

Comparing the Effects of Cook Book and Non-Cook Book Based Lab Activities

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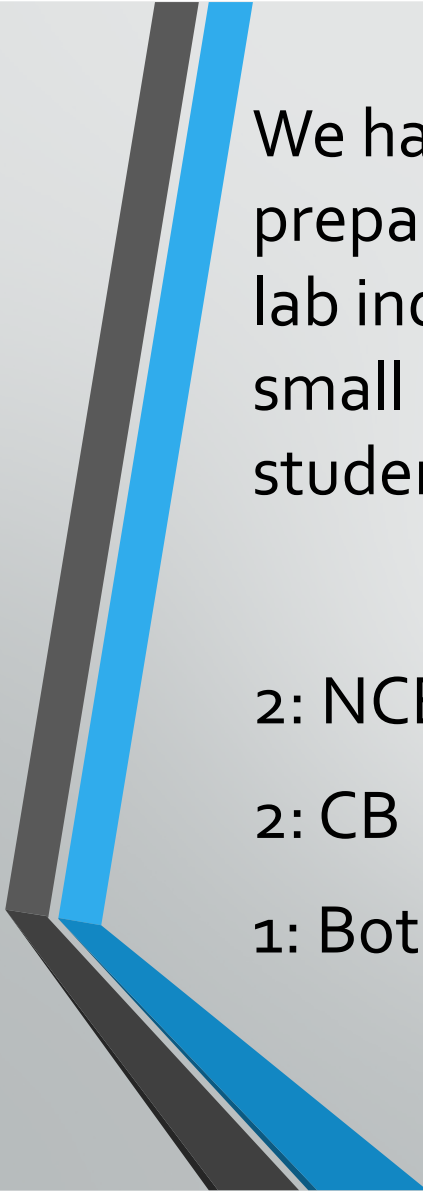
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Purpose

- 1- Investigating the benefits of using two different type of lab activities depending students' thoughts.
- 2- Involving students during the process of changing the type of lab activities as a metacognitive method to improve their understanding about their skills.



We have compared the effects of two written and prepared lab activities(CB) with the impacts of doing two lab inquiry-based and orally-guide activities(NCB) on a small introductory engineering physics course with 22 students.

2: NCB

2: CB

1: Both: combination of two other activities

Metacognitive effects of this study

- Laboratory activities are last longer, self-paced and require students to work in groups to complete a task (communicating)
- All these things make it important for students to be aware of metacognition process of their lab activities (active learners and being curious to recognize CB and NCB)
- If they don't know what their goal is, what they are currently doing, what they should be doing next, and how that will help them reach their goal, they are less likely to benefit from the lab.

Questionnaire: 17 questions including three categories:

- -The first category, was investigating students' understanding and ideas about the lab activity types: CB, NCB and BOTH;
- -The second category was analyzing students' improvement in scientific skills;
- -The third category was discussing students' improvement in general skills.

Research Questions

1-Questionnaire Validation

- Virtual based?
- Physical based?-
- Time for activity in lab?
- Prepared procedure?
- Prepared equipment?

2-Scientific Skills

- Observing the qualities?
- Measuring quantities?
- Sorting concepts?
- Inferring?
- Predicting?

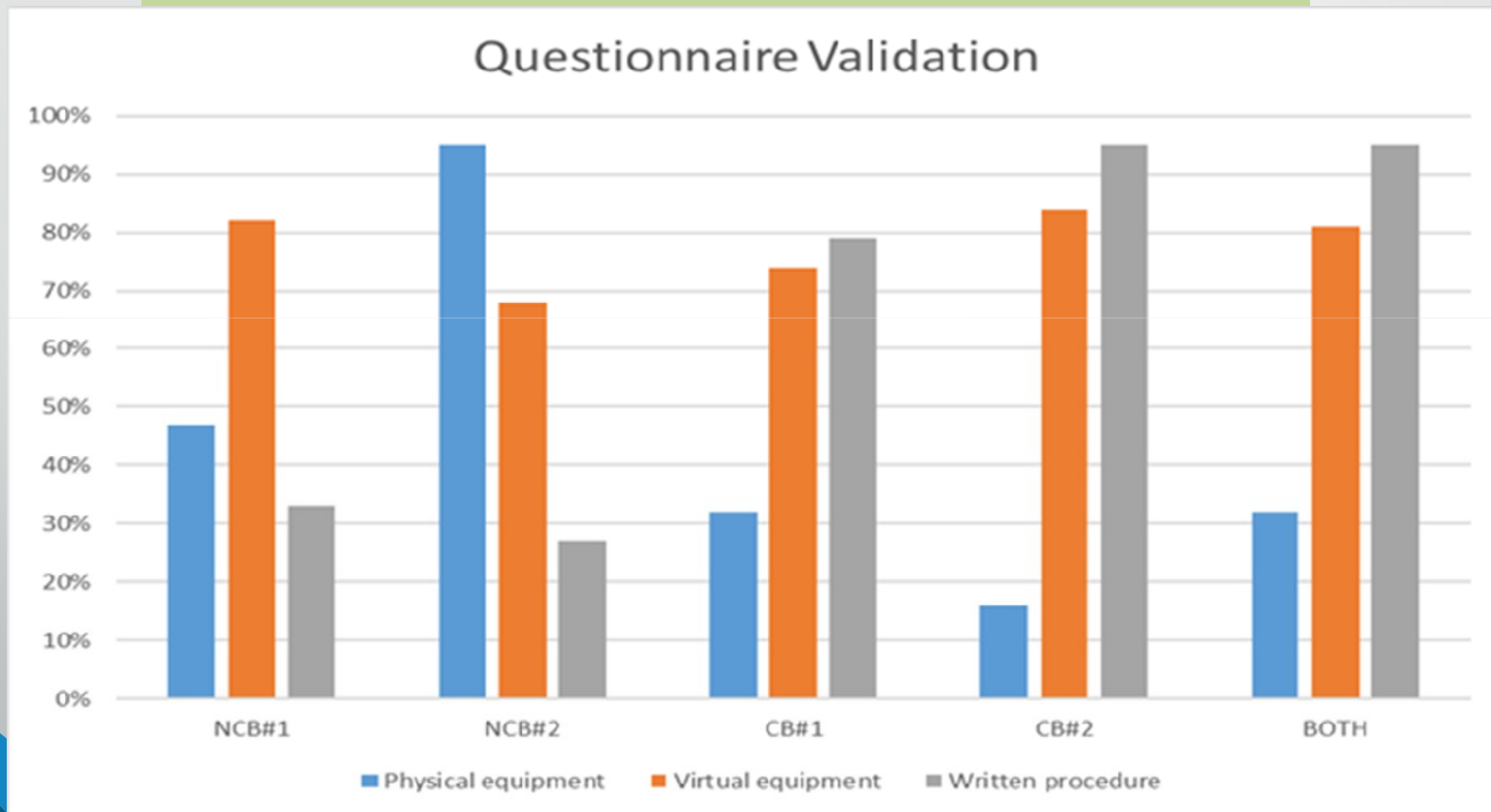
General Skills

- Curiosity to experiment?
- Communication/teamwork?
- Recalling concepts?
- Conceptual understanding?
- Writing skills?
- Self-efficacy?

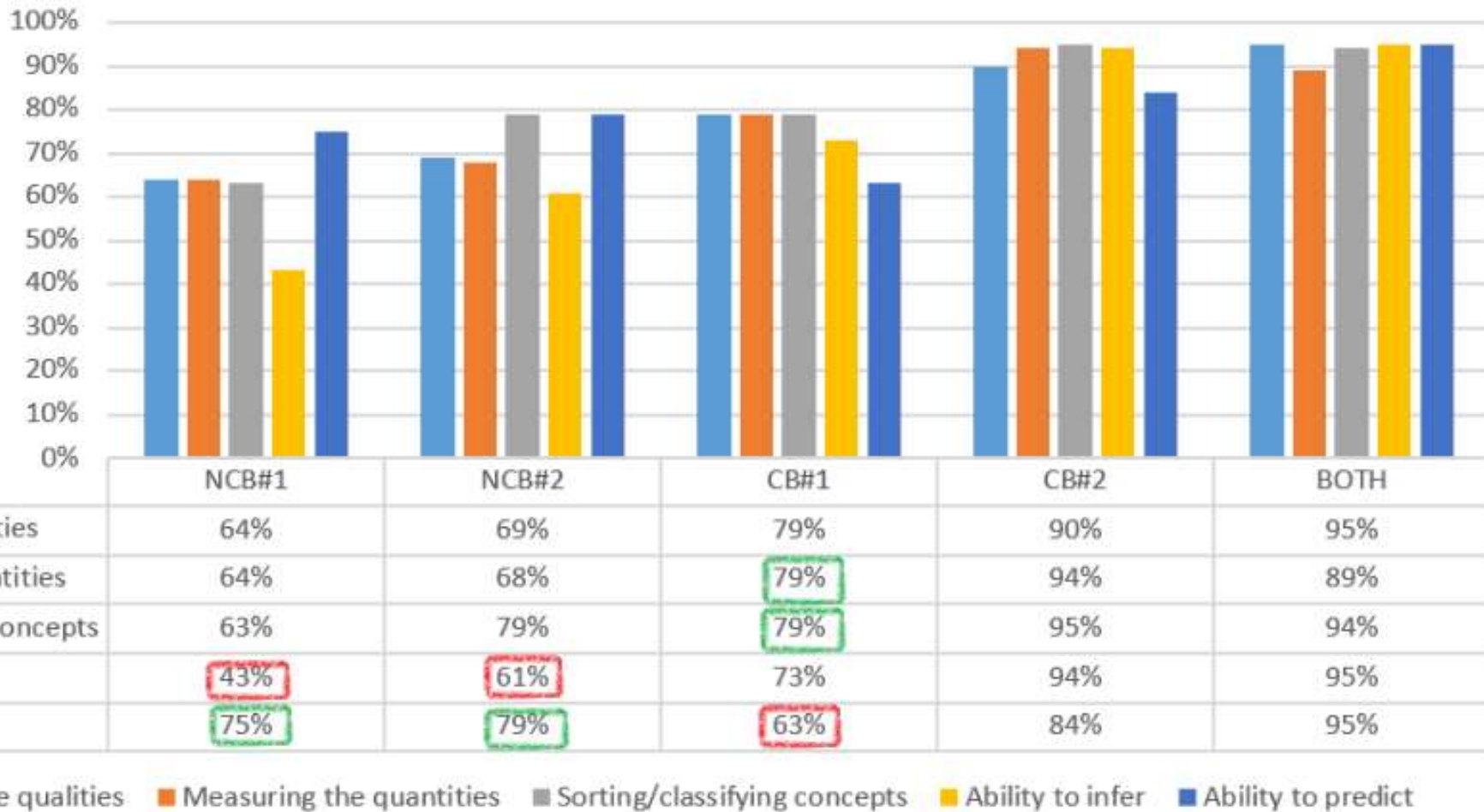
Looking at Students' Thinking: Creating a Questionnaire

The percentage shows more than average choices; for instance, 90% for physical equipment shows 90% of students at least chose average, above average or very high in their responses; therefore, 10% of the population chose below average and very low responses.

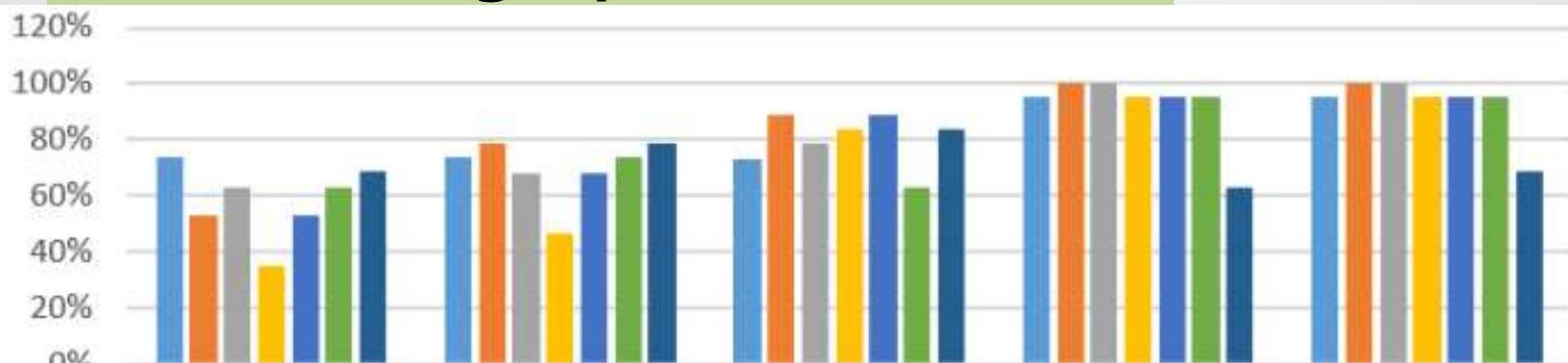
First Category of Questions: Questionnaire Validation



Second Category of Questions: Scientific Skills



Third Category of Questions:



	NCB#1	NCB#2	CB#1	CB#2	BOTH
Recalling concepts	74%	74%	73%	95%	95%
conceptual understanding	53%	79%	89%	100%	100%
scientific writing skills	63%	68%	79%	100%	100%
writing the lab report	35%	47%	84%	95%	95%
Self-efficacy	53%	68%	89%	95%	95%
Being curious to experiment	63%	74%	63%	95%	95%
communicating and teamwork	69%	79%	84%	63%	69%

- Recalling concepts
- conceptual understanding
- scientific writing skills
- writing the lab report
- Self-efficacy
- Being curious to experiment
- communicating and teamwork

Conclusions

Analyzing the Students' Attitudes to NCB, CB & BOTH

Type	Positive Points		Negative Points	
	Scientific Skills	General Skills	Scientific Skills	General Skills
NCB	-Predicting	- <u>Communicating</u> -Recalling concepts - <u>Conceptual understanding</u>	-Inferring	-Preparing lab reports
CB	-Measuring the quantity -Sorting concepts	- <u>Communicating</u> - <u>Conceptual understanding</u> - Self-efficacy -Writing skills	-Predicting	-Being Curious - <u>Communicating</u> -Recalling the concepts
Both	All	All	-	- <u>Communicating</u>

Results for NCB

- In NCB “Predicting” , “Recalling concepts” and “Conceptual understanding” were positive points and the “Ability to Infer” and “Preparing lab reports” and “Writing the lab report” were negative points.
- They last longer, are self-paced and require students to work in groups to complete a task. All these things make it important for students to be metacognitive about their activities during lab. If they do not know, what their goal is, what they are currently doing, what they should be doing next, and how that will help them reach their goal, they are less likely to benefit from the lab. [Evrin Ural,2016]

Results for CB

- “Measuring the quantity” and “Sorting/classifying”, “Conceptual understanding” and “Scientific writing skills” and “Self-efficacy” have positive points and “Being curious to experiment” and “Recalling concepts” were the negative points.
- “Recipe-like activities often short circuit opportunities to stimulate thinking by students” [Germann, P.J., S. Haskins, and S. Auls. 1996]. In this type of lab activities students often, do not see a big concept of what they are trying to convey. Students read each step discretely and do not connect the steps to see the bigger intention of the laboratory experience.

Suggestions for Instructors

- Emphasizing the positive points and reducing the negative points could be a useful idea for planning for the future lab CB and NCB activities. Instructors and lab procedure planners can use these results to combine them and reduce negative aspects of each type.



Let's do it one more time! Summer at North Seattle College!

- PHYS 221
- 19 Students
- CB-NCB-Both



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