Teacher Experiences with Professional Development and Virtual Labs:
A Mixed-Method Study Proposal

Giancarlo Perez-Flores

Statement of the Problem

- The absence of lab experiences could be detrimental to the students' construction of scientific skills like modeling, computational thinking, and collaboration (NRC, 2012).

- Virtual labs (VL) are great alternatives when funding or facilities are not available.

- Limited, or one-time, professional training workshops on using new technology, like VLs, are not practical enough to help teachers adopt new technology and successfully implement it into their daily lessons (Carlson & Gadio, 2002).

- Teacher-efficacy is crucial to implementing new technology

Purpose of the Study

- This mixed methods sequential explanatory study aims to understand the factors that can impact the implementation and efficacy of virtual labs in high school science courses by obtaining quantitative results from a survey of teachers and then following up with purposefully selected participants to explore those results in depth through qualitative descriptive research analysis.

Research Questions

- **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):** In what ways does the interview data of teachers' experiences with professional development training explain the quantitative survey results on teachers' self-perceived efficacy using virtual labs?

Existing Research

- Virtual Labs (Hamed & Aljanazrah, 2020; Darrah et al., 2014; Son et al., 2016; Reece & Butler, 2017)

  - Research on virtual labs in the classroom indicates they are as effective as traditional physical labs and have the potential to improve learning under the right circumstances. Further studies are necessary to understand the impact of other factors, like teacher mastery of the tool and familiarity with virtual labs.
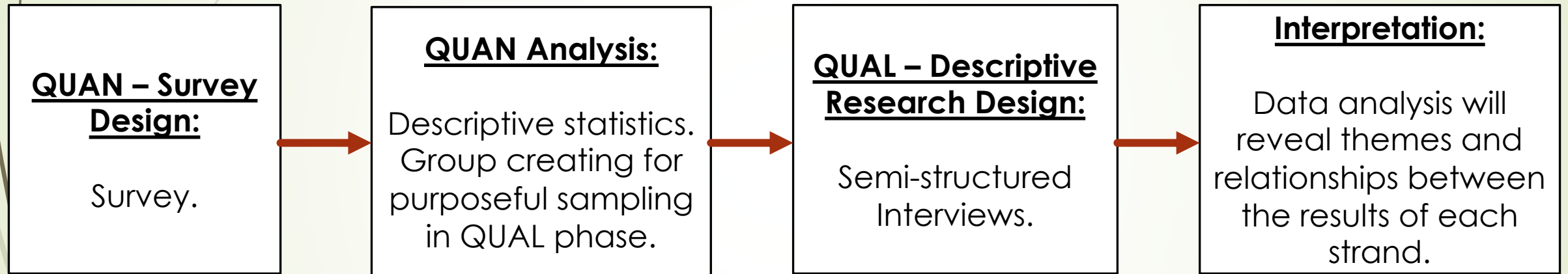
Existing Research

- Teacher Self-Efficacy (Carlson & Gadio, 2002; Joo et al., 2018)

    - 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. Recent studies show that training in technology and instructional practice can positively impact the self-perceived efficacy of pre-service teachers.

Theoretical Framework

- Functionalism Theoretical Framework associated to Emile Durkheim and Herbert Spencer (Sage, 2020).

- Pragmatic Philosophical Worldview (Creswell & Clark, 2018)

Research Design

QUAN – Survey Design:

Survey.

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QUAN Analysis:

Descriptive statistics. Group creating for purposeful sampling in QUAL phase.

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QUAL – Descriptive Research Design:

Semi-structured Interviews.

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Interpretation:

Data analysis will reveal themes and relationships between the results of each strand.

(Creswell & Clark, 2018)

Population

- The target population of this study will include secondary science teachers using virtual labs in the United States.

- Participants will be recruited through social network teacher groups, science teaching organizations, and available emails in school websites.

Instrument

- 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, quantity and quality of professional development questions, and Likert scale questions on their self-perceived efficacy with virtual lab platforms.

- The qualitative phase of the study will seek to explore deeply into the teachers' experiences with professional development for the virtual lab platform using semi-structured interviews.

(Creswell & Clark, 2018)

Data Analysis

- The data collected through surveys will be analyzed using descriptive statistics for relationships between the variables through an SPSS platform.

- The results of the quantitative phase will be used to direct the qualitative phase of the study.

- The interviews will be transcribed using Otter.ai an online tool. The researcher will share the transcripts with the participants for accuracy.

- The data collected from the interviews will be coded and analyzed for emergent themes using ATLAS.ti

- Ultimately, the researcher will analyze in which ways the results from the qualitative phase explain the results from the quantitative phase to answer the research questions in this study.

(Creswell & Clark, 2018)

References

- Carlson, S., and Gadio, C.T. (2002). Chapter 8: Teacher professional development in the use of technology. In W.D. Haddad and A. Draxler (Eds), *Technologies for education: Potentials, parameters, and prospects*. Paris and Washington, DC. UNESCO and the Academy for Educational Development.

- Creswell, J. W., & Clark, V. L. (2018). *Designing and conducting mixed methods research*. SAGE Publications.

- Darrah, M., Humbert, R., Finstein, J., Simon, M., & Hopkins, J. (2014). Are virtual labs as effective as hands-on labs for undergraduate physics? A comparative study at two major universities. *Journal of Science Education and Technology*, 23(6), 803-814. https://doi.org/10.1007/s10956-014-9513-9

- Hamed, G., & Aljanazrah, A. (2020). The effectiveness of using virtual experiments on students' learning in the general physics lab. *Journal of Information Technology Education: Research*, 19, 977-996. https://doi.org/10.28945/4668

- Joo, Y. J., Park, S., & Lim, E. (2018). Factors Influencing Preservice Teachers' Intention to Use Technology: TPACK, Teacher Self-efficacy, and Technology Acceptance Model. Educational Technology & Society, 21(3), 48–59.

- National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. The National Academies Press.

- Reece, A., & Butler, M. (2017). Research and teaching: Virtually the same: A comparison of STEM students' content knowledge, course performance, and motivation to learn in virtual and face-to-face introductory biology laboratories. *Journal of College Science Teaching*, 046(03). https://doi.org/10.2505/4/jcst17_046_03_83

- Son, J. Y., Narguizian, P., Beltz, D., & Desharnais, R. A. (2016). Comparing physical, virtual, and hybrid flipped labs for general education biology. *Online Learning*, 20(3).

- https://doi.org/10.24059/olj.v20i3.687