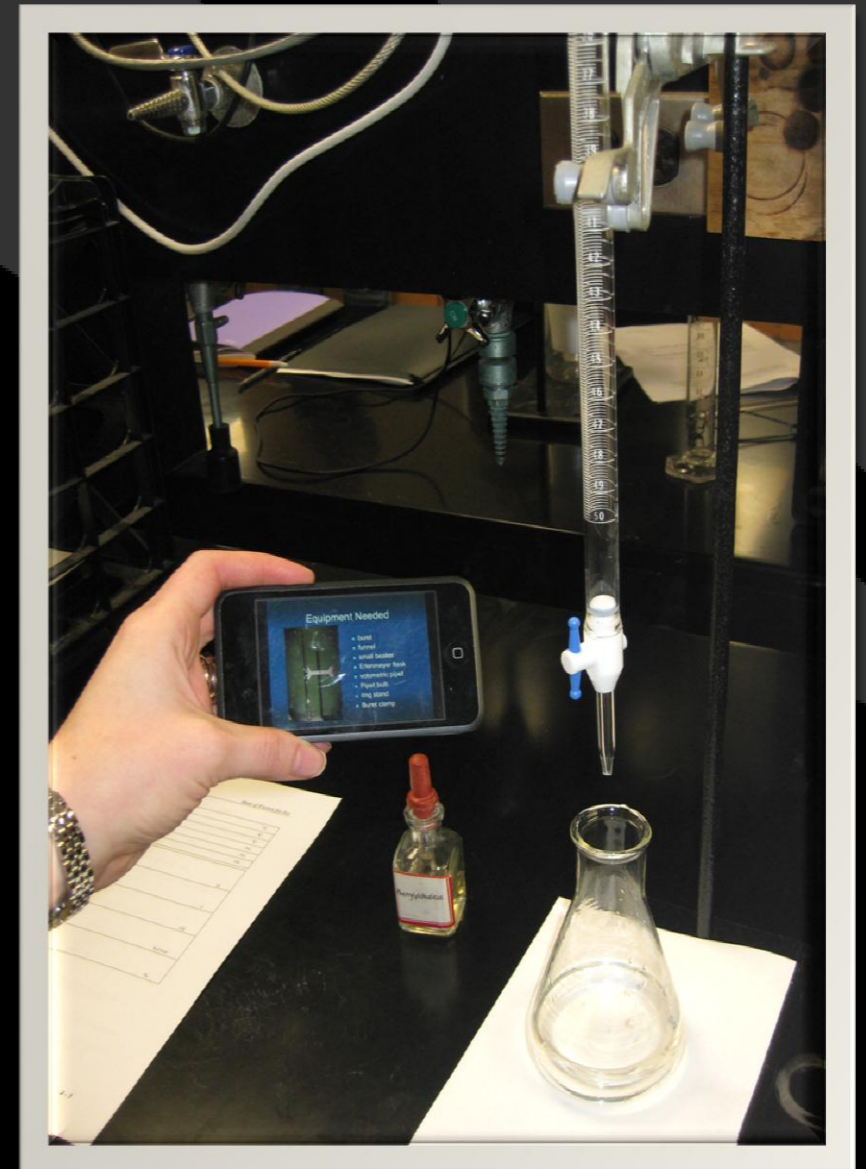


Using Mobile Devices to Support Inquiry-based Learning in Chemistry Laboratories

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Research Design

- ▶ Resource files and podcasts that can be accessed on the iPhones *as needed* during labs taught with an inquiry-based curriculum.
- ▶ Select two treatment groups: podcast treatment group and a pre-lab lecture treatment group
- ▶ Gather quantitative and qualitative data to compare the effect of the treatments



Laboratory Resource Files

Written laboratory materials

MSDS sheets

Syllabi, grading rubrics, and safety contract

Podcasts in two categories:

Chemistry calculations & concepts

General laboratory techniques



Research Questions

- ▶ ***Focus of Research Question 1:*** How frequently will student research teams access podcasts?
- ▶ ***Focus of Research Question 2:*** Are there differences in the number, types, and topics of scaffolding interactions between students who have podcast access and those taught with a pre-lab lecture?
- ▶ ***Focus of Research Question 3:*** Are there performance differences between students who have podcast access and those taught with a pre-lab lecture?

Podcast Usage *during* the Lab Period

Accessed podcast	Total access events	Mean access events per team
Simple Statistics	75	3.13
Filtering	73	3.04
Planning an Experiment	59	2.46
Comparing Reactivity of Metals	53	2.21
Using Pipets	46	1.92
Titration Techniques	46	1.92
Using Acids Safely	43	1.79
Vernier Gas Pressure Equipment	32	1.33
Collecting a Gas Sample	32	1.33
Mass Determination	11	0.46

Mean access events per team per week across data collection: 2.80 events

Clarifying interactions per team by treatment block

Treatment group	Mean clarifying interactions by treatment block				
	Contrasting treatment (Weeks 3, 5, 8, 9, 10, 11)		Equivalent treatment (Weeks 6, 7, 12)		Mixed treatment (Week 4)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Podcast treatment teams (n = 24)	2.942*	.662	1.942	.485	3.950
Lecture treatment teams (n = 14)	4.478*	.866	1.977	.605	4.210

* Welch's *t*-test indicates these are statistically significantly different at $\alpha = .05$ level

$$Cohen's d = (M_t - M_c) / S_{pooled} \text{ for contrasting treatment block} = 2.18$$

Mean Values of Outcome Measures

	Podcast treatment n = 81	Lecture treatment n = 51
Lab Reports	91.6 ± 6.74	90.61 ± 5.83
Quizzes	78.79 ± 11.49	75.84 ± 12.33
Lab Final Exam	72.38 ± 13.56	73.21 ± 11.43
Lab Course Grade	87.09 ± 7.91	85.92 ± 6.66

No category shows a statistically significant difference at the $\alpha = .05$ level

Demographics and interaction effects?

“Highly motivated”	Podcast treatment n = 33	Lecture treatment n = 20
Lab Reports	95.99 ± 2.74	91.80 ± 4.45
Quizzes	86.95 ± 6.56	79.44 ± 11.00
Lab Final Exam	83.24 ± 6.91	79.45 ± 10.28
Lab Course Grade	93.64* ± 3.13	88.72* ± 5.93

* ANOVA and Tukey Post-Hoc tests indicate that these values are statistically significantly different at $\alpha = .05$ level

Research Conclusions

- ▶ Student research teams did access podcasts frequently. The mean number of **access events** per team per week was **2.80**.
- ▶ Students in the **podcast treatment group** had on average statistically **fewer *clarifying interactions*** with the instructors during the contrasting treatment weeks, but not during equivalent treatment weeks.
- ▶ The student outcome scores indicate that the **treatment groups performed comparably on outcome measures**.
- ▶ One observed demographic **interaction effect**: students with high observed motivation ratings in the podcast treatment group performed at a higher level than highly motivated students in the lecture treatment group.

Beyond the quantitative data: other uses for iPhones in the laboratory

Ready access to all posted resources

Online searching

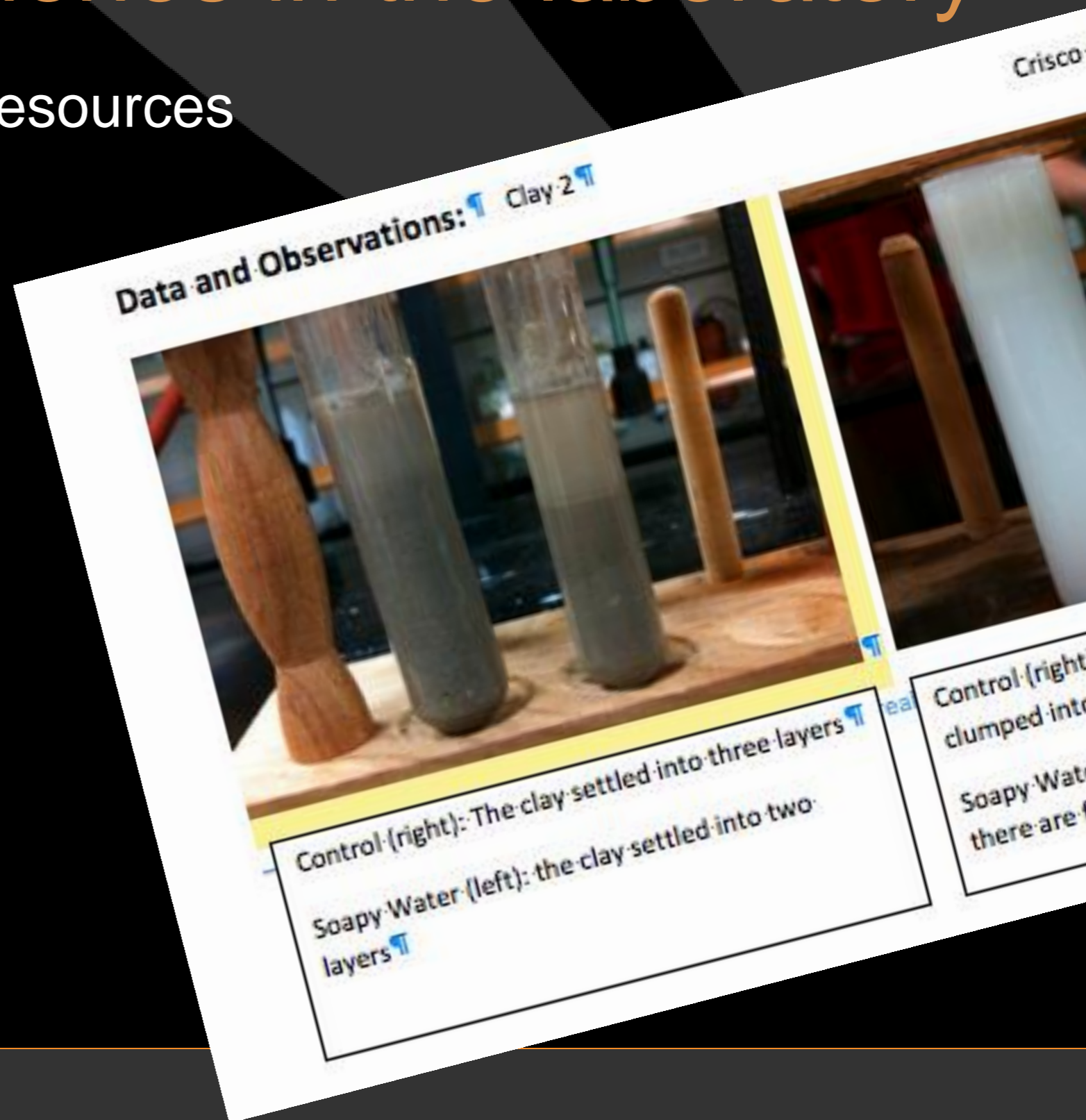
Timers

Flashlights

Cameras →

Video Cameras

Calculators



Current project

- ▶ *Physical Sciences course for pre-service elementary school teachers:*

Deploying podcasts covering laboratory techniques, planned laboratory practicals

Instructor prepared topical podcasts that will be an enduring resource for the students as they move into the teaching world

Plan to have students prepare topical podcasts