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Evaluating multiple remote laboratory instruction strategies

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During the pandemic, four different strategies were used to teach physics labs remotely from the University of North Carolina at Chapel Hill. *At-home* experiments were performed with either found materials or equipment shipped to students. *Virtual* experiments involved combinations of pre-recorded procedure footage, pre-collected data, and interactive “choose your own adventure”-style activities. *Simulation* experiments allowed students to collect data via online simulations, while *remotely-controlled* experiments allowed students to manipulate physical equipment on campus. Despite added complexity, each strategy exhibited strengths and weaknesses in meeting different learning objectives, and we report on the outcomes from these new instructional modes that were forced upon us. Positive outcomes include higher lab report scores, exam performance, and morale in three different undergraduate physics courses: a general education course for non-STEM majors, the introductory calculus-based sequence for physical science majors, and the intermediate lab course required of all physics majors. Based on this experience, we believe some of the innovations used during this past year should continue to be implemented once in-person instruction resumes.