

Research Problem

- Limited research on professional development (PD) for teacher educators (TE) (Milner-Bolotin, 2018; Murray, 2005; Tack et al., 2018; Trantiafillou et al., 2021)
- Need to build capacity of Kazakhstani TE to prepare teachers for 21st century STEM pedagogies (National Research Council [NRC], 2012; Zaragoza et al., 2021)

Research Questions

How did the collaboration of Kazakhstani TE with peers and PD facilitators contribute to the impact of PD on their practice?

SubQ1: How did TE perceive the PD course?

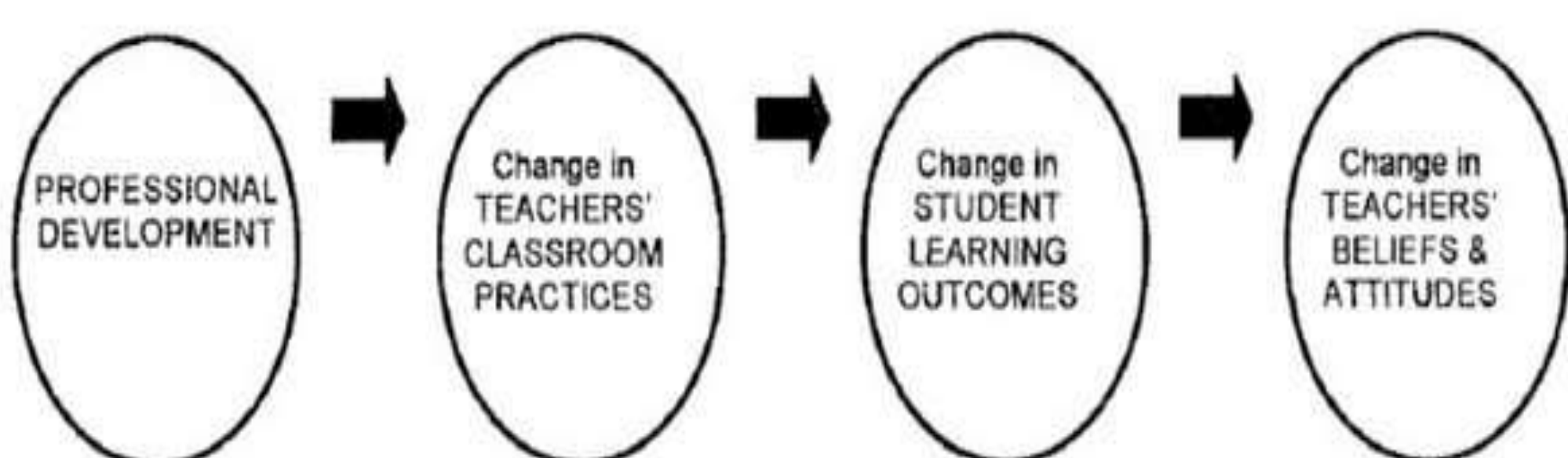
SubQ2: How did TE practices change after PD?

SubQ3: How did TE perceived changes in student learning outcomes after PD?

SubQ4: How did TE beliefs about STEM education pedagogies change after PD?

Theoretical Framework

Guskey’s model of professional development program (2002)



Methods

- Multiple case study (Yazan, 2015)
- STEM faculty in 3 regional pedagogical university and 1 pedagogical college (n=46), participating in professional development

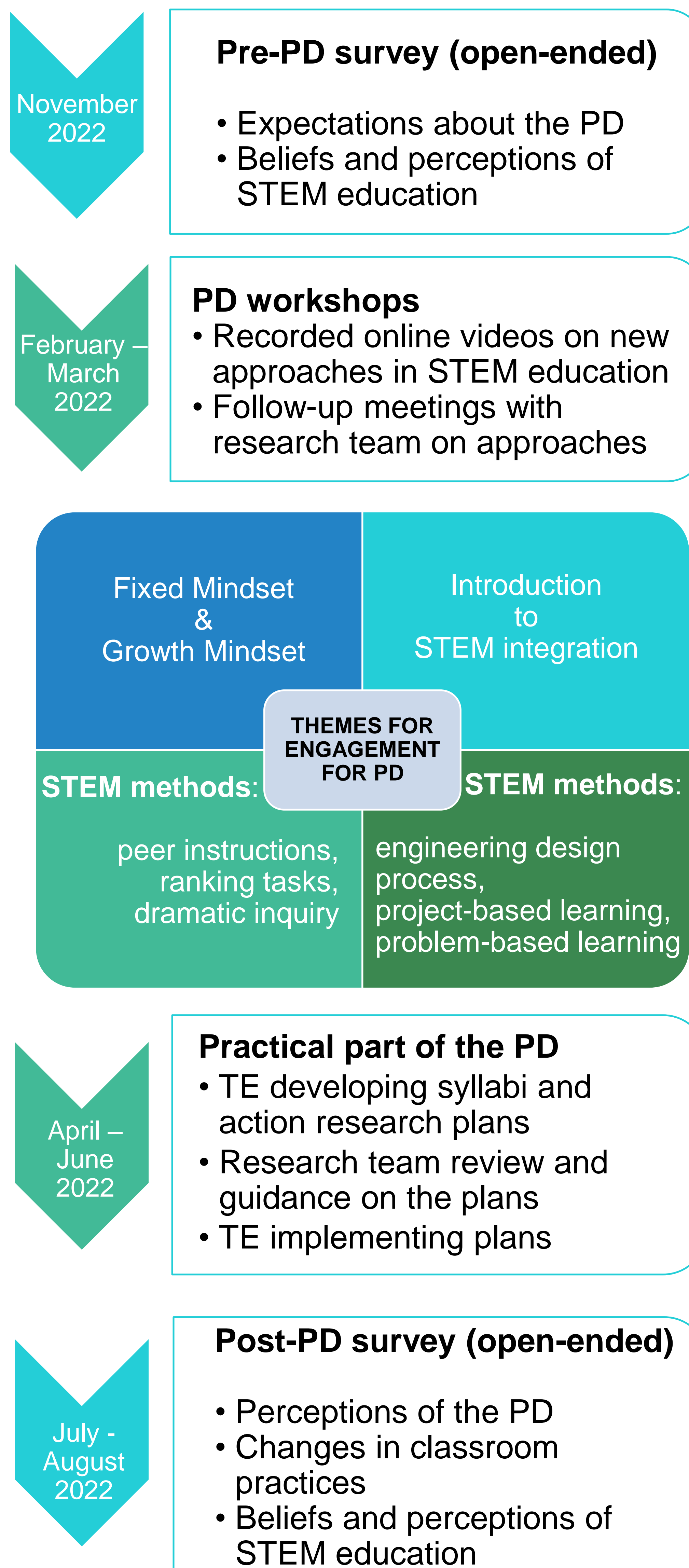
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References

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- Milner-Bolotin, M. (2018, November). Evidence-based research in STEM teacher education: From theory to practice. In *Frontiers in Education* (Vol. 3, p. 92). Frontiers Media SA.

Phases of Data Collection



Data Analysis

Thematic analysis (Braun & Clarke, 2006) using NVivo:

- pre-PD survey responses
- STEM syllabi & action research plans developed and implemented by TE
- post-PD surveys responses

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- National Research Council (NRC). (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: The National Academies Press.
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Findings

Perceptions of PD

Pre-PD: Expectations of “knowledge, skills and abilities”:

- enhancement of what exists
- acquisition of new

Post-PD:

- enhancement of knowledge, skills, abilities and techniques
- acquisition of knowledge, skills, abilities and techniques
- collaboration** with both colleagues and PD facilitators was helpful

Changes in STEM teaching practice

- making connections among disciplines
- making connections to practical examples
- activating students' knowledge of STEM as a resource for learning

Perceived changes in student learning outcomes

- increase in students' motivation & engagement
- students' developing critical thinking & problem solving skills
- increase in learner autonomy and development of independent learning skills

Beliefs about STEM education

Pre-PD: STEM education means:

- integration of subjects

Post-PD: STEM education means:

- integration of subjects
- one or more methods
- developing lifelong learning skills

Discussion and Conclusion

- importance of collaboration in PD is in line with existing literature (Birman et al., 2000; Shernoff et al., 2017; Owens et al., 2018; Miedijensky & Sasson, 2022)
- STEM teacher knowledge and competencies are strongly related to their own learning experiences and attitudes toward learning (Belland, 2009; Nadelson et al., 2013)

- Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017). Assessing teacher education and professional development needs for the implementation of integrated approaches to STEM education. *International journal of STEM education*, 4, 1-16.
- Tack, H., Valcke, M., Rots, I., Struyven, K., & Vanderlinde, R. (2018). Uncovering a hidden professional agenda for teacher educators: A mixed method study on Flemish teacher educators and their professional development. *European Journal of Teacher Education*, 41(1), 86-104.
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- Yazan, B. (2015). Three approaches to case study methods in education: Yin, Merriam, and Stake. *The Qualitative Report*, 20(1), 134-152.