



A Short Course on Experimental Design for Applications of Road User Safety



6th November - 27th November 2021

through
Centre for Continuing Education (CCE)

Indian Institute of Science (IISc), Bangalore, India

Background: Humans are curious. By nature, we seek to explore new grounds, improve systems, products, and services, and explore unsolved problems. All these activities are guided by asking the correct questions, by searching for answers in the right spots, and by making appropriate decisions. Researchers and practitioners answer complicated questions from the micro levels of our human systems to the macro level encompassing infrastructure and environment. Experiments are the professional way to answer difficult questions, identify cause or effect, and determine predictors or outcomes. Experiments help us understand why things are the way they are, and the outcomes of a well-designed experiment help us change the world.

Proper design of an experiment, apart from its proper analysis and interpretation, is important to convince a researcher that your results are valid and that your conclusions are meaningful. Were enough subjects (experimental units) tested, for example, to detect the desired difference? Were enough replications used to be able to draw wide inferences? Were proper procedures used to randomize the treatments to the experimental units or, if you prefer, the experimental units to the treatments?

In this course, the factors influencing experiment design and measurement are covered. The various methods of experiment design are explored broadly, inclusive of confounds and biases that can influence the outcomes. The course wraps up with a discussion of road safety applications hinged on well-designed experiments.

Course Objective/Format: This course is expected to serve the following objectives:

- Understand and use the terminology of experimental designs
- A succinct understanding of the various steps in effective design of experiments
- An introduction to the different types of experiment design.
- A detailed exposure to various ways to avoid biases/confounds in experiment design
- Familiarity with the nuances of statistical considerations in experiment design
- Simultaneous study of several factors versus study of one factor at a time.
- Examine how a factorial design allows cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process; and discuss its advantages to those who conduct the experiments as well as those to whom the results are reported.
- Ability to articulate the pros and cons of applying driving simulation to a traffic engineering problem inclusive of the definition of independent and dependent variables complete with confounds noted for such experiments.

Course Content:

- Fidelity & Validity of Simulated Environments
- Independent Variables and Confounding Effects
- Nature and Function of Experimental Design
- Experimental Design Examples and Typical Steps
- Three Types of Experimental Design
- Two Ways to Study Human Behavior
- Three Measurements to Avoid Bias
- Participant/Respondent Management
- Cross-sectional vs Longitudinal vs Mixed Designs
- Orthogonality & Fully Orthogonal Design
- Randomized Complete Block Design & Full Factorial Experiments
- Selecting & Arranging Stimuli
- Modalities & Sensors
- Eye Movements
- Application: Non-motorized Road Users
- Application: Design and Evaluation of Signs & Pavement Markings using Driving Simulators

Prerequisites: Course participants are expected to be familiar with practical statistical concepts, have prior exposure to road safety, have an interest in the design of experiments that involve human subjects, and an appreciation for cognitive psychology and decision making. The course is designed for researchers who have some experience in designing experiments: those who are at the beginning of their scientific careers, and those who have more experience and want to refine their statistical skills. We assume knowledge of descriptive statistics, hypothesis testing, simple and multiple regression, and analysis of variance. We urge participants who do not have that knowledge to review those topics before the start of the course.

Who will benefit from the course?

This course is appropriate for anyone interested in designing, conducting, and analysing experiments in the biological, chemical, economic, engineering, industrial, medical, physical, psychological, or social sciences. Applicants need only have interest in experimentation.

- Post graduate students and research scholars working in fields of Human Factors, Road Safety, Applied Statistics, Experimental Design, Applied Social Sciences, Cognitive Psychology, and Public Health.
- Faculty members and research staff from academic institutes and R&D centers
- Practicing professionals from consulting firms and transportation planning and transit agencies

Course Deliverables: This short course will involve weekly assignments, readings, and exams. Successful completion of the course will lead to a certificate acknowledging course participation.

Course Dates: 6th November to 27th November 2021 (Two sessions every Saturday - 11 am to 12:15 pm & 3 pm to 4:15 pm)

Venue: Fully Online (“Microsoft Teams” or “Google Meet”)

Registration: Registration is necessary. Please use the following link (and select this course) to register and pay fees online:<https://iisc.online/admissions/home.html>

Registration fees are:

- Students from academic institutions: Rs. 1,500/- (plus 18% GST).
- Non-student participants from academic institutions and industry: Rs. 3,000/- (plus 18% GST)

Please upload a PDF of your resume/CV at the end of the online registration form.

Last date for registration is 30th October 2021. Number of participants for the course is limited to 50.

Instructor: Dr. Siby Samuel is a faculty in the department of Systems Design at the University of Waterloo, Canada. Siby is also a Visiting Faculty at the Center for Infrastructure, Sustainable Transportation & Urban Planning (CiSTUP) at IISc Bangalore. Siby has successfully designed several dozen road safety experiments involving thousands of human participants over the past decade and is a co-author on over 100 peer-reviewed papers. Siby serves on two standing committees of the Transportation Research Board (ACH30 – Human Factors of Vehicles & ACH50 – Road User Measurement & Evaluation). Siby has previously taught in-person courses on experimental design.