# Teacher Experiences with Professional Development and Virtual Labs:

# A Field Study Proposal

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## Need for the Study

Laboratory experiments are keystone experiences conducive to the learning of science concepts. Unfortunately, many schools struggle to secure the resources, funds, and access to facilities to conduct hands-on labs requiring teachers to use alternative methods like virtual labs (Marble, 2017). VLs are computer-generated simulations of traditional PLs that can be used when resources or access to lab facilities are unavailable (Son et al., 2016). Although, insufficient professional development has been shown to impact teachers' efficacy in incorporating educational technology in their lessons (Dolighan & Owen, 2021).

Additionally, the restrictions due to the ongoing global health crisis have limited access to labs in science courses. The lack of lab experiences can negatively impact student development of scientific skills like modeling, computational thinking, and collaboration (NRC, 2012). While research on virtual labs indicates they are as effective as traditional physical labs (Hamed & Aljanazrah, 2020), further studies are necessary to understand the impact of other factors, like instructor experience with professional development and its relationship to self-perceived efficacy.

Literature review indicates that limited professional development on new technologies, like virtual labs, is not beneficial enough for teachers to introduce technology into their lessons (Carlson & Gadio, 2002). Recent studies show that training in technology and instructional practice can positively impact the self-perceived efficacy of pre-service teachers (Joo et al.,

2018). Self-perceived efficacy is a crucial factor in the successful adoption of new educational technology. Additional studies are needed to understand further the impact of professional development on teachers' self-perceived preparedness to implement virtual labs into their lessons and the successful adoption of technology in the classroom.

## Description of the Study

This study explores the teacher experiences with professional development that affected their self-perceived efficacy by adopting virtual labs. The research will investigate the impact of professional development on teacher self-perceived efficacy and familiarity with the virtual lab platform. Next, the researcher will explore the teachers' experiences with professional development on educational technology through questionnaires and interviews. Ultimately, the researcher will analyze the data acquired to identify the instructional training factors contributing to the teachers' self-perceived efficacy with the platform.

### Research Questions

The following questions will help guide the researcher through the study:

**RQ1 (QN):** What is the impact of professional development on the teachers' self-perceived efficacy with the virtual lab platform?

**RQ2 (QL):** What are teachers' experiences with professional development for the virtual lab platform?

**RQ3 (MM):** How does the teachers' experience with professional development impact their self-perceived efficacy using the platform?

## Methodology

This study will use an explanatory mixed-methods design to explore the impact of professional development on teacher self-perceived effectiveness. A mixed-method study can integrate the data obtained from qualitative and quantitative methods to gain a deeper understanding of the issue (Creswell & Creswell, 2018). The purpose of this study is to examine how professional development impacts the teachers' self-efficacy, quantitative data will present the relationship between hours and type of professional development and self-perceived efficacy with the platform, while qualitative data will further explore teacher experiences with professional development and the virtual lab platform.

The researcher will collect qualitative through surveys and quantitative data through interviews. Creswell & Plano Clark (2018) state that explanatory designs intend to explain the results of quantitative data through further qualitative phases. Thus, the researcher will collect quantifiable data from a correlational study phase on the impact of professional development on teachers' self-efficacy. Next, the researcher will gather qualitative data from selected participants in the quantitative case studies, as match comparisons, of teacher experiences with professional development through interviews. Ultimately, the researcher will examine the data from both phases of the study independently. Then, the researcher will analyze the results for emergent themes and relationships to answer the research questions.

### Population and Sample

The target population for this study is secondary science teachers in public and private schools in New Jersey. The choice of secondary science teachers will allow for teachers in various grades to participate in the study. The researcher will contact district science supervisors

and building administrators to request information on their teacher's usage of virtual labs. Once potential schools are identified to fit the criteria, the researcher will request teacher emails from school administrators. The research will select an equal number of potential participants from each county. Next, the researcher will contact teachers through email to explain the importance of the study and request their participation by responding to the survey attached. The researcher will use convenience sampling from the poll of participants in the quantitative phase of the study for the qualitative phase. After analyzing the data, the researcher will group the potential participants into two categories, teachers with the most hours of professional development and the teachers with the least number of hours. The potential participants will be contacted for follow-up interviews to explore their experiences with professional development.

As with any research, there are various concerns for potential issues with the population sample. Suppose supervisors and administrators do not respond to emails. In that case, the researcher will have to seek information from other administrators in the district and research the publicly available science curriculums in each district. Similarly, if teacher contact information is not provided, the researcher will have to search individual school websites for publicly available emails of science teachers. Additionally, if quantitative data is not enough for proportional representation in each county, the researcher will have to seek additional participants or note the study's limitations.

**Sample Questions**

This mixed-method study will combine data from quantitative and qualitative phases in the research. The quantitative data will be collected through a survey including biographical questions, professional development quantity, quality questions, and Likert scale questions on

their self-perceived efficacy with virtual lab platforms. The following sample questions are representative of the questions that will be asked in the quantitative phase of the study:

1. How confident are you with implementing virtual labs in your lessons?
2. How comfortable are you learning from the district-mandated professional development?
3. How would you rate your familiarity with the virtual labs?
4. How confident are you utilizing virtual labs features?
5. How confident are you in explaining the virtual lab features to your students?

The qualitative phase of the study will seek to explore deeply into the teacher experiences with professional development for the virtual lab platform:

1. What were your experiences, whether positive or negative, with professional development on virtual lab platforms?
2. How would you describe the depth of information and applicability of the trainings you attended?
3. How would you describe your understanding and familiarity with the platform before and after the trainings?
4. In which ways to feel that the professional development improved your instructional practices and ability to use the platform in your lessons?
5. How would you describe your use of technology in your lessons?

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