



RICE

RICE UNIVERSITY SCHOOL MATHEMATICS PROJECT
(RUSMP) - <http://rusmp.rice.edu/>

The Relation between Teacher-Related Factors and Student Mathematics Achievement

Adem Ekmekci & Danya Corkin
Rice University

Perspectives on Research in Mathematics Education
in the next Decade

University of Wurzburg, Germany
April 4-9, 2016



- Knowledge and beliefs of teachers matter (Pajares, 1992; Philipp, 2007)
- No studies identified to date have examined the collective effects of beliefs and knowledge on students' mathematics achievement (Ekmekci, Corkin, & Papakonstantinou, 2015)





- Built on Bandura's (1986) self-efficacy framework
- Defined as the extent to which teachers believe they can successfully enact teaching-related tasks. (Tschannen-Moran & Hoy, 2001)
- Linked to instructional approaches, students' motivation and achievement. (e.g., Stipek et al., 2001)





- Defined as how much teachers attribute student outcomes (i.e., achievement) to themselves or external factors.
(Rose & Medway, 1981)
- Positively predicts teacher job performance and student achievement.
(Jeloudar & Lotfi-Goodarzi, 2012; Rose & Medway, 1981)



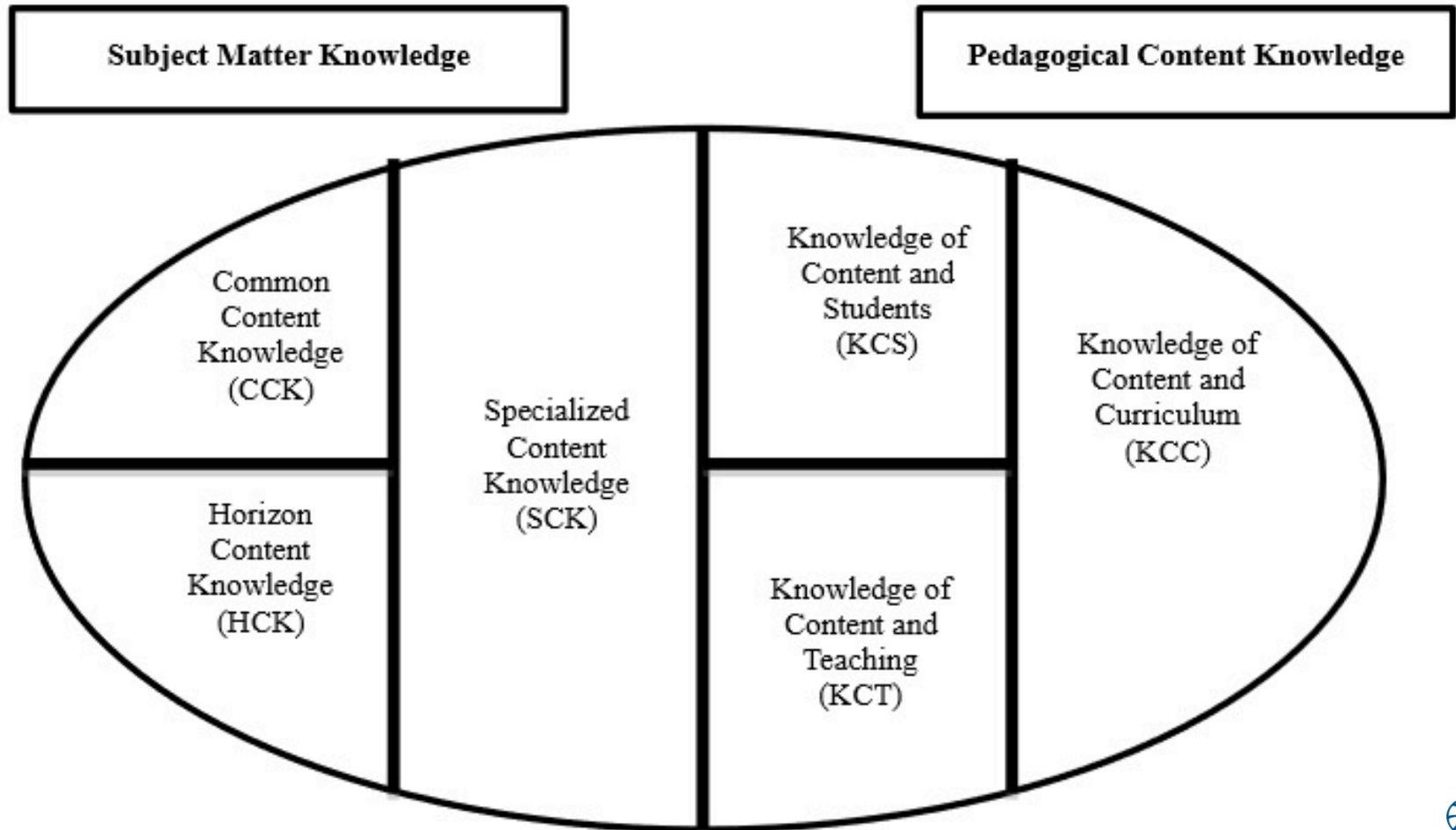
- Defined as an individual's belief about knowledge. Where does it come from? What is the essence of it? How does one come to know and justify beliefs? (Hofer & Pintrich, 1997)
- Conceptualized on a continuum from non-availing to availing. (Muis, 2004)
- Found to be associated with teaching practices. (Gill et al., 2004)





- Defined as
“The mathematical knowledge that teachers use in classrooms to produce instruction and student growth”
(Hill, Ball, & Schilling, 2008, p. 374).
- Found to be associated with student performance
(Hill, Rowan, & Ball, 2005)





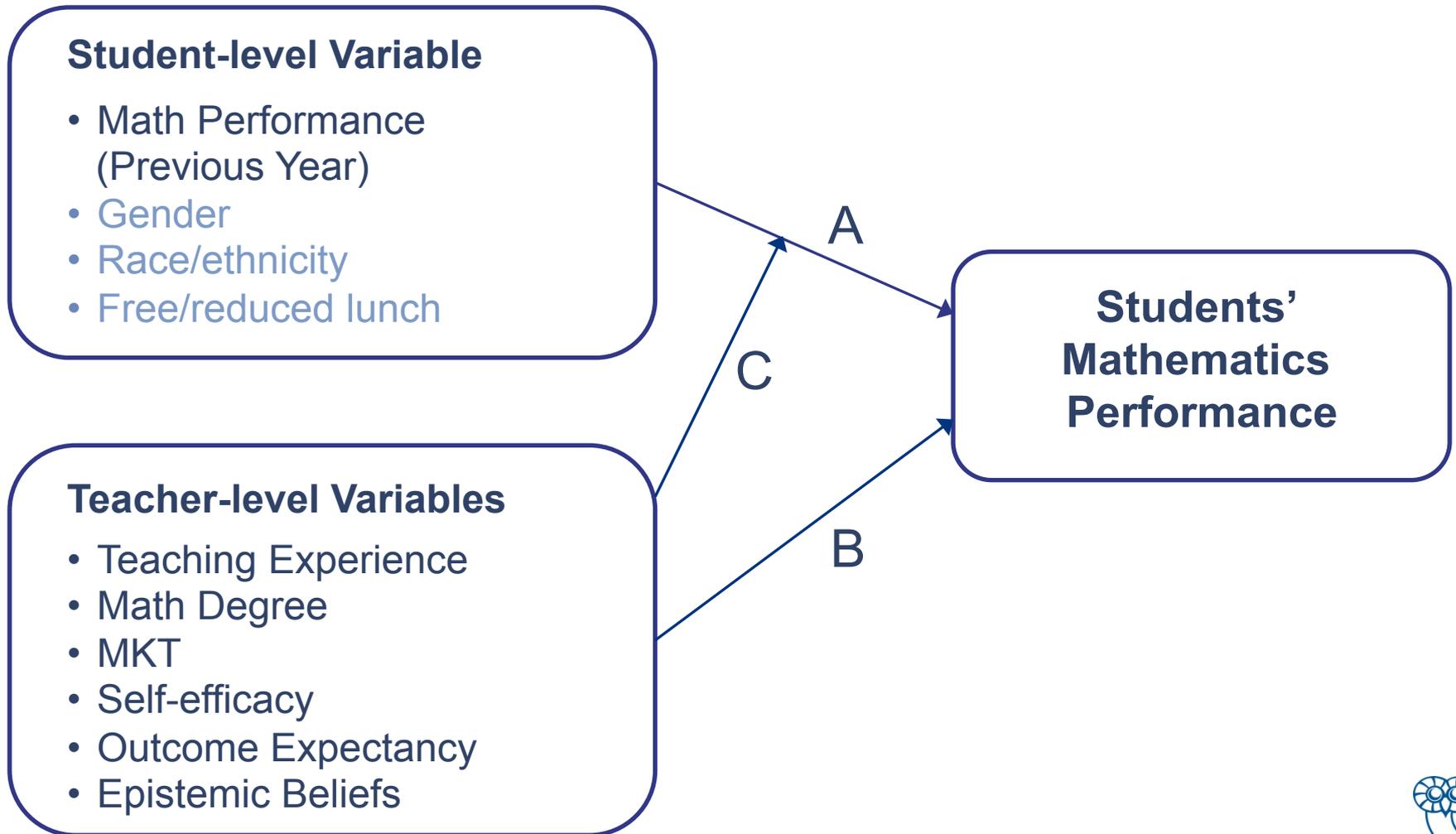
- Experience (Rice, 2003)
- Educational background in subject matter (Rice, 2003)





- A. To what extent do students' demographic characteristics and prior math achievement relate to their subsequent math achievement?
- B. To what extent do teacher-level characteristics (e.g., beliefs, MKT, college math degree, and experience) relate to students' math achievement?
- C. To what extent does the relation between student level factors and math achievement vary by teacher-level characteristics?



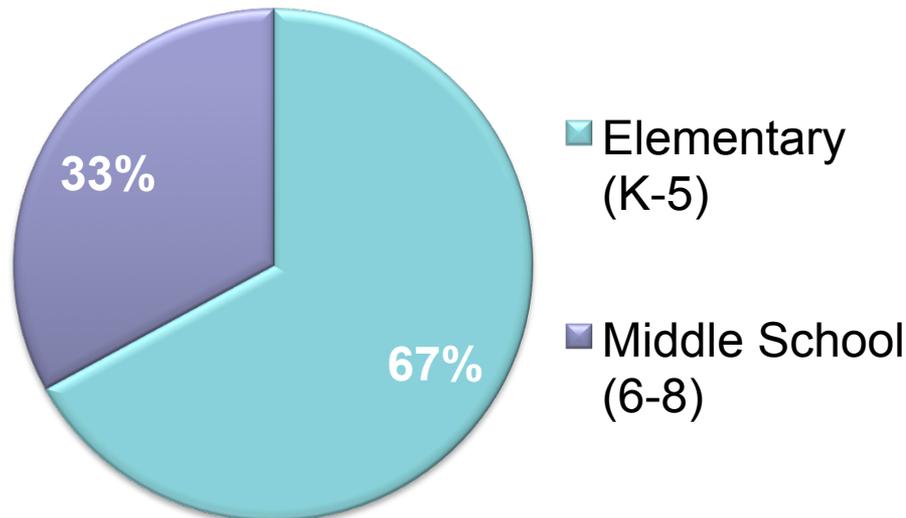


- Teacher data:
 - Survey:
 - Demographics and teachers' educational background
 - Teacher self-efficacy (Enochs, Smith, & Huinker, 2000)
 - Outcome expectancy (Enochs, Smith, & Huinker, 2000)
 - Epistemic beliefs (Schoenfeld, 1989)
 - MKT:
 - Learning Mathematics for Teaching (LMT) assessment (Hill, Schilling, & Ball, 2004)
- Student data (HERC):
 - Student NCE scores on Stanford 10-Math

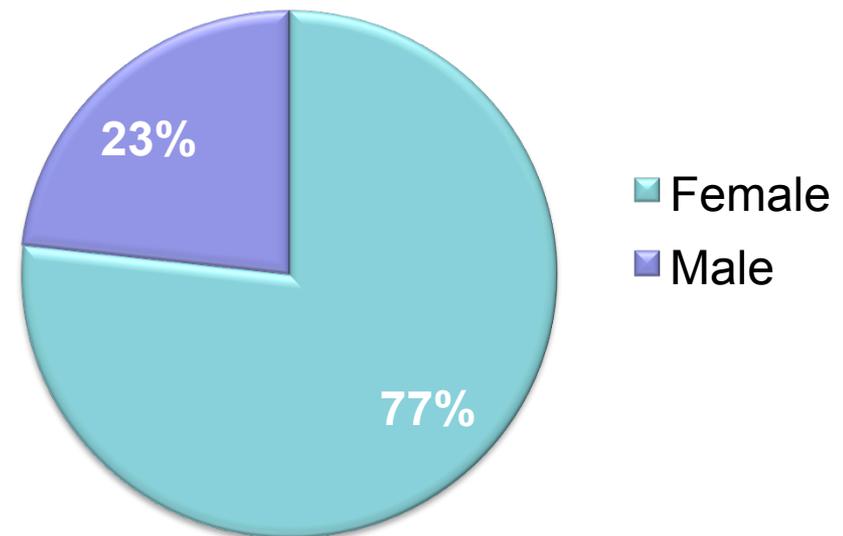


- This study included 34 K-8 mathematics teachers their 2230 students

School Level of Teachers



Gender of Teachers





Independent Variable	Model 1 (unconditional)		Model 2 (within teacher)		Model 3 (between teacher)	
	<i>Coeff</i>	<i>SE</i>	<i>Coeff</i>	<i>SE</i>	<i>Coeff</i>	<i>SE</i>
<i>Fixed Effects</i>						
Intercept	55.61**	1.91	55.61**	1.9	56.5**	1.38
Prior Math Achievement			16.53**	0.46	16.63**	0.47
Years of Teaching					1.55	1.18
Math Degree					4.04*	1.18
LMT					7.89**	1.47
Self-Efficacy					-0.45	1.46
Locus of Control					1.23	1.25
Epistemic Beliefs (Non-Availing)					3.29	1.49
Prior Math Achievement X						
<i>Years of Teaching</i>					-0.24	0.43
<i>Math Degree</i>					-0.22	0.46
<i>LMT</i>					0.18	0.53
<i>Self-Efficacy</i>					0.23	0.54
<i>Locus of Control</i>					0.01	0.48
<i>Epistemic Beliefs</i>					0.42	0.54
<i>Random Effects (Variance Components)</i>						
Student-level effect r_{ij} (σ^2)	309.27**	9.33	109.03**	3.31	109.01**	3.31
Intercept Teacher mean, u_{0j}	115.94**	29.73	119.54**	29.58	51.21**	13.00
Variance explained	27%		65%		57%	
AIC	19225		16972		16966	

Arrow A

Arrow B

Arrow C

* $p < .01$. ** $p < .001$.



- Significant stand-alone predictors of mathematics achievement were
 - Prior mathematics achievement (*student level*)
 - Teachers' mathematics degrees (*teacher level*)
 - Teachers' MKT (*teacher level*)
- The effects of prior math achievement did not vary significantly across teachers





- Findings may provide practical implications for the School Districts related to the recruitment and professional development of mathematics teachers.
- Follow-up analysis will include examining other student level variables





RICE

THANK YOU !

Adem Ekmekci
ae16@rice.edu

Danya Corkin
dmc7@rice.edu

**RICE UNIVERSITY SCHOOL MATHEMATICS PROJECT
(RUSMP)**

<http://rusmp.rice.edu/>

