

Symposium: Effective Tools for Evaluating
Teacher Professional Development

Adaptive Teaching Competency and Student Learning

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Based on SNSF research project

Based on Swiss National Science Foundation (SNSF) research project "Adaptive Teaching Competency"

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Overview

1. Introduction and main objective
2. The concept of adaptive teacher competency (ATC)
3. Research questions
4. Methods
5. Results:
 - Confirmatory Factor Analysis (CFA) of ATC
 - Correlations between ATC and classroom processes
 - Effects of ATC on students' learning progress
6. Conclusions

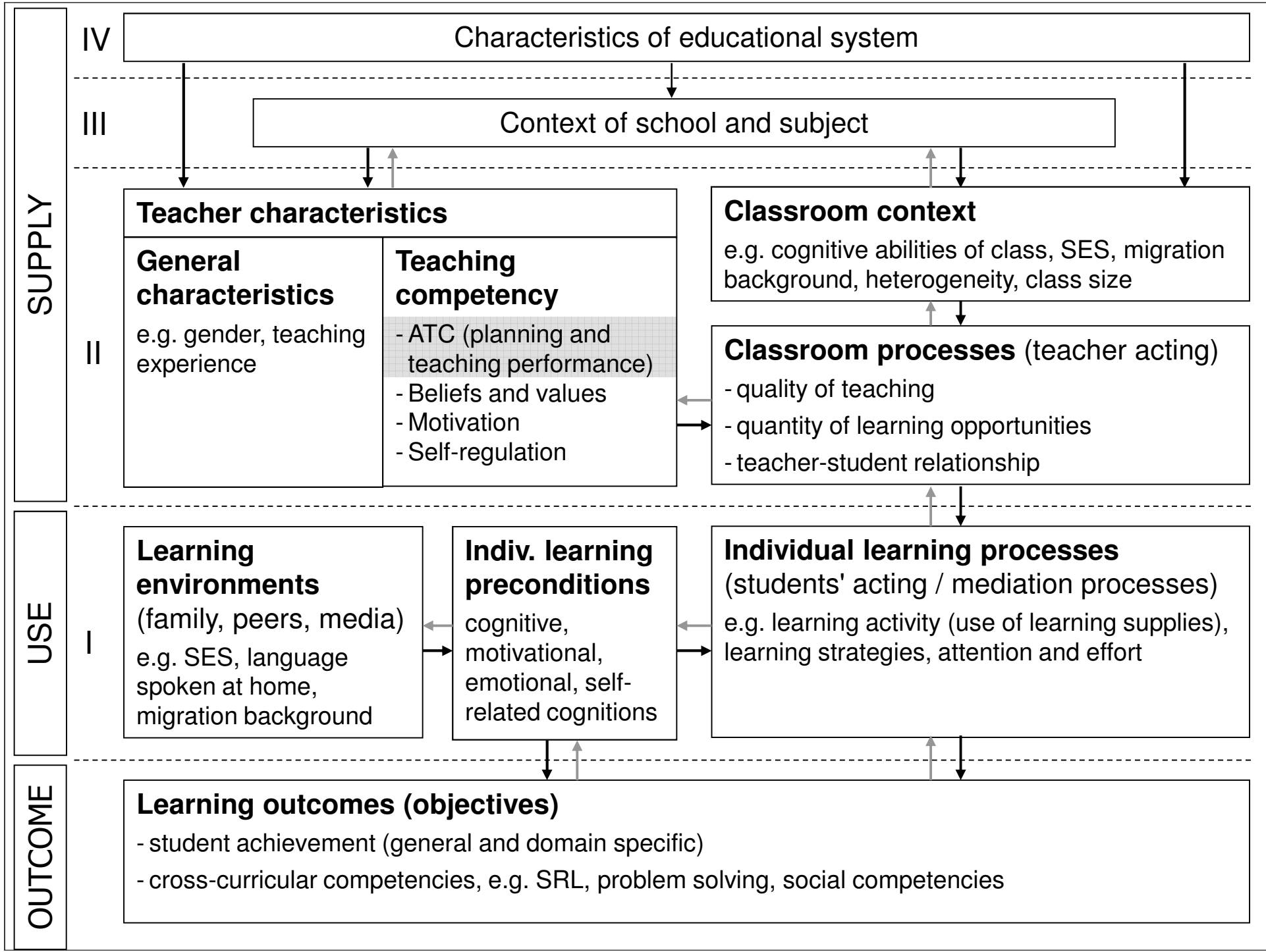
Introduction and aim of study

Context

- Constructivist understanding of learning (Stebler, Reusser & Pauli, 1994).
- Learning is multi-determined by students' preconditions, teaching, classroom context etc. (Helmke & Weinert, 1997)
- Large heterogeneity among students (e.g. prior knowledge, SES, migration background) (Corno & Snow, 1986; Coradi Vellacott & Wolter, 2005)

Main objective

Gaining a deeper understanding of the effects of (adaptive) teaching competency on classroom teaching and student learning.



Concept of Adaptive Teaching Competency (ATC)

Definition (cf. Wang, 1980; 1992)

ATC is defined as the teacher's ability to *adjust instruction to the individual learning processes* of pupils in such a way as to *create favourable conditions for each students' learning* for understanding (Beck et al., 2006).

Four dimensions (Helmke & Weinert 1997):

- Subject knowledge (SK)
- Diagnosis of students' learning (DG)
- Methods of instruction (MI)
- Classroom management (CM)

Two modes

- lesson planning (ATC-planning)
- teaching performance (ATC-performance)

Research questions

1. Can the theoretical structure of ATC be confirmed empirically?
(construct validity)
2. What is the relationship between ATC and classroom processes?
(criterion-related validity)
3. What impact does ATC have on student learning?

Sample

49 teachers of science classes (level 2)

- 26 primary (grades 4 & 5) and
- 23 secondary (grades 7 & 8) school teachers

teaching experience: mean = 15.5 yrs (2 to 34 yrs)

898 students (level 1)

- 446 primary (age: mean = 11.5 yrs) and
- 452 secondary (age: mean = 14.5 yrs) school studentsVVC

Methods of measurement*

Teachers:

- **vignettes** identifying teachers' ATC for lesson planning
- **video test** simulating instructional decisions to measure teachers' ATC for teaching performance
- **unit on a specific topic** ("germination of seeds" 4 lessons of 90 min. with predefined learning objectives) with assessment of
- **subject knowledge** and **accuracy of diagnosis** of students' achievement

Students:

- **pre-/post-tests in unit** on "germination of seeds" measuring students' learning progress
→ using multi-matrix sampling (IRT scaling)
- **students questionnaires** (e.g. perception of classroom processes, learning preconditions, SES)
- **general science test**

*selection - as referred to in this paper



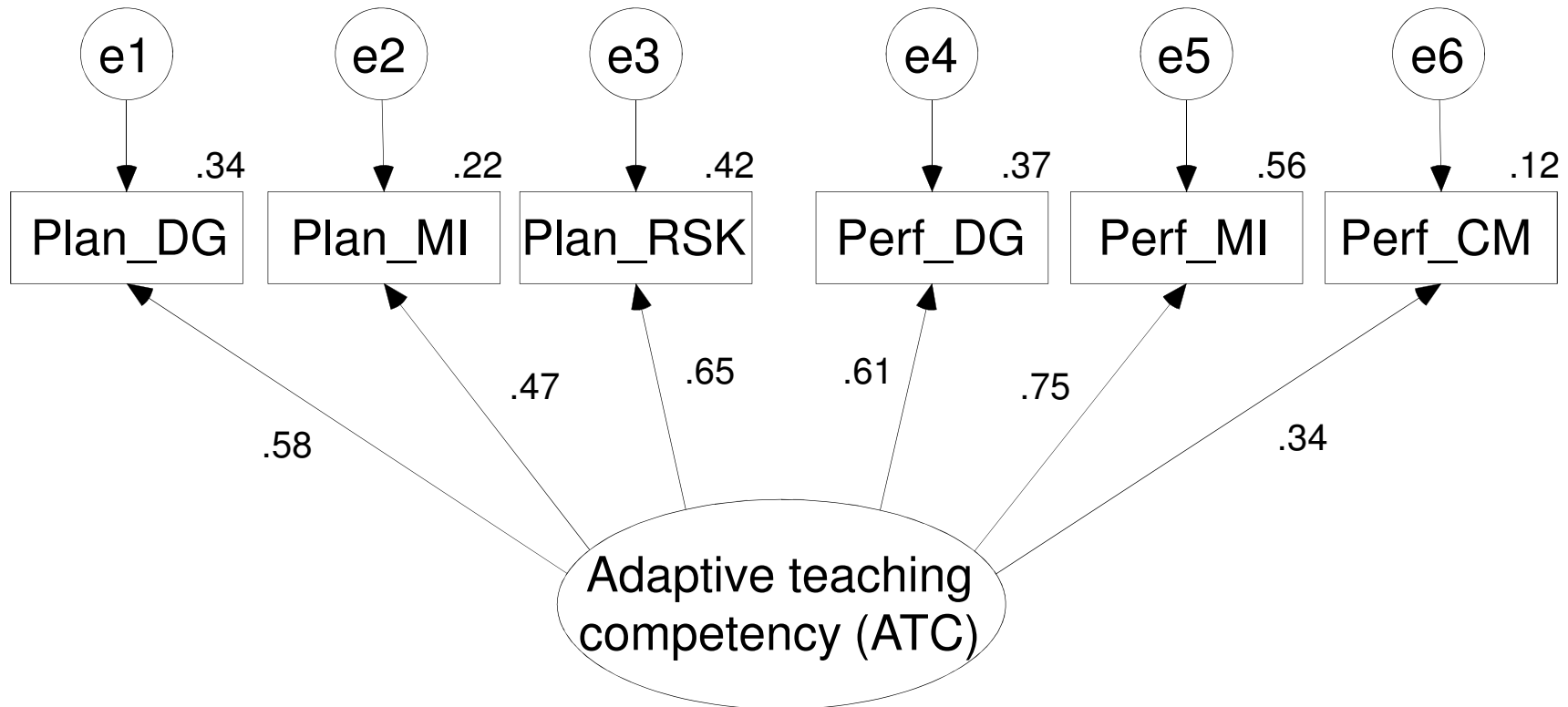
Instructions:

1. Please stop the video if you would act *differently* than the teacher.
2. What would you do differently?
3. Give an explanation for your reaction.
4. Continue watching the video and stop it each time that you would act differently.

Research questions

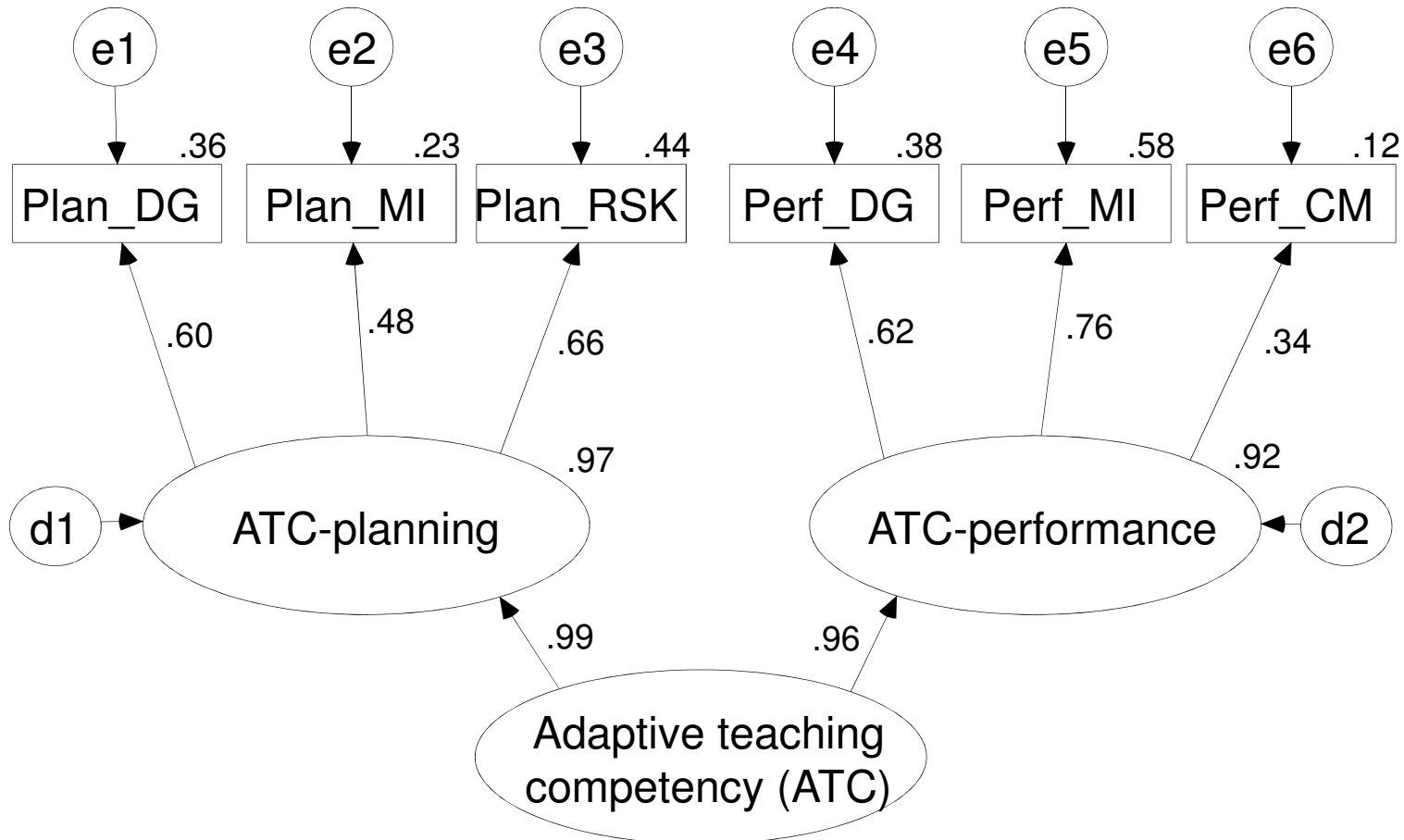
1. Can the theoretical structure of ATC be confirmed empirically?
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Measurement model of ATC (one-factor CFA model)



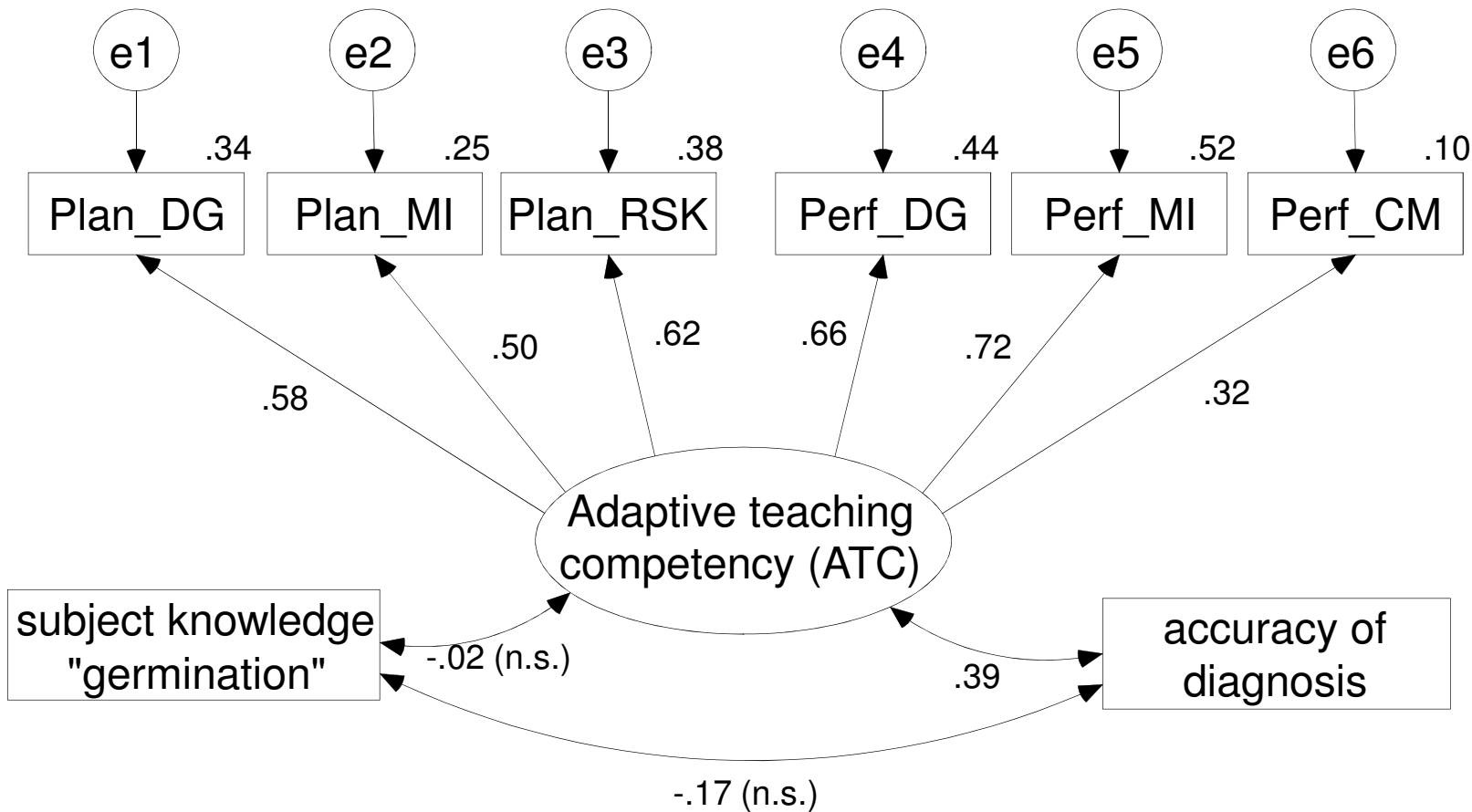
chi-square=7.299; df=9; p-value=.606
cfi=1.000; srmr=.057; caic=65.243; rmsea=.000; pclose=.684
Standardized estimates

Measurement model of ATC (second-order CFA model)



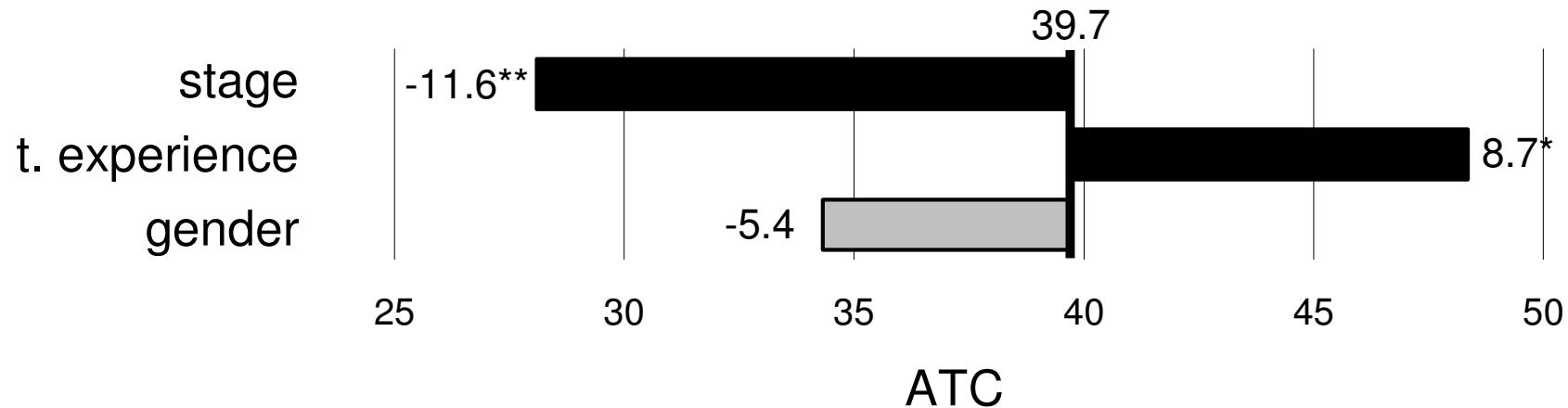
chi-square=7.147; df=8; p-value=.521
 cfi=1.000; srmr=.056; caic=69.919; rmsea=.000; pclose=.601
 Standardized estimates

Measurement model of ATC (including content knowledge and accuracy of diagnosis)



chi-square=18.342; df=19; p-value=.500
 cfi=1.000; srmr=.076; caic=100.429; rmsea=.000; pclose=.626
 Standardized estimates

ATC and teacher characteristics



Note: N = 47; *p<.05; **p<.01.

Dummy variables:

- stage (0 = primary school; 1 = secondary school)
- gender (0 = female; 1 = male)
- teacher experience (0 = less than 6 yrs.; 1 = 6 yrs. or more)

→ higher ATC for

- primary school teachers
- more experienced teachers

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Correlations between ATC and classroom processes (class-level)

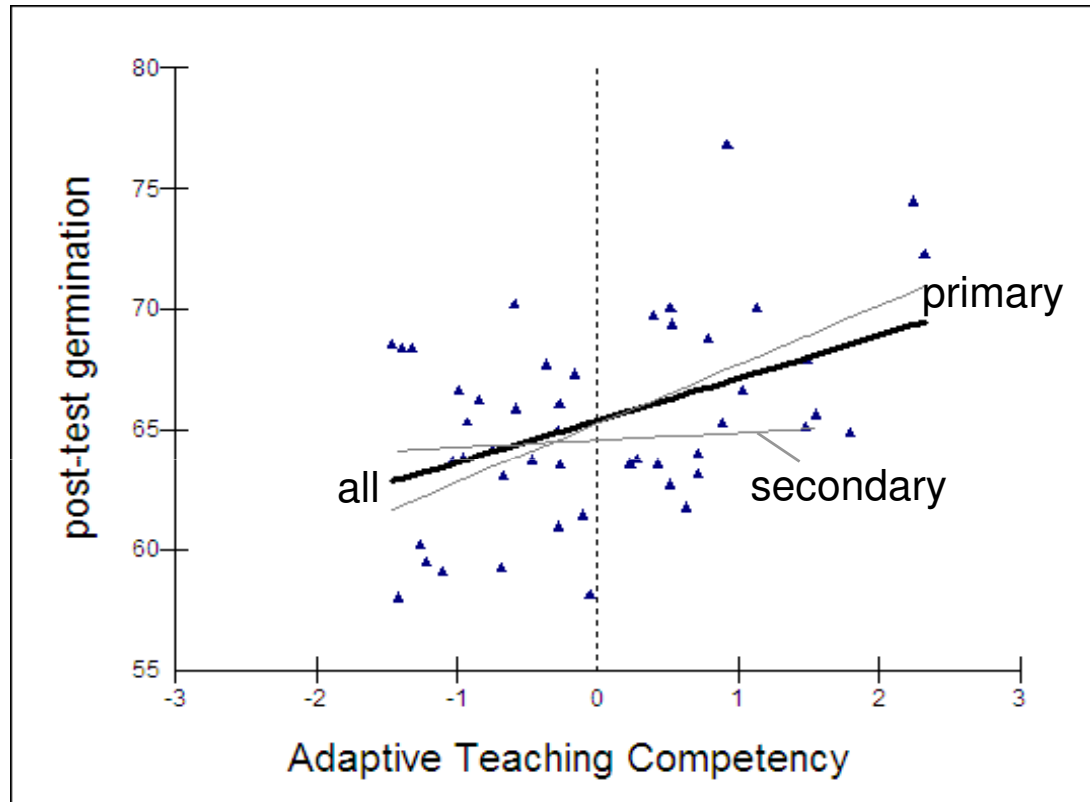
	ATC- planning	ATC- performance	ATC
<i>Quality of Instruction</i>			
Pressurised teaching	-.26*	-.08	-.21
Student participation	.28 ~	.26 ~	.31*
Teaching quality	.29*	.26 ~	.32*
Pupil interest in instruction	.24~	.22	.26 ~
Disturbance and noise	-.14	.19	.01
Orientation towards rules	.06	.15	.11
<i>T-S-Relationship</i>			
Pedagogical engagement	.32*	.21	.31*
Importance of student opinion	.25~	.17	.24 ~

Note: N = 49; ~p<.10; *p<.05; **p<.01.

Research questions

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Effect of ATC on students' learning progress



Note: Controlled for pre-test results; predictors are z-standardised.

- significant effect of ATC (1 SD \rightarrow 1.75 points learning progress)
- effect of ATC due to primary school teachers

Effect of ATC on students' learning progress controlled for context variables (multilevel analysis)

Models (random intercepts)	M0	M1	M2
	B (SE)	B (SE)	B (SE)
post-test (intercept)	65.43 (.73)	65.39 (.68)	66.60 (.67)
ATC		1.75 (.69)*	1.22 (.56)*
class size			-1.74 (.60)**
pre-test result of class			2.70 (.71)**
science achievement of class			-.98 (.74)
SES of class			-.06 (.72)
proportion of L1 speakers			-1.29 (.66)~
pre-test "germination"	3.59 (.35)**	3.59 (.35)**	2.09 (.40)**
science achievement			2.35 (.42)**
gender			-1.22 (.67)~
socio-economic status (SES)			.73 (.39)~
language spoken at home			-2.24 (1.00)*
Intra-class correlation	.190	.166	.098
-2(log-likelihood)	6132.85	6126.71	5629.11

Note: N = 832 within 47 classes; ~p<.10; *p<.05; **p<.01. Predictors are z-standardised. Dummy variables: gender (0 = female; 1 = male), language (0 = german, L1; 1 = others).

Effect of ATC on students' learning progress controlled for context variables (interpretation)

- **significant effect of ATC remains** after having controlled for individual context variables and class context
- **individual context** variables with positive effect on learning progress:
 - higher prior knowledge of "germination"
 - higher general science achievement
 - German (L1) spoken at home
 - and a tendency ($p < .10$) for female and higher SES
- **class context** variables with additional effect on learning progress:
 - higher average prior knowledge of "germination"
 - smaller class size
 - and a tendency ($p < .10$) for classes with a higher proportion of foreign language speakers
- no additional effect of average science achievement of class and SES of class

Conclusions

1. Data (collected through vignette and video test) fit the theoretically proposed construct; but no clear distinction between ATC-planning and ATC-performance.
→ construct validity
2. Positive correlations between ATC and
 - accuracy of diagnosis of students' achievement,
 - quality of instruction as perceived by the students (e.g. student participation, teaching quality), and
 - teacher-student-relationship (e.g. pedagogical engagement).→ criterion-related validity
3. Students of highly adaptive teachers make greater learning progress than students of teachers with lower ATC; however, effect can only be shown for primary school teachers.

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Thanks for your attention!

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