10TH AACHEN INTERNATIONAL SUMMER SCHOOL IN RESEARCH METHODS AND DATA SCIENCE (ACISS)

INTRODUCTION TO LAB AND VR EXPERIMENTS

Dr. Özgür Gürerk

University of Cologne | Faculty of Management, Economics and Social Sciences

Contact: guererk@wiso.uni-koeln.de

SUMMER 2024

1 COURSE OVERVIEW

Course Name:	**Introduction to Lab and VR Experiments**
Degree Programmes:	1. Post-Docs and PhD students 2. Master BWL (all specializations): MSBWL10, MSBWL13 Master Wirtschaftswissenschaften (all specializations): MSWiWi10, MSWiWi14 Master Wirt.-Ing. (MSWiBau, MSWiEET, MSWiWPT, MSWiMB, all specializations): MSWI10, MSWI15
Lecturer:	Dr. Özgür Gürerk
Contact:	guererk@wiso.uni-koeln.de
Location and Time:	Templergraben 64, Room 518 (WiÜ) 16th September to 20th September, 9:15 am – 5:00 pm
Content Description:	This course focuses on design and execution of economic experiments in the classic lab setting, as well as in virtual environments.
Qualification Objectives:	Students learn key methodological aspects for designing economic experiments, in the classic lab setting, as well as in virtual reality. Students also learn the organizational aspects of conducting an experiment.
Literature:	See readings below.
Course Examination:	The final grade will be based on (1) class participation/discussion, (2) a group presentation, and (3) a short essay based on the group presentation.
Participation Requirements:	Command of English language, basic understanding of social science research practices; willingness to think about a research experiment. The course is designed for Ph.D. and master students interested in conducting experimental research.
Group Size:	18 participants (max)
Workload:	30 hours of lecturing and group work 120 hours of additional individual and group preparation
Type of Teaching Event:	Lecture with integrated individual and group work
Language:	English
Credits:	5

2   SCOPE OF THE COURSE

This course provides students with an overview of and experience with experimental research methods to design and conduct an economic experiment in the lab, or in an immersive virtual environment. We will cover topics as defining a research question, setting up the research hypothesis and the corresponding experimental design, and how to plan and conduct experimental sessions. The course also provides exposure to some examples of experimental software. We will examine conventions for ensuring that experiments are properly designed, and tips for preparing experimental research for publication.

The course also introduces to the emerging experiments in virtual reality. We will learn the potential of this experimental method for behavioral research. During a visit in the VR lab, participants will experience some demos in immersive virtual environments. We will learn the advantages of VR experiments and discuss potential issues.

3   PARTICIPANTS AND REQUIREMENTS

Participants
1. Post-Docs and PhD students
2. Master BWL (all specializations): MSBWL10, MSBWL13
   Master Wirtschaftswissenschaften (all specializations): MSWiWi10, MSWiWi14
   Master Wirt.-Ing. (MSWiBau, MSWiEET, MSWiWPT, MSWiMB, all specializations): MSWI10, MSWI15

Due to the interactive teaching format, the number of participants is limited to 18. Advanced master students are invited to participate, but preference will be given to Ph.D. students.

Requirements
Command of English language, basic understanding of social science research practices. The course is specifically designed for Ph.D. students interested in conducting experimental academic research studies but is also open to advanced masters' students meeting the above criteria.

As a preparation for the course, the participants are asked to think about a research idea they would like to investigate experimentally. During the course, participants should then iterate by revising their answers as they think about each question, discuss it with other participants and the instructor.

Approx. 14 days before the course starts, the instructor will contact the participants, and ask them to state their preferences with respect to the research topics (see the topics listed at the end of this document). According to their stated preferences, the instructor will allocate the students in groups consisting of 2-3 persons.

Before the course starts, the participants/groups then must submit a short research proposal. In these 1-2 pages text, each group present one or two raw experimental research ideas. In the research proposal, each should refer at least to the questions 1-3

mentioned below in the *Guideline Questions* below, as proposed by Shyam Sunder (Yale University).

Guideline Questions to Think About Your Research Experiment

1. What is the question you would like to have answered after the experiment? Your answer should be a single sentence with a question mark at the end!
2. What do you know already about the possible answers to the question you have stated above?
3. What are the various possible ways of finding an answer to the question you have stated above? Include both experimental as well as any other methods you can think of.
4. What are the advantages and disadvantages of using an experiment to find an answer?
5. How important is this question to *you*? What are the chances that the answer you get from the experiment will surprise you or others? What are the chances that it will change someone's mind?
6. How would you conduct the experiment? (Write down a design and instructions.)
7. Is your experimental design the simplest possible design to help answer the question you have stated?
8. What are the possible outcomes of the experiment? Do the possible outcomes include at least one outcome that will answer the question you stated above? What is the chance that you will observe this outcome?
9. At any stage of your thinking, feel free to go back and revise your earlier answers if you wish to.

Grading
1. Individual Presentation on Day 1: Each participant/group introduces herself/their members and her/their raw experiment idea and motivation to participate in this course. In this five-minute oral presentation, each participant/group should refer at least to the questions 1-3 mentioned above in the Guideline Questions.

2. Team Presentation: You will do a group presentation on the final day of the course. During the week, each group develops the experimental idea, to address the following points in the team presentation on Day 5.

   The beginning of your team presentation should give a general motivation leading to your specific research question. Then, you derive up to three hypotheses grounding on theory or previous empirical/experimental literature, present your experimental design that is based on your hypotheses. Explain your treatments, which are carefully set up, to test each of your hypotheses. You speculate about possible results that you expect. You present your data analysis plan.

Each master's team must submit a written synopsis of their presentation (~1500-2000 words). The synopsis must be submitted by October 4, the latest.

Evaluation:

- Class Participation 20 %:
  Overall, class contribution will be calculated based on your attendance, the quality of your discussion, and your meaningful contributions to class discussion.

- Group presentation (including the written synopsis/essay) 80 %

4   COURSE OBJECTIVES

1. To understand the philosophy of science behind experimental methods, and the interaction between theory and experiments.
2. To be able to generate research questions and to set up an appropriate experimental design to researching those questions.
3. To learn how to organize and conduct an experimental session.
4. To understand the challenges associated with gathering, organizing, and analyzing experimental data.

5   READINGS

Readings for all Participants

- Daniel Friedman and Shyam Sunder. 1994. *Experimental Methods. A Primer for Economists.* Cambridge University Press.
- Guillaume R. Fréchette, Andrew Schotter (Editors). 2015. *Handbook of Experimental Economic Methodology*, Oxford University Press.

Student Reading Responsibilities

Once the groups are formed, participants are expected to read three of the important publications (and possibly more) related to their specific research question. It is the duty of the participants to identify this literature, though I will give tips if I can. The related literature is an essential part of the group presentation on Day 5. In 25 Minutes, each group present the motivation and the research idea, the related literature, the hypotheses (up to three), and the corresponding experimental design and treatments.

Example Research Topics and Related Literature
The topics below correspond to my research interests and expertise. However, you are not obliged to choose a topic from the list. I very welcome if you bring your own topic!

Topic 1: Gender Differences in Competitiveness

Azmat, G., & Petrongolo, B. 2014. Gender and the labor market: What have we learned from field and lab experiments? *Labour Economics*, 30, 32-40.

Hoogendoorn, S., Oosterbeek, H., & Van Praag, M. 2013. The impact of gender diversity on the performance of business teams: Evidence from a field experiment. *Management Science*, 59(7), 1514-1528.

Gürerk, Ö., Irlenbusch, B., & Rockenbach, B. (2018). Endogenously Emerging Gender Pay Gap in an Experimental Teamwork Setting. Games, 9(4), 98.

Topic 2: Leadership Experiments

Brandts, J., Cooper, D.J., & Weber, R.A. 2014. Legitimacy, communication, and leadership in the turnaround game. *Management Science*, 61(11), 2627-2645.

Zehnder, Christian; Herz, Holger; Bonardi, Jean-Philippe; 2016. A productive clash of cultures: Injecting economics into leadership research. *Leadership Quarterly*.

Gürerk, Ö., Lauer, T., & Scheuermann, M. (2018). Leadership with individual rewards and punishments. *Journal of Behavioral and Experimental Economics*, 74, 57-69.

Topic 3: Inter-Generational Cooperation in the Lab

Charness, G.; Villeval, M.C.; 2009. Cooperation and Competition in Intergenerational Experiments in the Field and the Laboratory, *Am. Economic Review*, 99(3), 956-978.

Hauser, Oliver P; Rand, David G; Peysakhovich, Alexander; Nowak, Martin A; 2014. Cooperating with the future, *Nature*, 511(7508), 220-223.

Böhm, R., Gürerk, Ö., & Lauer, T. (2020). Nudging Climate Change Mitigation: A Laboratory Experiment with Inter-Generational Public Goods. *Games*, 11(4), 42.

Topic 4: VR, Empathy and Behavior Change

Bertrand, P. et al. (2018). Learning empathy through virtual reality: multiple strategies for training empathy-related abilities using body ownership illusions in embodied virtual reality. Frontiers in Robotics and AI, 5, 26. https://doi.org/10.3389/frobt.2018.00026

Gürerk, Ö., & Kasulke, A. (2018). Does virtual reality increase charitable giving? an experimental study. An Experimental Study (October 8, 2018).

Martingano, A. J., Hererra, F., & Konrath, S. (2021). Virtual reality improves emotional but not cognitive empathy: A meta-analysis. *Technology, Mind, and Behavior*.

Topic 5: VR in Marketing

Barnes, S. (2016). Understanding virtual reality in marketing: nature, implications and potential. https://ssrn.com/abstract=2909100

Huang, Y. C., Backman, K. F., Backman, S. J., & Chang, L. L. (2016). Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research*, 18(2), 116-128.

Loureiro, S. M. C., Guerreiro, J., Eloy, S., Langaro, D., & Panchapakesan, P. (2018). Understanding the use of Virtual Reality in Marketing: A text mining-based review. *Journal of Business Research.*

Topic 6: VR/AR Training in Manufacturing

Gonzalez-Franco, M., Pizarro, R., Cermeron, J., Li, K., Thorn, J., Hutabarat, W., ... & Bermell-Garcia, P. (2017). Immersive mixed reality for manufacturing training. *Frontiers in Robotics and AI*, 4, 3.

Berg, L. P., & Vance, J. M. (2017). Industry use of virtual reality in product design and manufacturing: a survey. *Virtual reality*, 21(1), 1-17.

Bohné, T., Heine, I., Gürerk, Ö., Rieger, C., Kemmer, L., Cao, L.Y. (2021). Perception Engineering Learning with Virtual Reality, *IEEE Transactions on Learning Technologies*, 14 (4).

6   COURSE SCHEDULE

	Mon, Sep 16	Tue, Sep 17	Wed, Sep 18	Thu, Sep 19	Fri, Sep 20
09:15-10:45	Welcome and Introduction to the Course	Lecture 3: Experimental Design	Lecture 6: Theory and Experiments	Lecture 9: Running Lab and Online Experiments	Group Presentations (Groups 1-3)
10:45-11:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00-12:30	Lecture 1: Intro to Lab Experiments	Lecture 4: VR Concepts	Lecture 7: VR Methodology	Lecture 10: Experimental Procedures	Group Presentations (Groups 4-6)
12:30-13:45	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Wrap-Up & Farewell
13:45-14:45	Lecture 2: Intro to VR Experiments	Lecture 5: VR Technology	Groups' Short Presentations: Groups' research ideas & feedback	Q&A Session with the Lecturer	
14:45-15:00	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
15:00-16:00	VR Demo 1	VR Demo 2	Lecture 8: VR Embodiment	Group Work	
16:00-17:00		Q&A with the Lecturer/Group Work	Group Work	Group Work	

Slight changes in the course schedule are possible.

CONTACT DETAILS

Dr. Özgür Gürerk
University of Cologne
Seminar of Corporate Development and Business Ethics
Albertus-Magnus-Platz 50923

guererk@wiso.uni-koeln.de