Course Title: Research Methodology: Qualitative & Quantitative Methods in Science & Mathematics Education Research (SCE102.2)

- Course Credits: 4
- Core/Elective: Core
- Instructor(s): DurgaPrasad Karnam, Aniket Sule
- Course Starting Date: January 5, 2024
- Day & Time preference: Monday (2 pm – 4 pm) and Friday (2 pm – 5 pm)
- Course Duration: 15 weeks

Key learning outcomes:

- Students will be able to appreciate the importance of a method in doing Scientific research.
- Students will be able to identify the most appropriate methodology from a diverse set of methods for their research studies.
- Students will be able to develop various tools and analysis approaches necessary for their research studies.
- Students will be able to design studies incorporating the diverse considerations of rigour (reliability, validity, statistical significance, generalizability, ethical aspects, etc.)

Detailed Course Structure

The course has two parallel tracks:

- Students in teams or individually will collaborate on any ongoing real-world research projects or education projects (including thesis projects of other senior PhD students) throughout the entire course.
- There will be lecture sessions reading and reflecting on various topics.

Students shall use the projects as tangible and authentic contexts, in the light of which, they will critically engage with various concepts and considerations about methodologies. There will be three main phases in the entire course journey.

Phase	Student Activities (Track-1)	Topics Covered (Track-2)
Phase-1: Conceptualization [Jan-Feb]	They reflect on the importance of the scientific method and are exposed to multiple types of methodologies, and considerations to be made while designing their studies. They will be guided to identify some of the research projects or shall be asked to identify any of the projects that they	Sessions covering ● brief philosophical basis of the scientific method ● Brief intro to various methods and tools: experiments (control, pre-post), quasi-experiments, model-based abduction, design-based studies, case studies,

	already know of, on which they want to collaborate. Scope out and articulate their area of contribution to the research projects.	ethnography, textbook analysis, micro-genetic studies, surveys, tests, interviews, FGDs, ● Factors to consider in study design: reliability, validity, sampling, triangulation, ethics, etc.
Phase-2 Execution [Feb-Mar]	They execute their research design (collect data, organise) while learning from already existing seminal works using those methods and reflect and attempt to incorporate various best practices	● Best practices covering each of the methods: experimental set-up, identifying sample, framing and conducting interviews, data collection (types: video, gestures, movements, content, etc.) ● Methods for organising the data: representing data numerically and graphically, presenting a summary of qualitative data
Phase-3 Analysis and Reporting [Mar-Apr]	They analyse data and arrive at the results. No necessity of meaningful or conclusive results are needed. They can present these to the community and submit a report.	Sessions and workshops ● Data Analysis techniques: various statistical tests, coding methods, Discourse Analysis, Content Analysis, Thematic analysis, and epistemic network analysis ● Hypothesis testing, statistical methods (confidence intervals, significance), data modelling

- The course will take 2 slots in a week. Every alternate week, there will be a single longer 3.5-hour session.
  - 1.5-2 hours of whole-class theoretical exposure to various conceptual aspects relevant to each phase of the project (includes reading, discussion led by student presentations)
  - 1-1.5. hour discussion on project progress and reflection [students will present their project developments and their connections to the conceptual aspects etc]

Outputs

- Students in every week make a presentation on the topic of discussion in that week, as well as a short presentation on the progress and reflections based on their projects.
- Students shall present at the end of the course about the project, and submit a detailed report as a term paper.

Grading Scheme

- Daily class participation: 20%
- Project ideation and implementation: 50%
- Project report and presentation: 30%