EFFICACIOUSNESS OF GENERATIVE AI FOR INTEGRATED STEM PLANNING AND ITS IMPACT ON STEM TEACHER SELF-EFFICACY

RESEARCH PROPOSAL

JULIE A. OLSON

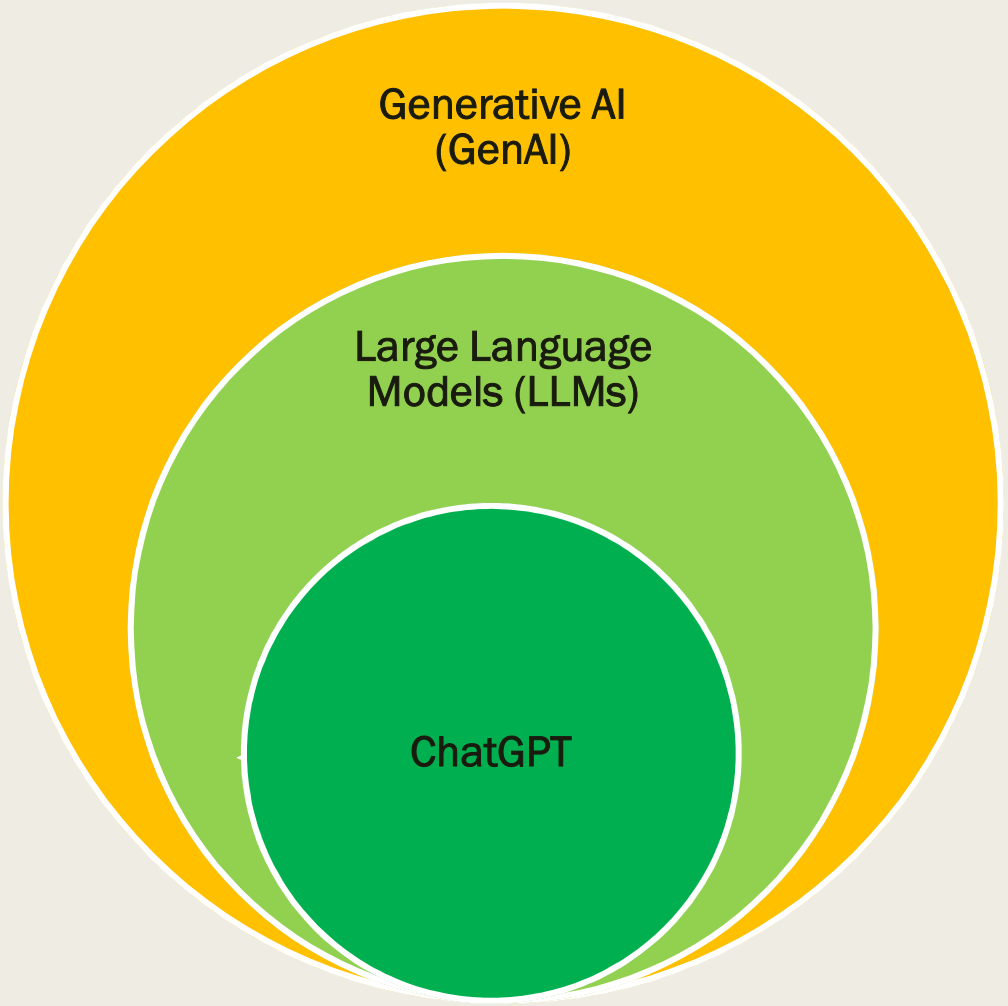
WHY THIS RESEARCH?

Introduction

GPT

General Purpose Technology

Generative Artificial Intelligence


Generative AI
(GenAI)
Large Language
Models (LLMs)
ChatGPT

GenAI in Education

ISSUES

SOLUTIONS

Benefits, Strengths and Opportunities
Conversational Language
Creativity
Decreased Teacher Workload
Assessment Design
Search Large Amounts of Data

Benefits of GenAI

Challenges, Weaknesses and Threats

Bias – Racial and Gender

Equity

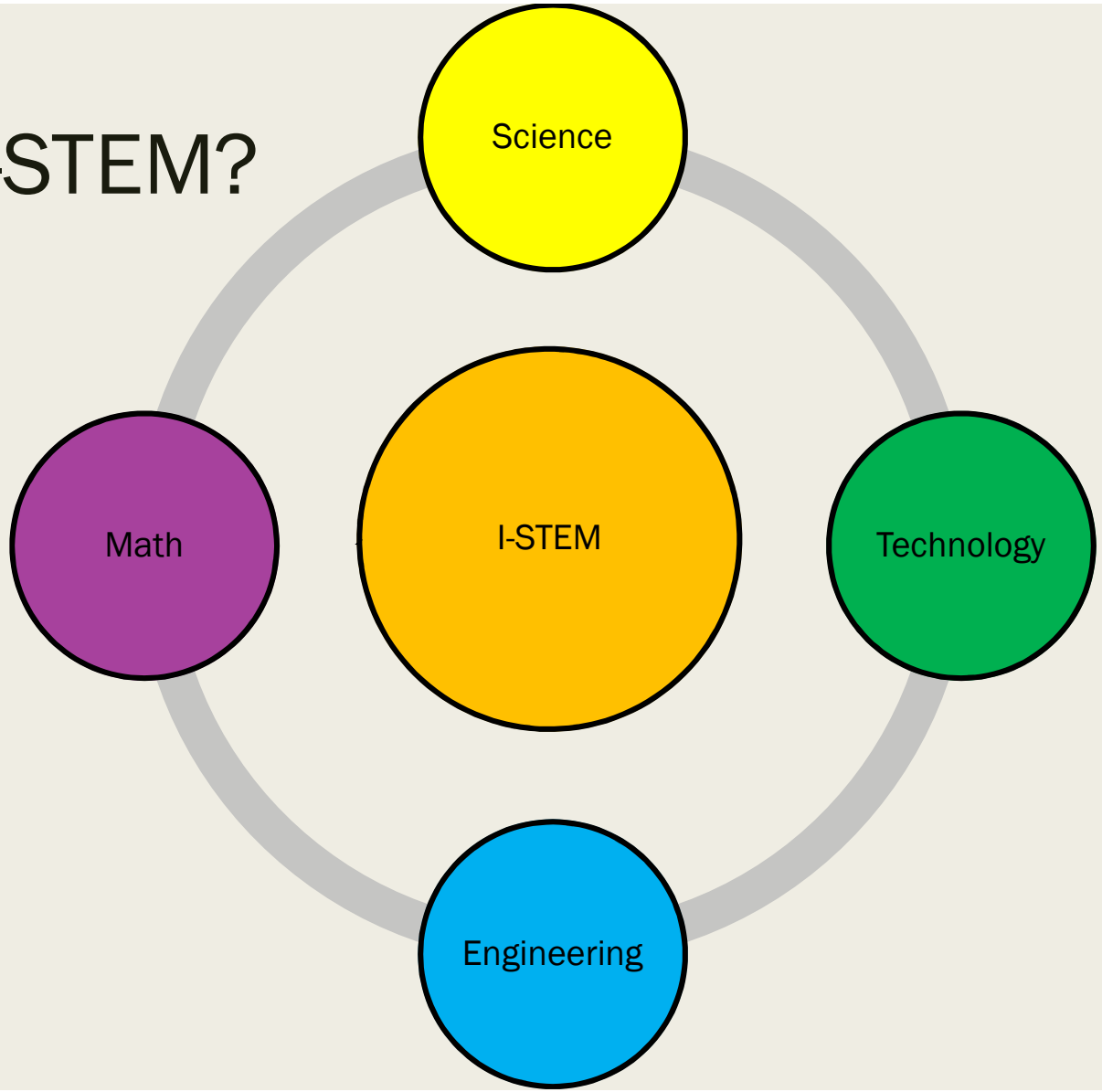
Lack of Metacognition

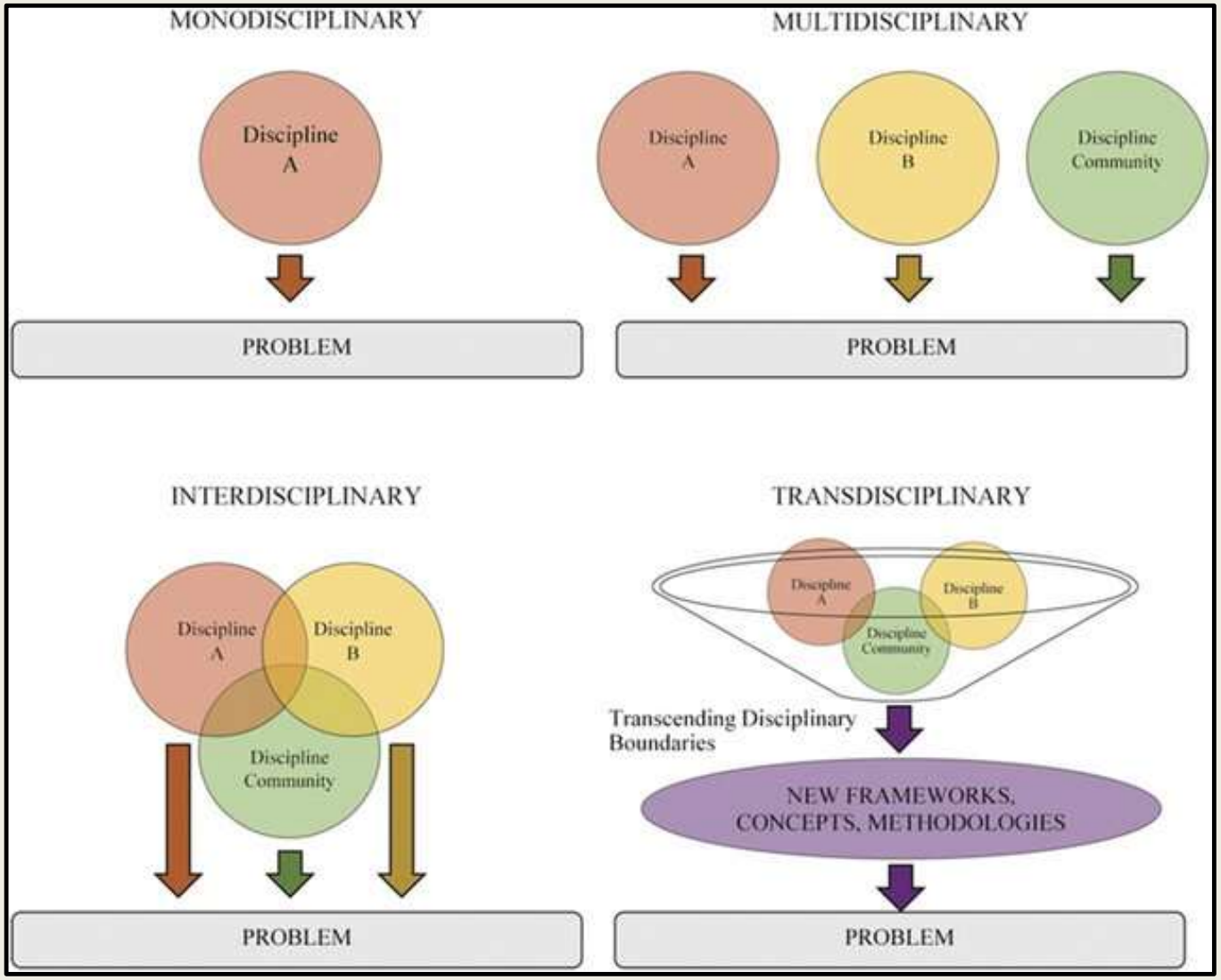
Misinformation

Lack of Deep Understanding

THE HUMAN ELEMENT IS STILL NECESSARY

What is I-STEM?

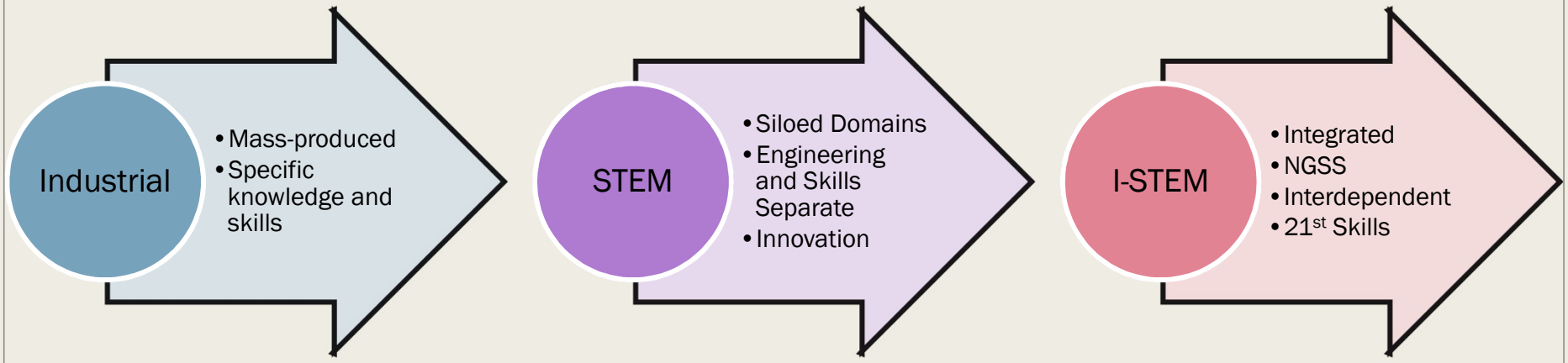




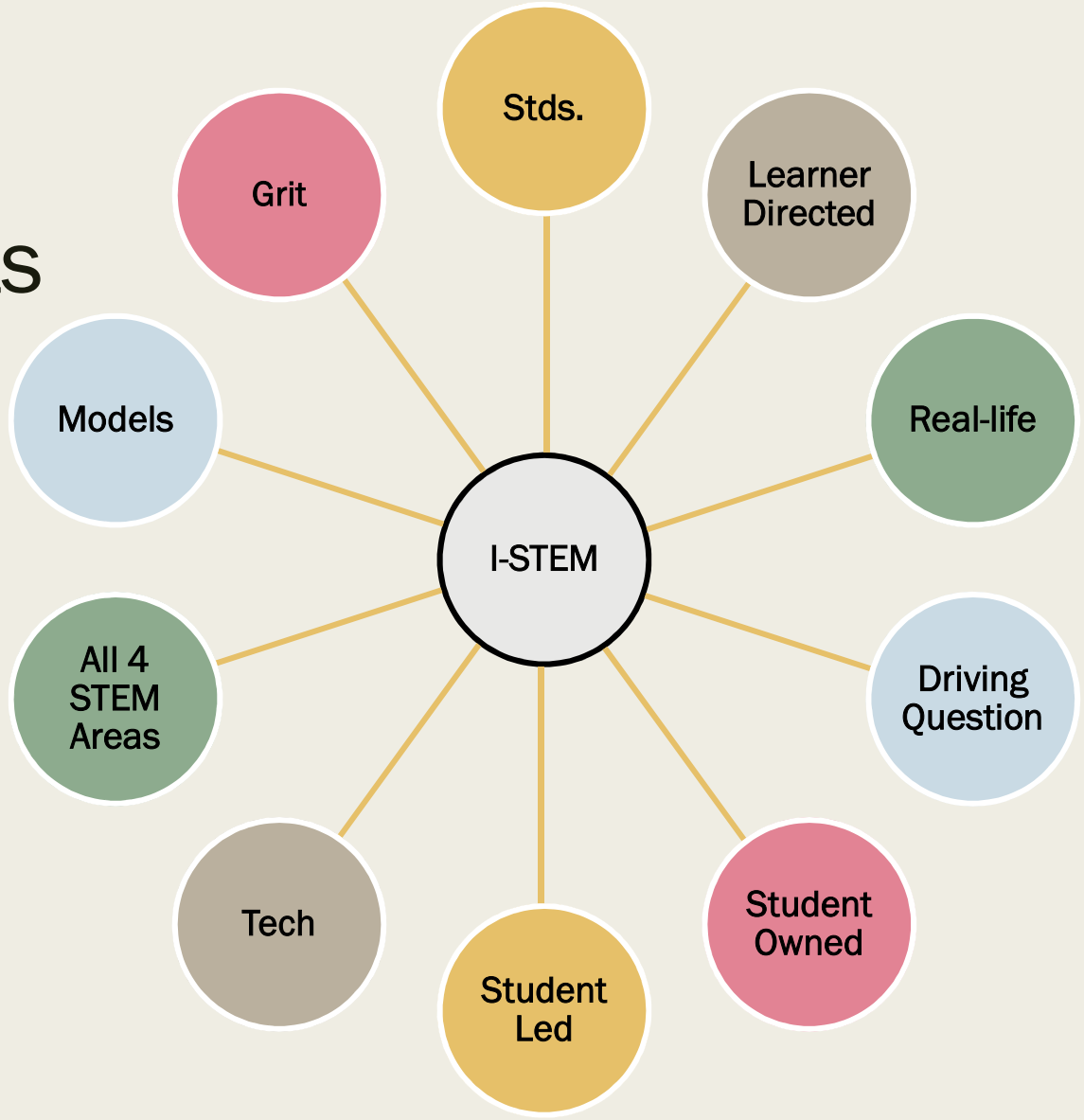
Adapted from Heinzmann et al., (2019). Reprinted with permission. CC By 4.0

Why I-STEM?

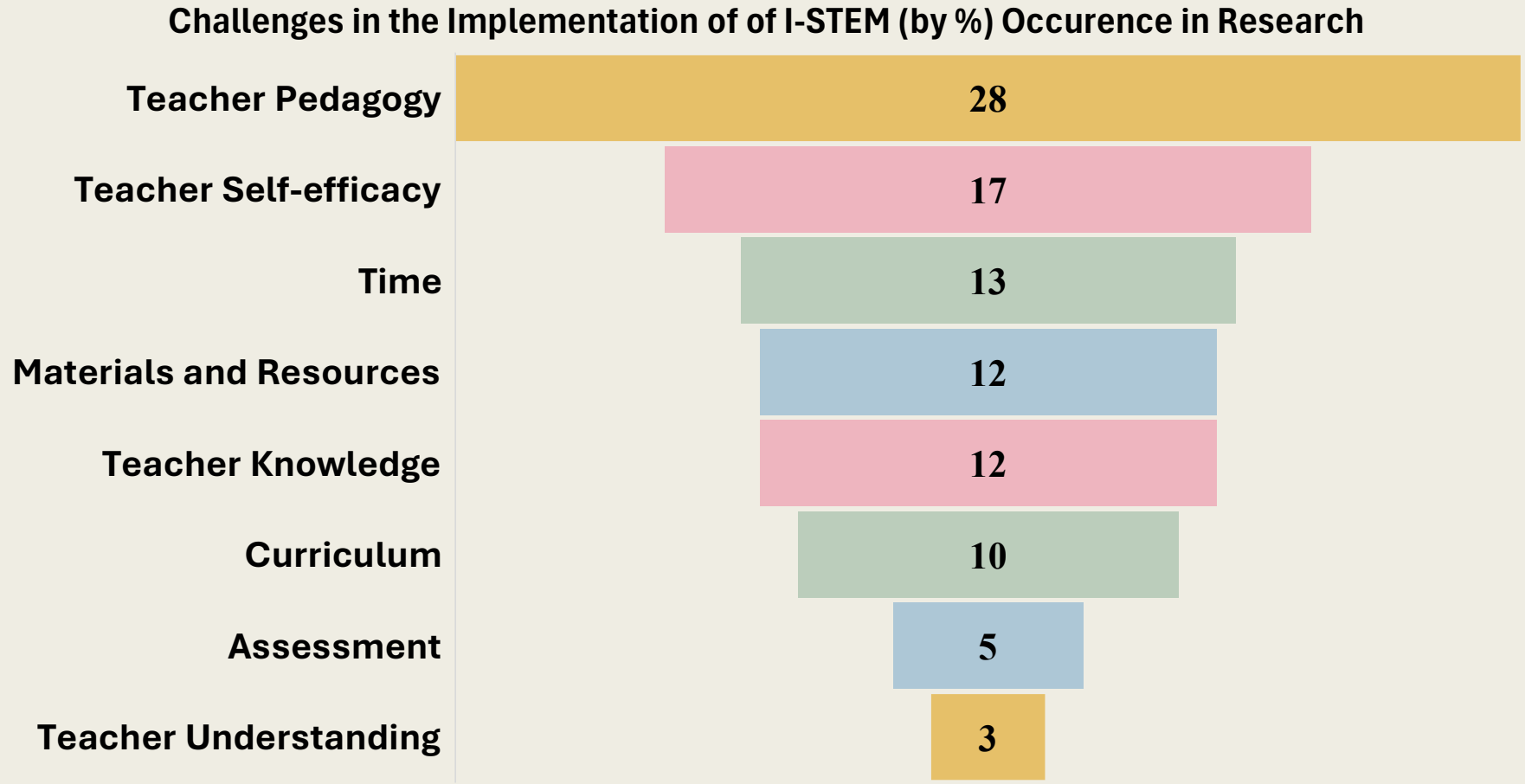
- Changes in education: Workforce focus changing over time forcing changes in education



Key Components of I-STEM (Cianca, 2020)



Challenges to the Implementation of I-STEM (*Arshad et al., 2021)*



Other Considerations of I-STEM Implementation

- In-service and preservice teacher training
- Engineering coursework?
- Changing from siloed content instruction
- Content Knowledge
- Pedagogy vs content training
- Age/Time teaching in STEM content areas
- Content area teachers and change?

GenAI to Brainstorm Ideas, Assimilate Resources, & Design Lessons for I-STEM:

Real-World Problems – Creative Generation

Standards from Multiple Domains to Guide Learning:

- Next Generation Science Standards
- Common Core State Standards for Mathematics
- International Society for Technology in Education Standards (
- State Standards

STEM Domain Knowledge

- Science (Life, Physical, Earth/Space)
- Technology
- Mathematics
- Engineering

CONFIDENCE AND I-STEM SELF-EFFICACY - THE BELIEF THAT THEY CAN SUCCESSFULLY DESIGN AND IMPLEMENT AN I-STEM LESSON.

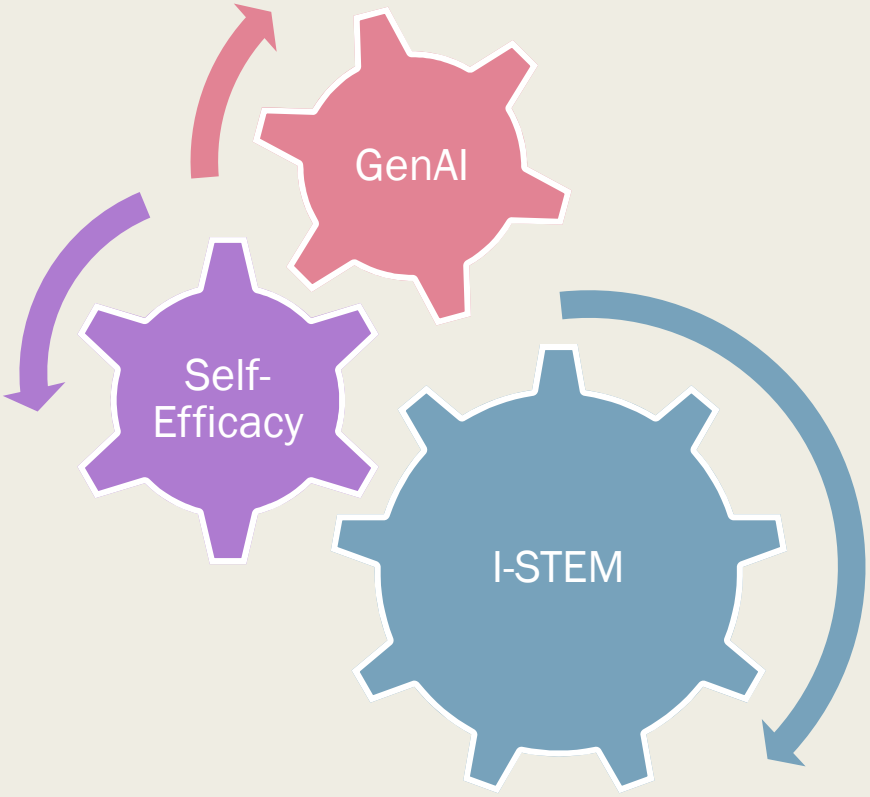
IMPLEMENTING AN I-STEM PEDAGOGY INVOLVES MANY COMPONENTS AND CHALLENGES, WHICH CAN LEAD TEACHERS TO HAVE LOW CONFIDENCE AND STEM SELF-EFFICACY.

Image created by Gemini (2025)

Bandura's Factors Affecting Self-Efficacy (Bandura, 1977) *Correlated to I-STEM and the Use of GenAI.*

Performance Accomplishment	Vicarious Experiences	Verbal Pursuasion	Physiological State
• Successful design of an I-STEM lesson using prompts • Perceiving GenAI and I-STEM as useful	• Perceiving GenAI as trustworthy • Model I-STEM lessons	• Receiving positive affirmations of ability • Collaborative interactions using GenAI	• Reduce fear and avoidance of challenges • Reducing teacher time on task • Increasing access to vast resources

Timely and Innovative



Professional Significance

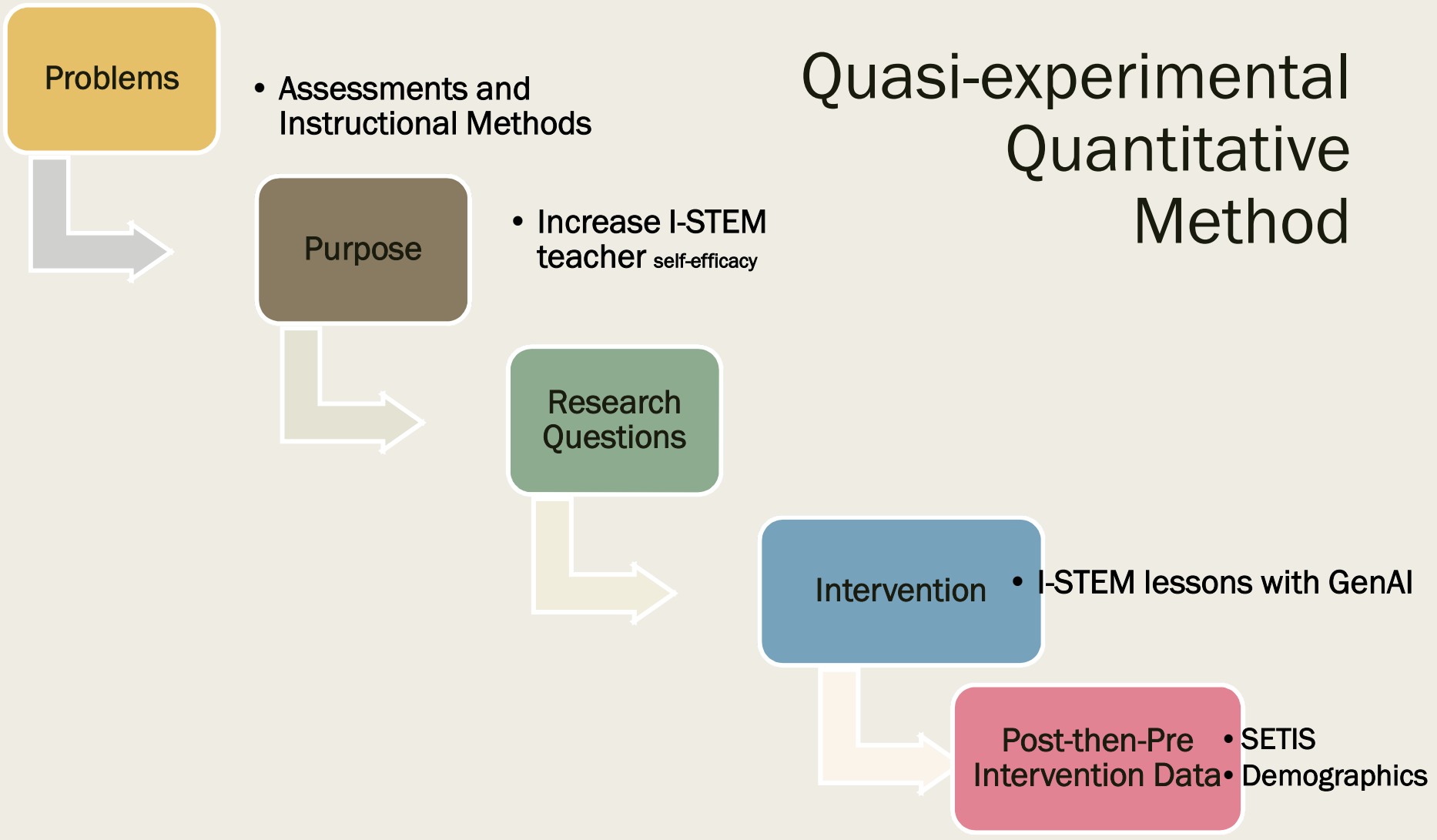
- Increasing STEM self-efficacy boosts teacher confidence.
- Improved self-efficacy fosters effective I-STEM implementation.
- Focus on assessment reform with GenAI integration.
- Developing AI literacy prepares educators for future challenges.
- Professional development is essential for educators in AI and I-STEM.

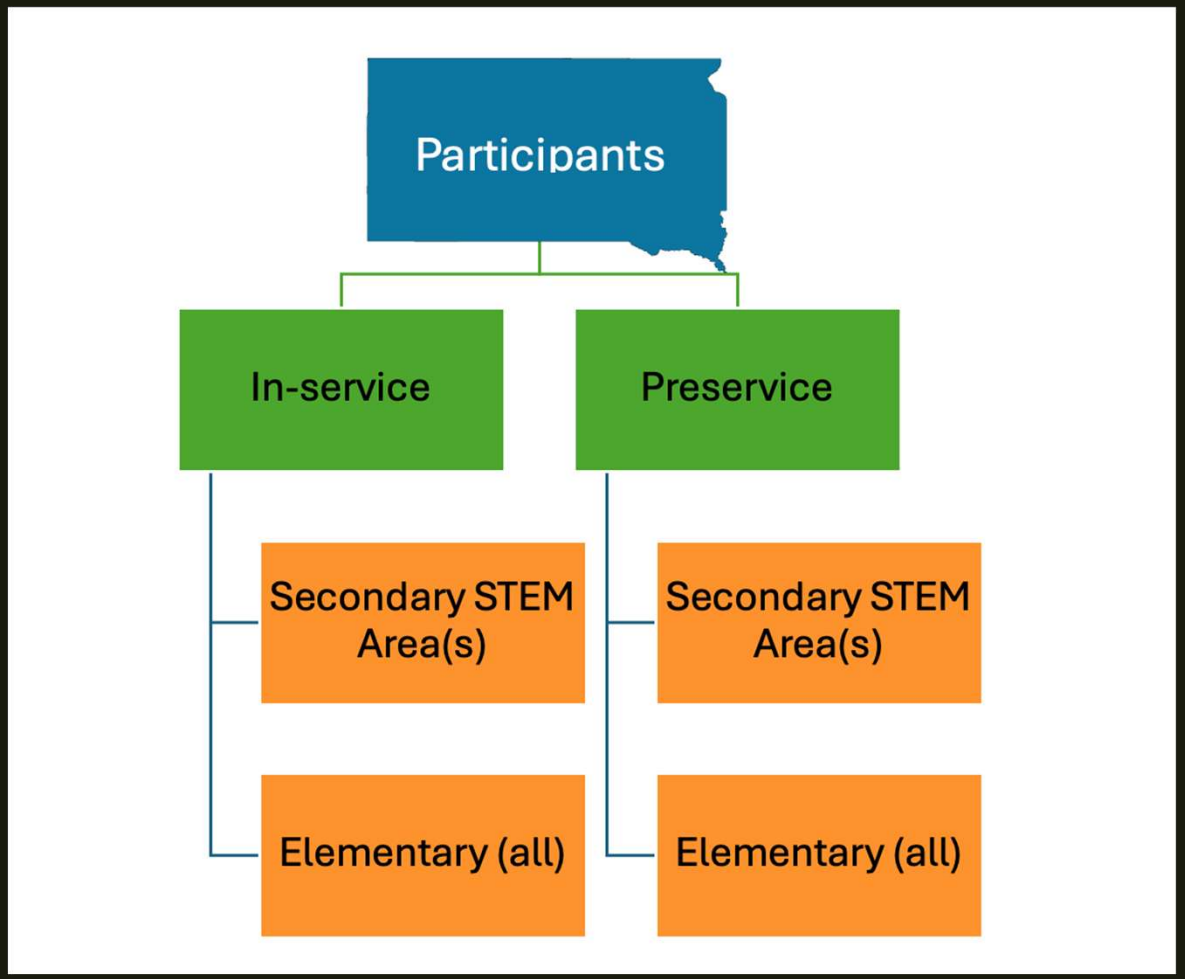
Research Questions

- Research question 1: Are there differences in participants' I-STEM teacher self-efficacy before and after a self-directed, AI-assisted, asynchronous training designed to support creating an I-STEM lesson?
- *Research sub-question 1A*: Do any of the differences in I-STEM teacher self-efficacy vary as a function of individual STEM content area expertise?
- *Research sub-question 1B:* To what extent does any change in I-STEM teacher self-efficacy vary as a function of prior teaching experiences?
- *Research sub*-question 1C: Does change in I-STEM teacher self-efficacy vary according to age?
- *Research sub*-question 1D: Does prior experience with GenAI for educational purposes affect change in I-STEM teaching self-efficacy?

METHODOLOGY AND ANALYSIS

Quasi-experimental Quantitative Method





POPULATION

Participants

INTERVENTION DESIGN

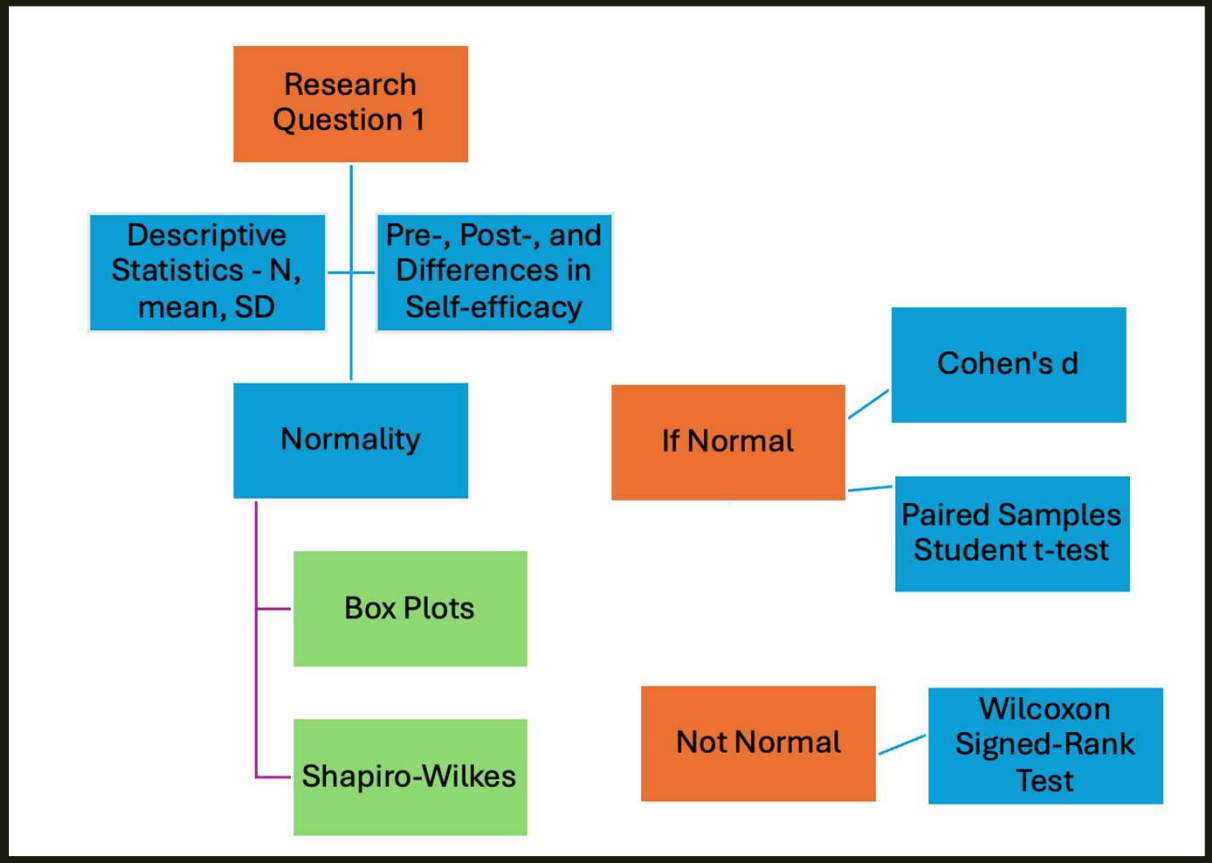
Quantitative Data

Demographic Data

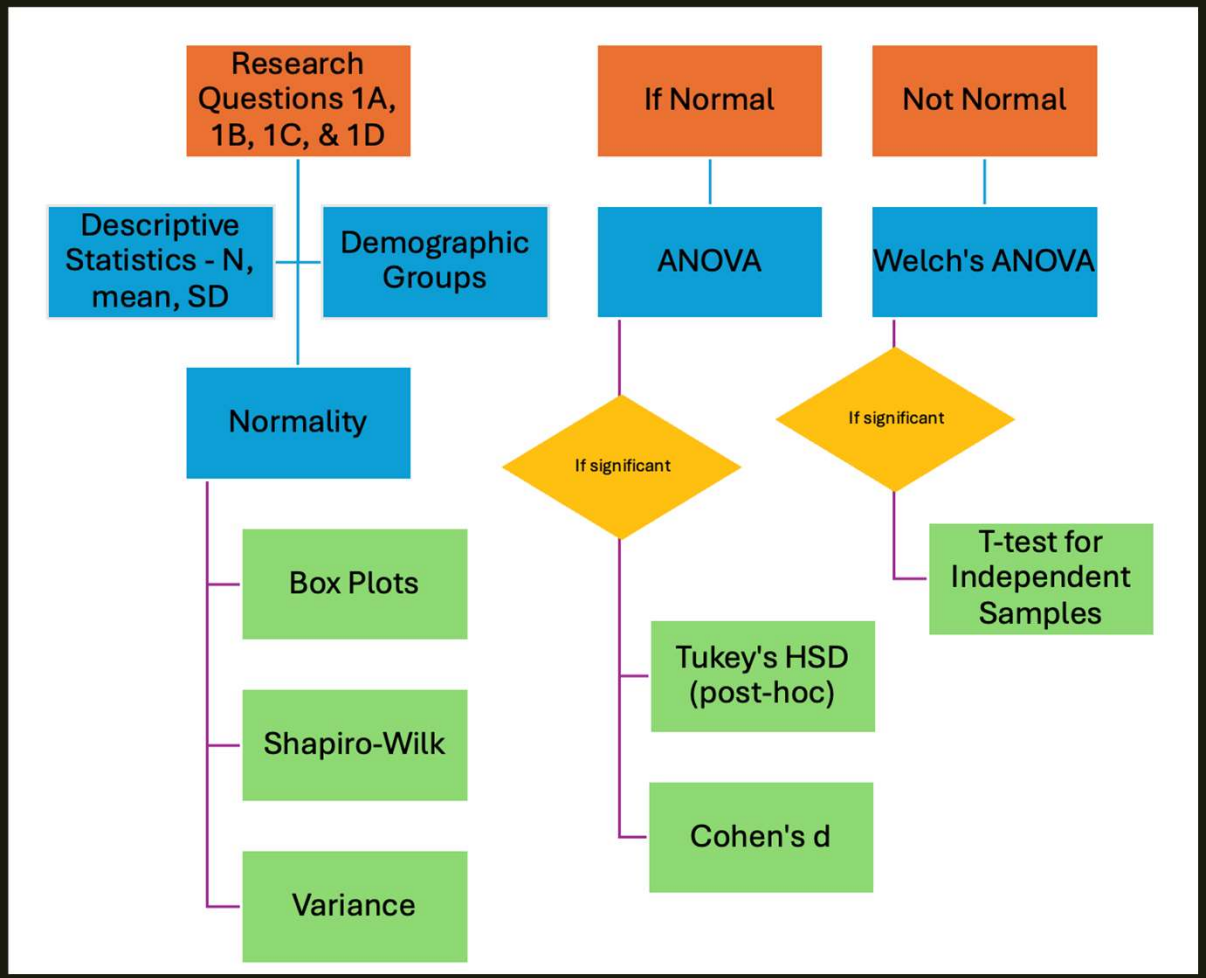
- Age group
- Number of years teaching
- STEM field(s) Teaching
- Current teaching level
- Highest degree completed
- What AI tools have you used for educational purposes
- Specific STEM fields – major
- Specific STEM fields – currently teaching
- Specific STEM fields – have ever taught

T-STEM Science Self-efficacy Score

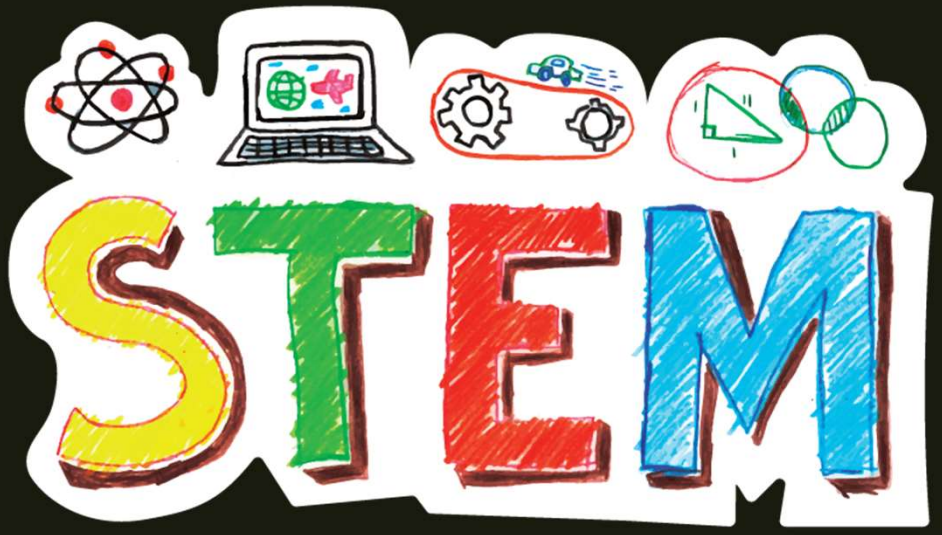
SETIS I-STEM TEACHER SELF-EFFICACY



RESEARCH QUESTION 1: ARE THERE DIFFERENCES IN PARTICIPANTS' STEM TEACHING SELF-EFFICACY BEFORE AND AFTER AN AI-FOCUSED ASYNCHRONOUS PROFESSIONAL DEVELOPMENT PROGRAM DESIGNED TO SUPPORT I-STEM LESSON PLANNING?



RESEARCH SUB-QUESTIONS 1A-1D.



Delimitations in Research

- SETIS instrument assesses I-STEM self-efficacy only.
- Sample limited to South Dakota educators.
- Selection bias with focus on science and math teachers.
- AI-assisted lessons won't be evaluated for accuracy.
- Survey completion time may influence recall of confidence.

Assessment and Limitations of SETIS

- Participants will complete SETIS for I-STEM efficacy assessment.
- SETIS lacks technology self-efficacy evaluation related to GenAI.
- Sample selection bias limits diversity of participants.
- AI-assisted lessons won't be evaluated for accuracy.
- Time limits for surveys may affect recall of confidence.

QUESTIONS?
COMMENTS?

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