#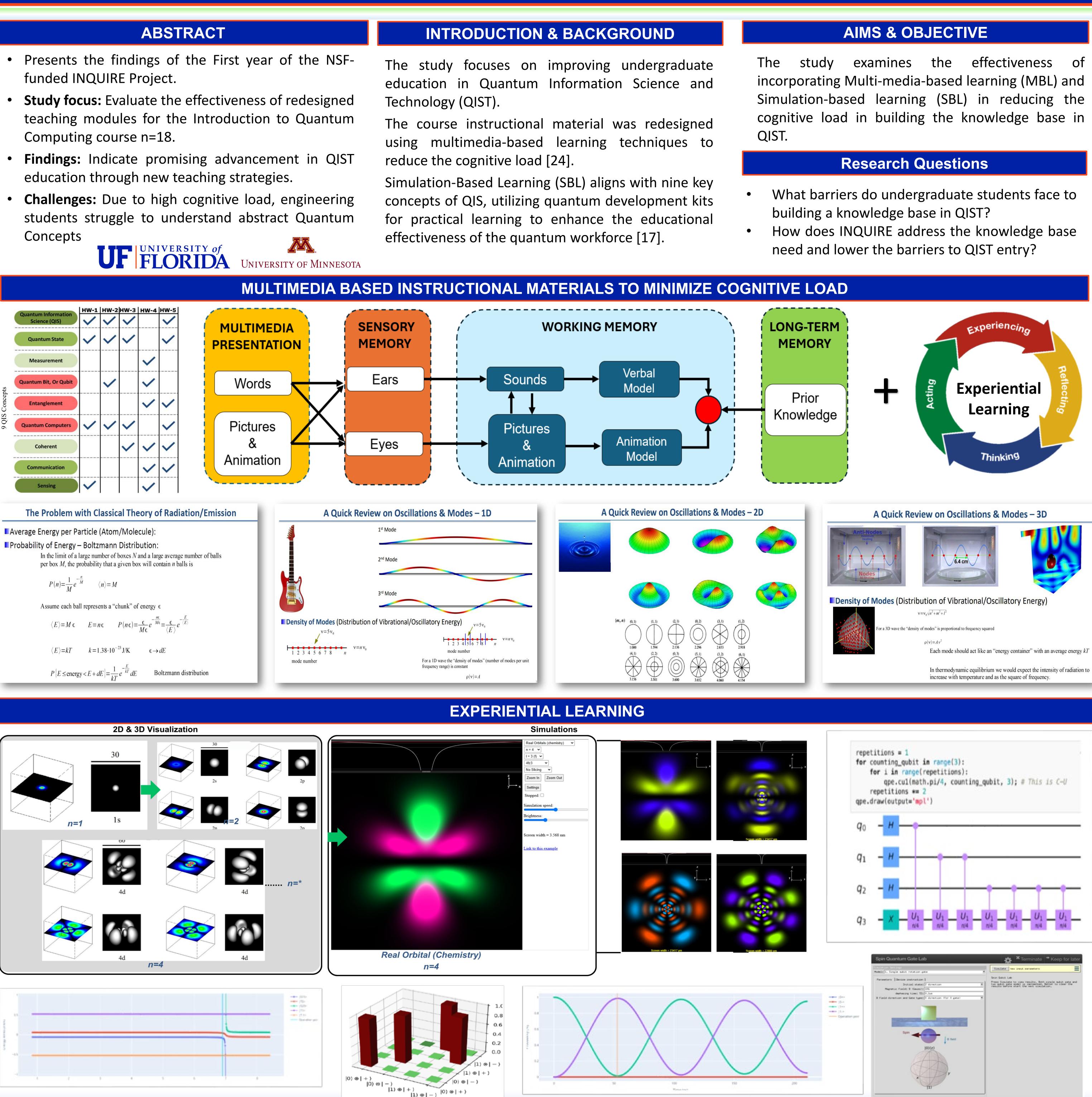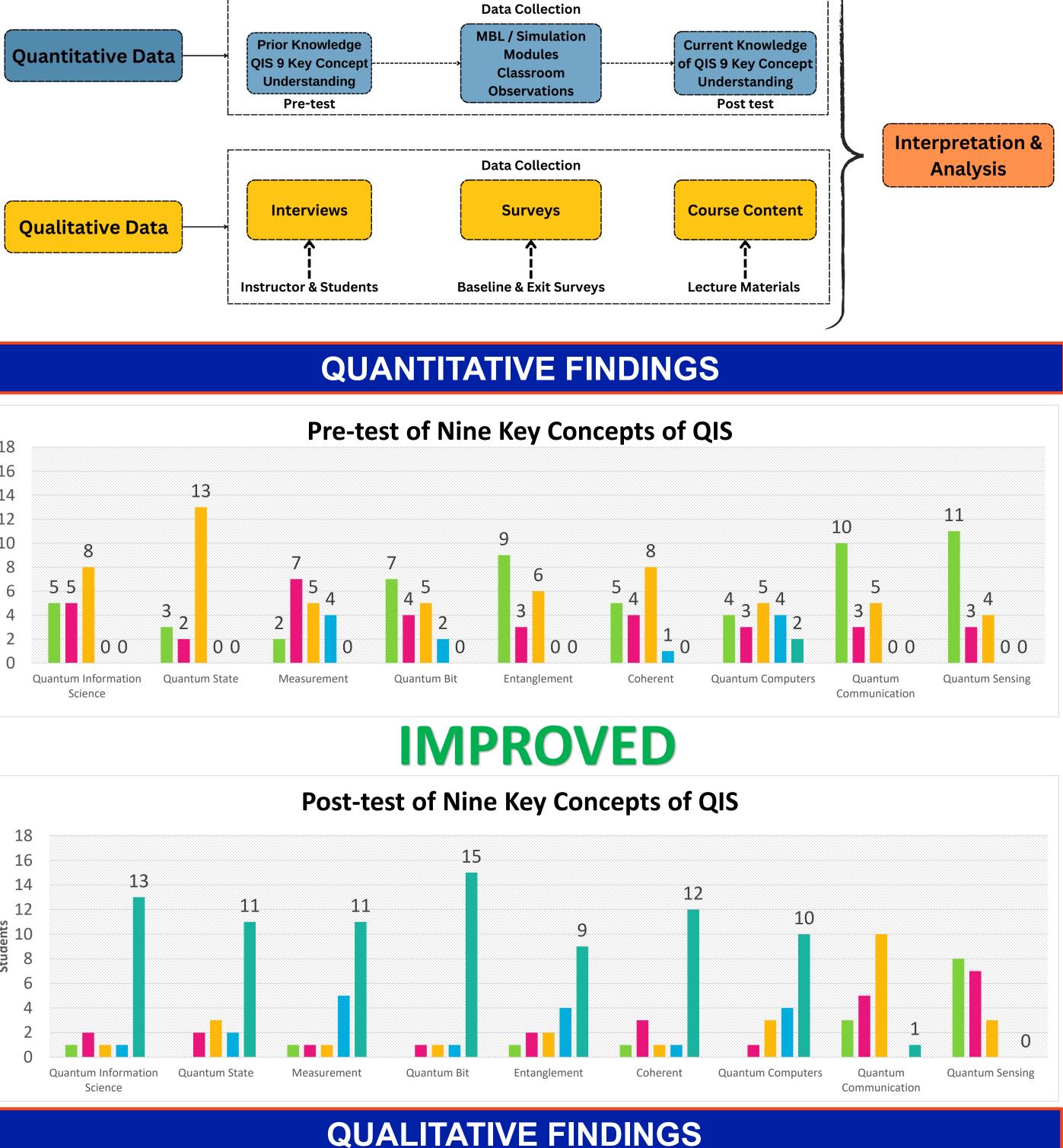 WIP: Immersive, Hand-On, and Interactive Quantum Information Science and Technology (QIST): Empowering Undergraduate students in Quantum Computing
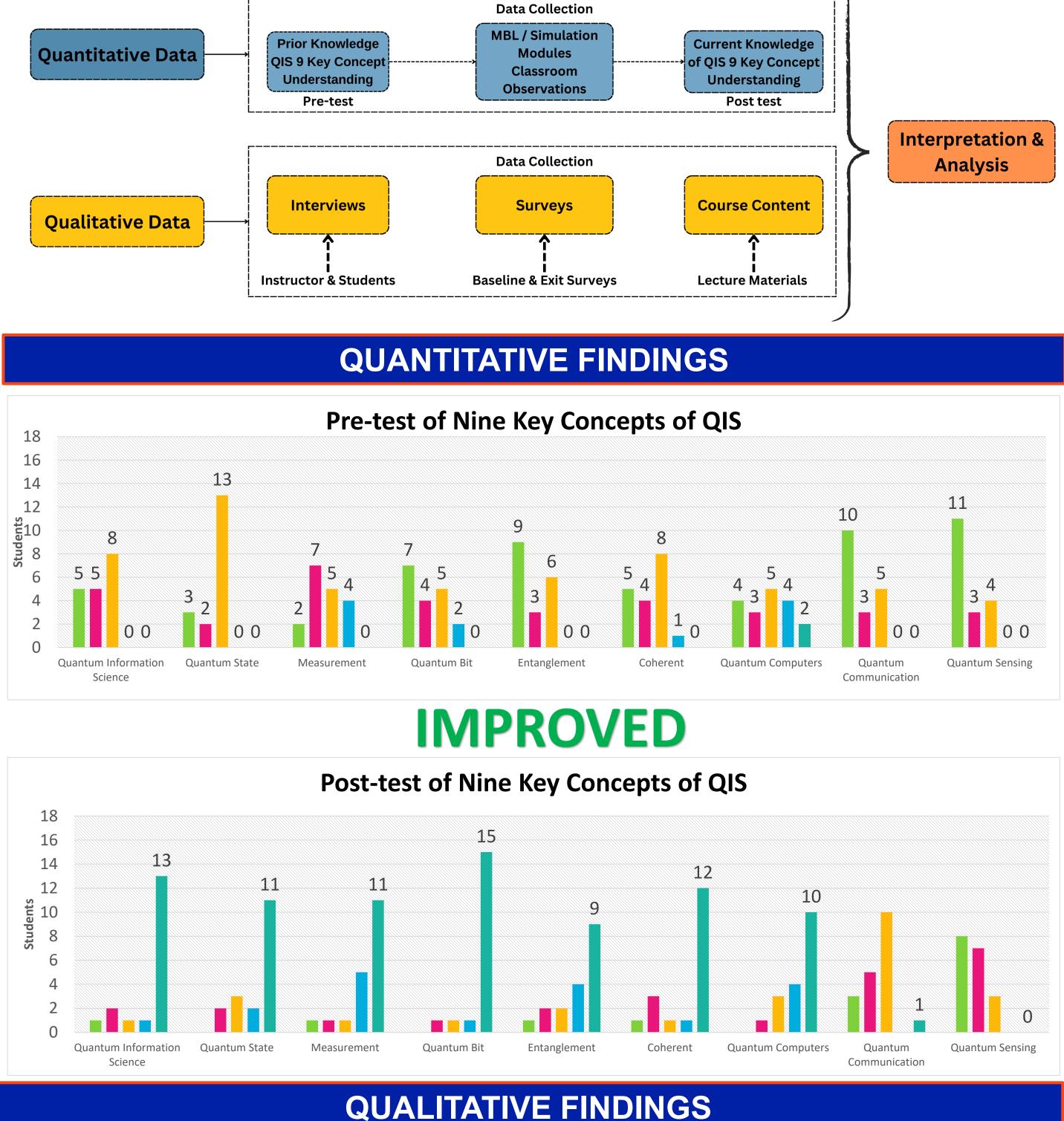
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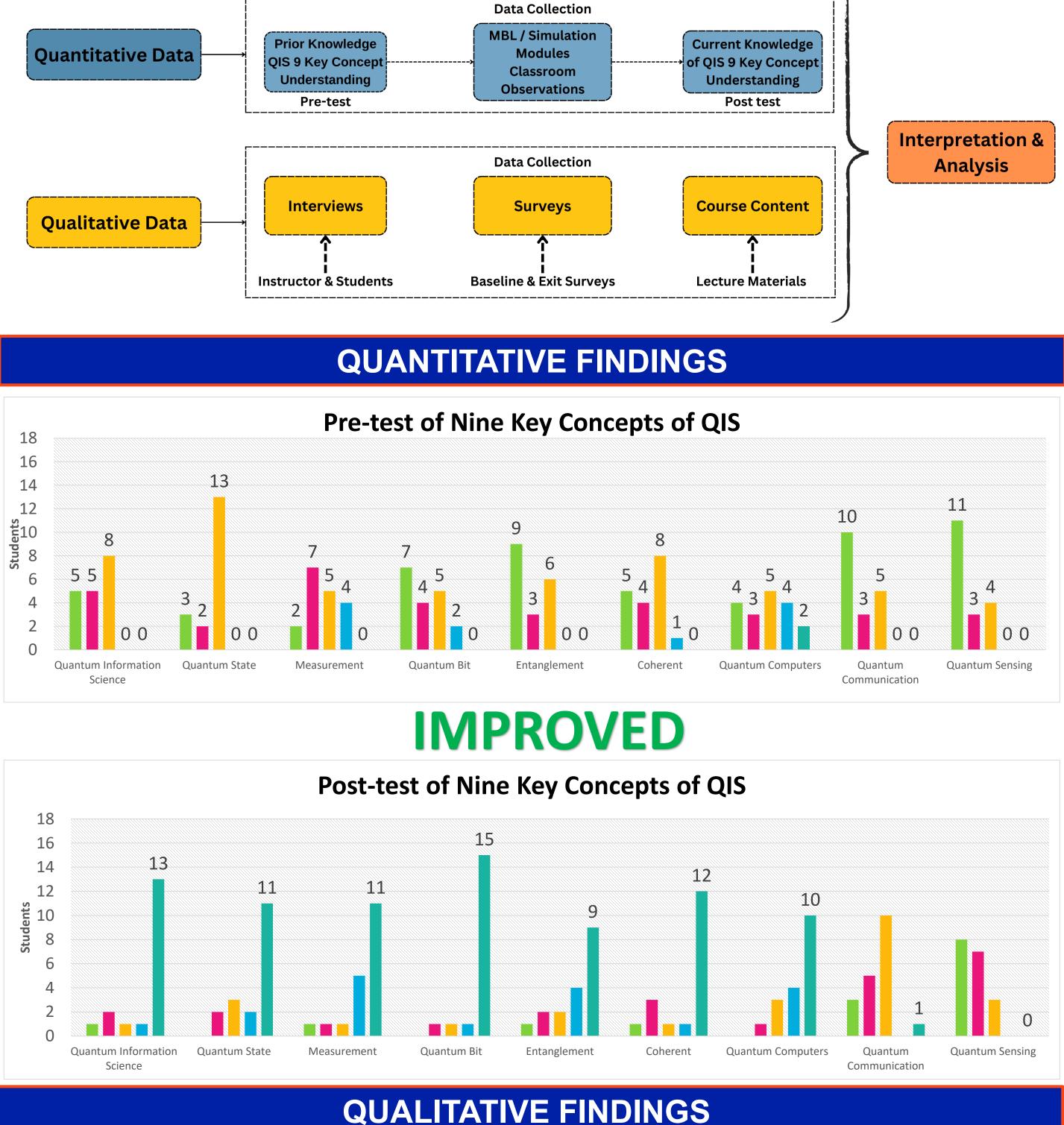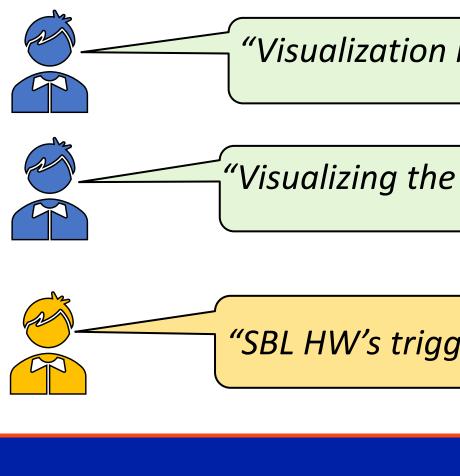
ABSTRACT

- Presents the findings of the First year of the NSF-funded INQUIRE Project.
- **Study focus:** Evaluate the effectiveness of redesigned teaching modules for the Introduction to Quantum Computing course n=18.
- **Findings:** Indicate promising advancement in QIST education through new teaching strategies.
- **Challenges:** Due to high cognitive load, engineering students struggle to understand abstract Quantum Concepts

INTRODUCTION & BACKGROUND

The study focuses on improving undergraduate education in Quantum Information Science and Technology (QIST).

The course instructional material was redesigned using multimedia-based learning techniques to reduce the cognitive load [24].

Simulation-Based Learning (SBL) aligns with nine key concepts of QIS, utilizing quantum development kits for practical learning to enhance the educational effectiveness of the quantum workforce [17].

AIMS & OBJECTIVE

The study examines the effectiveness of incorporating Multi-media-based learning (MBL) and Simulation-based learning (SBL) in reducing the cognitive load in building the knowledge base in QIST.

Research Questions

- What barriers do undergraduate students face to building a knowledge base in QIST?
- How does INQUIRE address the knowledge base need and lower the barriers to QIST entry?

MIXED-METHOD METHODOLOGY

- The study highlighted the effectiveness of MBL and SBL in teaching quantum computing concepts.
- The SBL homework enhances the course's relevance to the practical needs of the quantum field.
- Insights from the classroom observation were shared with the course instructor to foster an interactive and engaging learning environment.

MULTIMEDIA BASED INSTRUCTIONAL MATERIALS TO MINIMIZE COGNITIVE LOAD

QUANTITATIVE FINDINGS

Pre-test of Nine Key Concepts of QIS

IMPROVED

Post-test of Nine Key Concepts of QIS

EXPERIENTIAL LEARNING

QUALITATIVE FINDINGS

Undergraduate

"Visualization helped me to understand the rotation of qubit.."

"Visualizing the concept... Trigger Critical thinking while I was solving "

Graduate

"SBL HW's trigger critical thinking while I was solving "

CONCLUSIONS

- The study highlighted the effectiveness of MBL and SBL in teaching quantum computing concepts.
- The SBL homework has enhanced the course's relevance to the practical needs of the quantum field.

FUTURE WORK

- Redesign the Hardware track Quantum course in the ECE department.

CONTACT US

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