V. DISCUSSION

The purpose of this case study was to find out how high school students develop assumption-associated abilities. Over a six-month period, high school students enrolled in a first year physics course worked collaboratively to design their own laboratory investigations. The students wrote up their findings in Google Documents and had opportunities to revise reports for repeated exposure to the scientific abilities. As illustrated in Fig. 2, 90-95% of high school students demonstrated proficiency or partial proficiency in assumption-associated abilities at the end of the mechanics portion of the curriculum.

The results of this study can be compared to findings at the college level. As stated earlier, prior research at the college level showed it took 5-8 weeks for 80% of students in the class to become proficient or partially proficient in a specific ability [12]. Work in reference 12 was done at a large state university in an algebra-based course for science majors. More than 50% of the students in this course never had physics prior to college. With respect to identifying assumptions, high school students demonstrated 80% proficiency or partial proficiency by the sixth lab in January. With respect to evaluating assumptions, high school students were still below 60% after writing their sixth lab report. This is consistent with the college students who also took longer to demonstrate proficiency in this ability. However, between the sixth and eighth lab investigations, high school student proficiency in these scientific abilities increased to 90%; college students did not achieve this in the one semester their reports were studied.

This difference in proficiency between high school and college students in introductory physics courses might be the result of several factors. First, the high school students attended physics class every day having more time on task compared to college students attending labs once a week. Second, the high school students have the same instructor for all activities while college students have different instructors for lectures, recitations and labs. Third, college students wrote all reports individually, while high school students wrote some reports in groups. Lastly, high school students have more frequent opportunities to ask questions and revise their work. Revisions might provide additional exposure to the scientific abilities.

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APPENDIX: SCIENTIFIC ABILITY RUBRICS FOR ASSUMPTION-ASSOCIATED ABILITIES

Scientific Ability	Missing	Inadequate	Partially Proficient	Proficient
Is able to identify the assumptions made in using the mathematical procedure.	No attempt is made to identify any assumptions.	An attempt is made to identify assumptions, but the assumptions are irrelevant or incorrect for the situation.	Relevant assumptions are correctly identified but are not significant for solving the problem.	All relevant assumptions are correctly identified.
Is able to specifically determine the ways in which assumptions might affect the results.	No attempt is made to determine the effects of assumptions.	The effects of assumptions are mentioned but are described vaguely.	The effects of assumptions are determined, but no attempt is made to validate them.	The effects of assumptions are determined and the assumptions are validated.