

# A Technical Briefing on Using Mixed Methods Research in Software Engineering

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**Abstract**—This technical briefing will introduce participants to the foundational principles and practical application of mixed methods research (MMR) in software engineering (SE). Participants will explore the rationale behind using mixed methods, learn how to design mixed methods studies, and understand how to integrate qualitative and quantitative data to produce novel insights. This session will also cover best practices and highlight common pitfalls, or “antipatterns” to avoid. This briefing is ideal for both novice and experienced researchers interested in enhancing their methodological toolkits in socio-technical SE contexts.

**Index Terms**—Mixed methods, mixed methods research, qualitative, quantitative, research design

## I. INTRODUCTION

Mixed methods research (MMR) has gained traction in software engineering due to the increasing complexity of socio-technical systems [1], [2] and the need for a more comprehensive approach to research questions [3], [4]. By combining qualitative (quaL) and quantitative (quaN) methods, mixed methods research offers a way to capture nuanced insights from multiple perspectives. It provides a flexible yet robust framework for understanding phenomena, making it ideal for SE’s socio-technical research contexts.

Despite its widespread use in many domains [5]–[9], SE researchers often lack clear guidelines on how to systematically design and apply mixed methods. This briefing aims to fill that gap by offering a structured approach to MMR design, demonstrating how qualitative and quantitative data can be integrated to produce more profound insights into SE problems and solutions.

## II. TARGET AUDIENCE

This session is designed for software engineering researchers from academia and industry, particularly those who want to explore or refine mixed methods research designs. Attendees should have a basic understanding of research methods, but no prior experience with mixed methods is necessary. It is suitable for Ph.D. students, postdoctoral researchers, experienced researchers, and industry professionals.

## III. KEY LEARNING OBJECTIVES

Participants in this technical briefing will:

- Understand the core principles of mixed methods research, including methodological rationale, novel integrated insights, procedural rigor, and ethical research.
- Learn to choose an appropriate mixed methods design based on their research questions and constraints.
- Explore how to effectively integrate qualitative and quantitative data to generate rich insights.
- Identify common “antipatterns” in mixed methods research and how to avoid them.
- Gain hands-on experience in designing and critiquing mixed methods research through scenarios and examples drawn from SE research.

This technical briefing will equip attendees with the knowledge and tools to design and conduct mixed methods research effectively in software engineering, or to critique their use in other research works. We hope that by following the principles of MMR, attendees will be better prepared to tackle complex socio-technical challenges and produce more comprehensive, insightful research outcomes.

## IV. OVERVIEW OF MIXED METHODS RESEARCH

### A. Overview of Principles

We build on existing literature from the social sciences [6], [8]–[10] and identify four essential guiding principles for Mixed Methods Research (MMR), which have been adapted to fit the context of software engineering. The first two principles, **Methodological Rationale** and **Novel Integrated Insights**, focus on the reasons for employing a mixed methods approach (*why?*). Whereas other two, **Procedural Rigor** and **Ethical Research**, pertain to the methods of designing and conducting MMR (*how?*). Participants will interact through discussions based on the examples provided for each principle.

### B. Mixed Methods Research Designs

Mixed methods research is not a one-size-fits-all approach. Depending on the research questions and context, different MMR designs may be used. This section introduces participants to some common designs, including:

- **Exploratory Sequential Design:** Typically begins with qualitative research to explore a phenomenon, followed by quantitative research to test or generalize the findings.
- **Explanatory Sequential Design:** Starts with quantitative research to test a hypothesis, followed by qualitative

research to explain unexpected results or gain deeper insights.

- **Convergent Parallel Design:** Involves collecting and analyzing qualitative and quantitative data simultaneously to provide complementary insights.
- **Embedded Design:** Combines one dominant method (either quaL or quaN) with a supporting method embedded within it.

### C. Practical Scenarios in Software Engineering

To bring these concepts to life, the briefing will showcase scenarios from SE research, featuring fictional personas dealing with real-world challenges (four scenarios can be found in this paper [11]), and we will consider papers that use mixed methods from the SE research landscape that are mentioned in the ACM Empirical Standard for Conducting Mixed and Multi method research [12].

## V. ANTIPATTERNS AND BEST PRACTICES IN MIXED METHODS RESEARCH

MMR is powerful, but it comes with challenges. This part will discuss common antipatterns—such as “smoke and mirrors”, “limitation shirker”, and “integration failure”—that can undermine MMR studies. Participants will learn how to avoid these pitfalls by ensuring that all methods used are well-integrated, clearly explained, follow the principles we present in the tutorials and are aligned with the research questions. Other aspects of critiquing mixed methods research will be considered from the ACM empirical standard for mixed method research [12].

## VI. HANDS-ON EXERCISE

Participants will engage in a practical exercise where they will design a mixed methods study using one of the presented scenarios. The exercise will include selecting appropriate methods, integrating data, and identifying potential antipatterns to avoid. Participants will also be invited to bring mixed method research designs for discussion at the briefing. The participants will discuss, compare and contrast multiple research designs during this exercise. The participants will also discuss how they could visualize integrated data from the use of mixed methods [9].

Note: Participants are encouraged to contact the presenter if they have any accessibility needs.

## VII. RECOMMENDED READING

We invite participants to review some of the materials listed below before the briefing.

- *Guidelines for Using Mixed Methods Research in Software Engineering* (Storey et al., 2024) [11]
- *Selecting Empirical Methods for Software Engineering Research* (Easterbrook et al., 2008) [4]
- *Designing and Conducting Mixed Methods Research* (Creswell, Plano Clark, 2017) . [13]
- *The sage handbook of mixed methods research design* (Poth, 2023) [9]

## SPEAKER INFORMATION

**Margaret-Anne Storey** is a Professor at the University of Victoria and a leading expert in mixed methods research in software engineering. With extensive experience in designing MMR studies, she has contributed to several key papers on the subject and continues to mentor the next generation of SE researchers.

**Rashina Hoda** is a Professor of Software Engineering at Monash University, Melbourne. She is a leading expert in qualitative and mixed methods empirical research. Much of her methodological knowledge is preserved in her new book “Qualitative Research with Socio-Technical Grounded Theory” published by Springer. Rashina has delivered several technical briefings on qualitative research and qualitative data analysis at ICSE and will be delivering another one this year.

**Maria Teresa Baldassarre** is an Associate Professor in Software Engineering at the University of Bari Aldo Moro, Italy. Her research expertise includes software quality, empirical software engineering, and software process improvement. She has been carrying out research on qualitative and quantitative methods through international research collaborations.

**Alessandra Milani** is a PhD student in the Department of Computer Science at the University of Victoria, British Columbia, Canada. Her research focuses on software engineering and developer productivity, with a particular interest in improving collaboration tools and practices in software development teams.

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