Shared Mental Models in Virtual Teams

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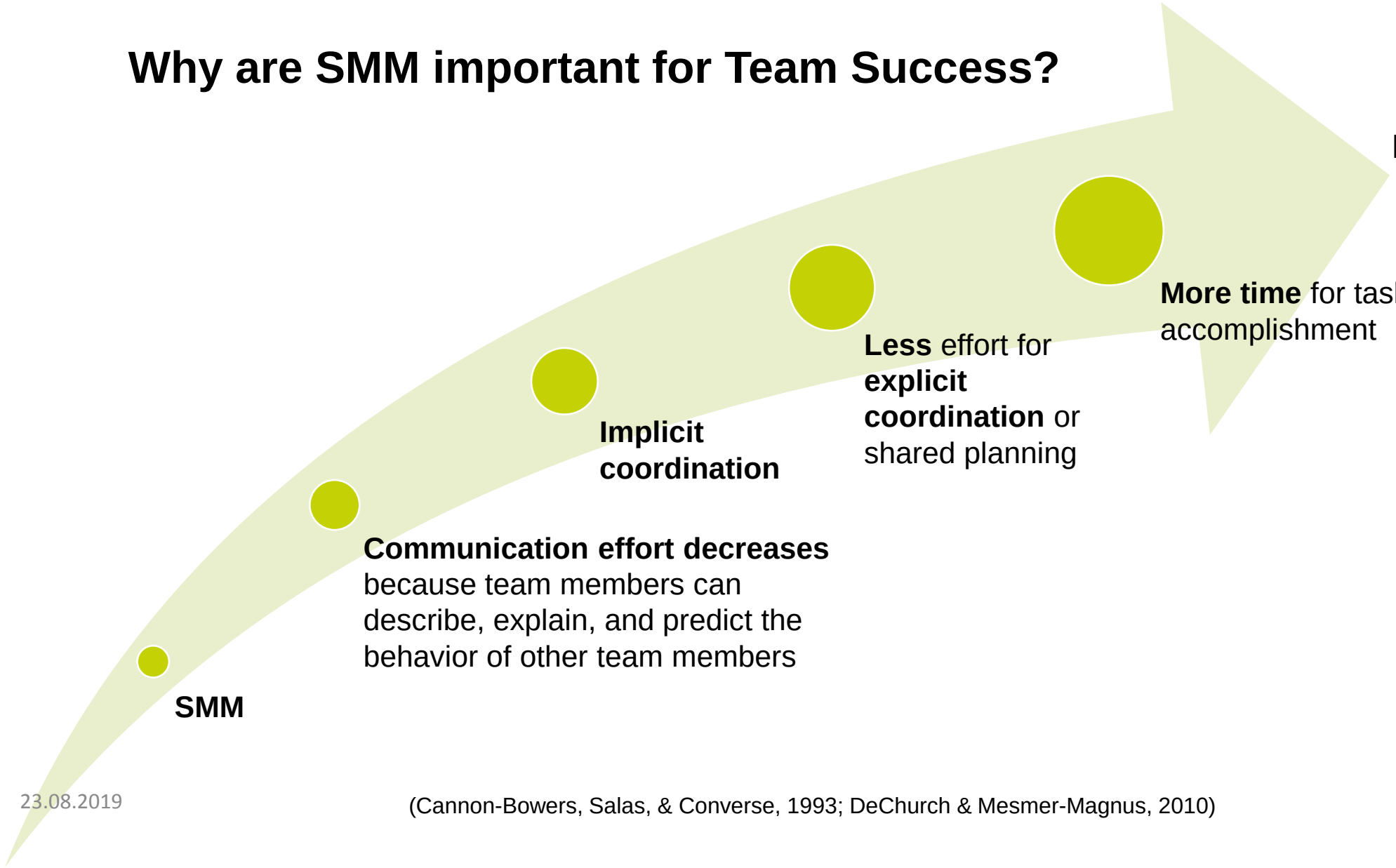
Shared Mental Models (SMM)

results in a common knowledge,
i.e. who communicates with whom about what…

Explicit coordination and shared planning…

results in implicit coordination processes and more time for task accomplishment

Why are SMM important for Team Success?



(Cannon-Bowers, Salas, & Converse, 1993; DeChurch & Mesmer-Magnus, 2010)

Which Mental Models should be shared in Virtual Teams?

- „Team members must share those mental models that describe **when** and **how** they must interact with one another in order to accomplish the task” (Cannon-Bowers et al., 1993, p. 234)

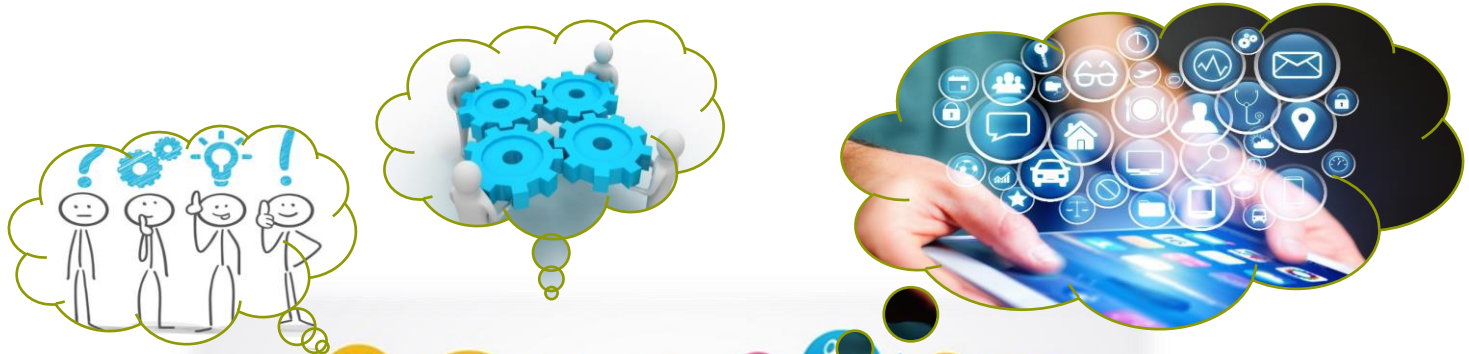
- Virtual Teams
  - Using Information and Communication Technologies (ICTs)
  - Different ICTs have the same features (text, document sharing, audio, video)
  - For the one task, there are a variety of appropriate ICTs (Media Synchronicity Theory)

- “Which ICT do we communicate with?”

Which Mental Models should be shared in Virtual Teams?

results in a common knowledge,
i.e. who communicates with whom about what …

and **with which ICT**



Explicit coordination and shared planning…

results in implicit coordination processes and more time for task accomplishment

ICT-SMM

- ICT-SMM: shared mental models about ICT-use (Müller & Antoni, 2019)
  - Less communication effort about ICT-use
  - Less inefficient ICT-use (e.g. Information search in several ICTs, unnecessary ICT-change)

- Similar knowledge about ICT-functions and –usefulness facilitates ICT-use and increases team performance (Thomas & Bostrom, 2007)
- Similar evaluations of ICT-richness increase knowledge transfer between communication partners (Hasty, Massey, & Brown, 2006)
- Different ideas of ICT-use (e.g. how an E-Mail should be written) lead to ineffective communication, misunderstandings and frustration (Klitmøller & Lauring, 2013)

Hypotheses

1. In VT, ICT-SMM are a distinct subtype of SMM next to teamwork- and taskwork-SMM.

2. ICT-SMM are positively associated with a) team coordination and b) team performance.

3. ICT-SMM are positively associated with
   a) team coordination beyond teamwork- and taskwork-SMM.
   b) team performance beyond teamwork- and taskwork-SMM.

4. The relationship between ICT-SMM and a) team coordination and b) team performance is moderated by flexibility in ICT-use.

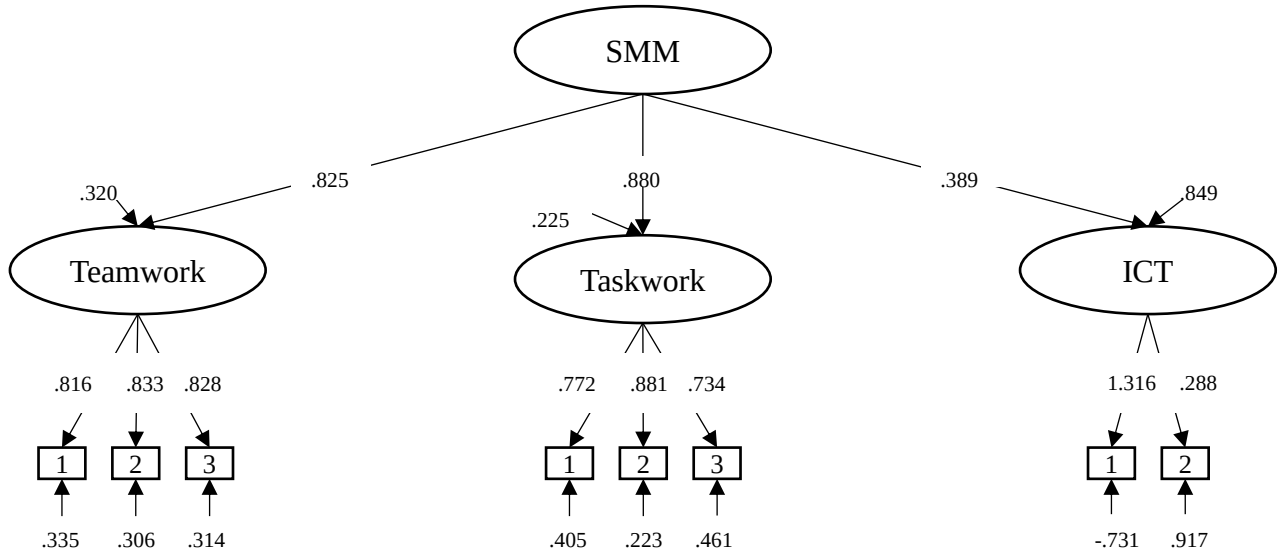
Method

- Online-survey in two IT-organizations (N = 141 employees in 31 teams)
- Analysis on multilevel / HLM

- Self-report questionnaires

Teamwork-SMM	"I know other team member's talents and skills." (Ellwart et al., 2014)
Taskwork-SMM	"I know our team goals and know where we stand in achieving them." (Ellwart et al., 2014)
ICT-SMM	"In our team, we agree which digital media are used for which purpose (e.g. e-mail, chat, telephone)."
Flexibility in ICT-use	"I can flexibly decide, which digital medium I use for which task."
Team Coordination (ICC_1 = .25)	"We accomplish the task smoothly and efficiently." (Lewis, 2003)
Team Performance (ICC_1 = .27)	"The team achieves its goals to the full extent." (Kearney, 2013)

Hypothesis 1:
ICT-SMM as a new SMM-Subtype (CFAs)

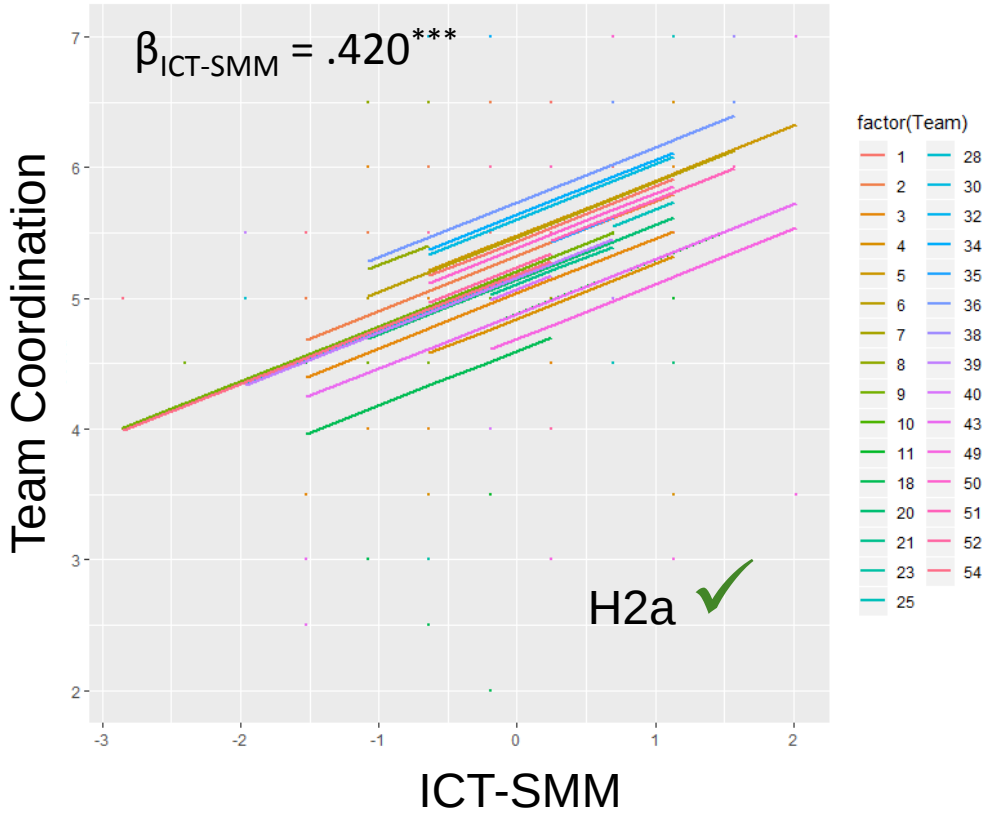


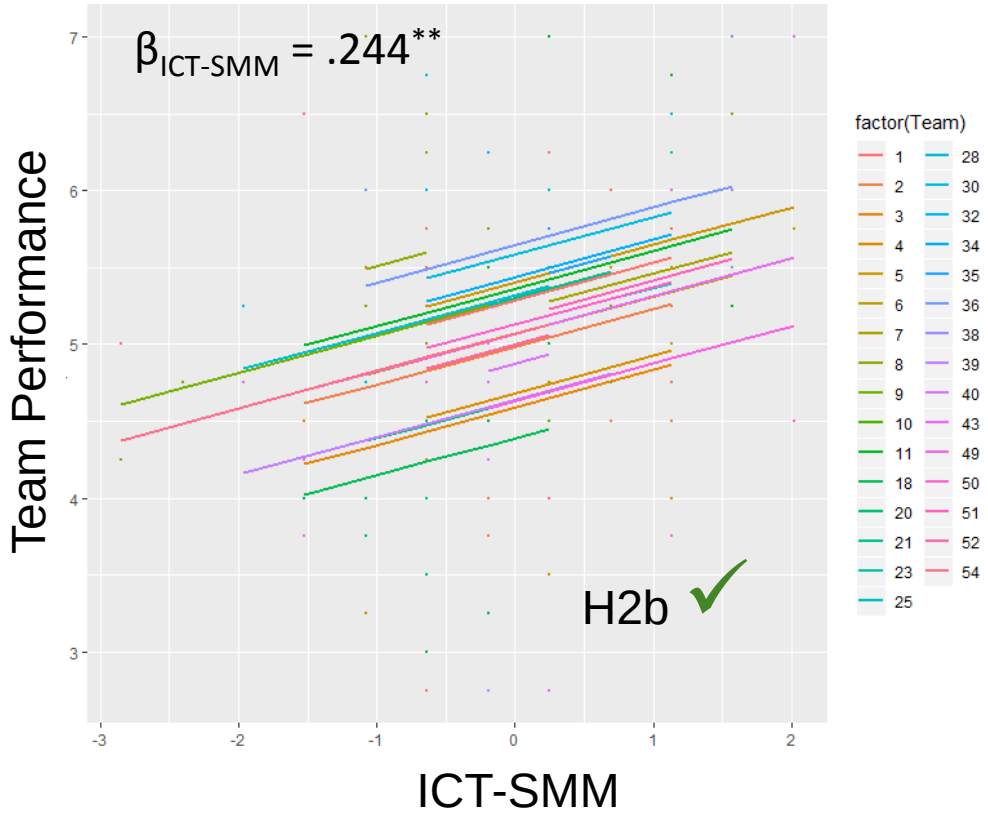
H1 ✓

Model	χ^2	p	df	CFI	RMSEA	SRMR	AIC	BIC	χ^2 difference test
1.	28.186	.042	40	.971	.065	.044	3497.777	3580.468	
2.	105.217	.000	44	.779	.164	.079	3575.372	3648.874	77.031***
3.	46.650	.000	41	.928	.096	.066	3517.289	3593.854	18.464***
4.	51.127	.000	41	.917	.103	.074	3525.172	3601.737	22.941***

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = Akaike information criterion; BIC = Bayesian information criterion.

Hypothesis 2:
Association between ICT-SMM and Team Coordination and Performance





Hypothesis 3a: HLM

ICT-SMM are positively associated with team coordination beyond teamwork- and taskwork-SMM.

Hierarchical regression analysis.

	Model I			Model II		
F	*5.19****			*5.18****		
R^2	*.41 [0.30, 0.52]*			*.47 [0.36, 0.58]*		
Variable	*b*	*SE*	*β*	*b*	*SE*	*β*
Step 1						
Teamwork-SMM	.14	.10	.124	.12	.10	.110
Taskwork-SMM	.60	.09	. 660***	.55	.09	.608***
Step 2						
ICT-SMM				.25	.06	.286***

Note. N = 141 in 31 teams. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$, $^{\dagger}p < .10$.

H3a ✓

Hypothesis 3b: HLM

ICT-SMM are positively associated with team performance beyond teamwork- and taskwork-SMM.

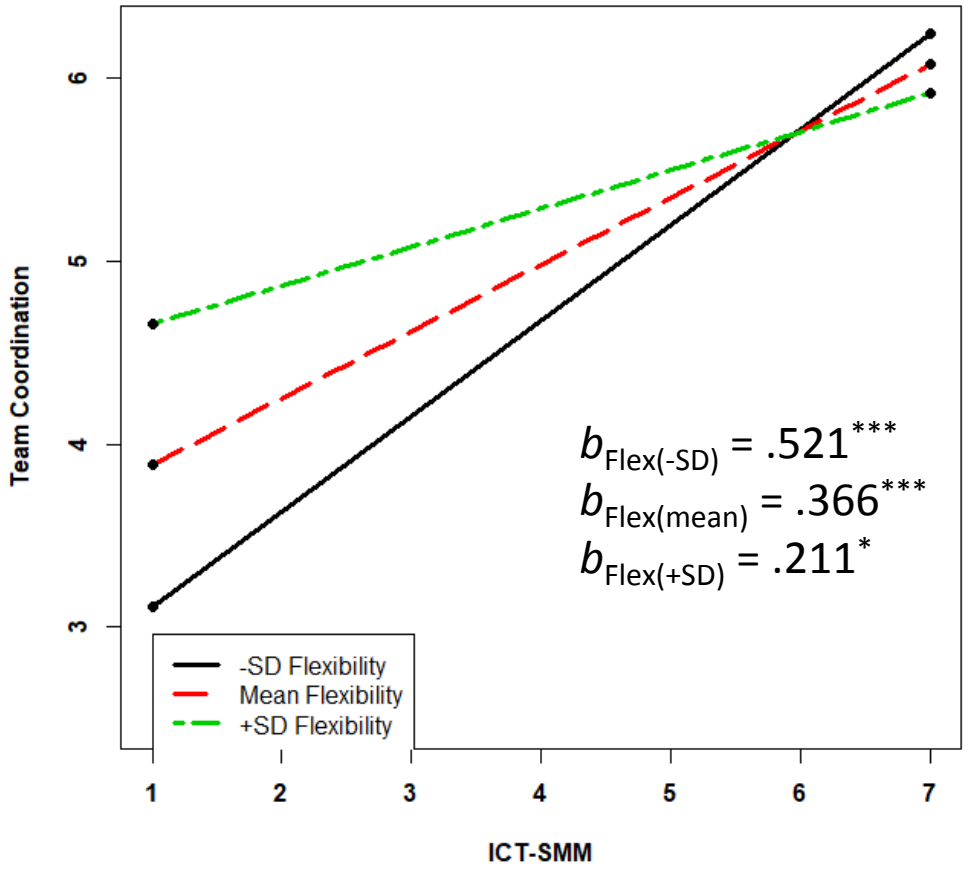
Hierarchical regression analysis.

	Model I			Model II		
F	*5.08****			*5.07****		
R^2	*.35 [0.24, 0.47]*			*.37 [0.26, 0.49]*		
Variable	*b*	*SE*	*β*	*b*	*SE*	*β*
Step 1						
Teamwork-SMM	.23	.09	.202*	.22	.09	.197*
Taskwork-SMM	.39	.08	.432***	.37	.08	.406***
Step 2						
ICT-SMM				.12	.06	.141*

Note. N = 141 in 31 teams. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$, $^{\dagger}p < .10$.

H3b ✓

Hypothesis 4: Moderation by Flexibility in ICT-use



$\beta_{ICT\text{-}SMM} = .405^{***}$
$\beta_{Flexibility} = .200^{*}$
$\beta_{ICT\text{-}SMM \times Flexibility} = -.182^{*}$

H4a: Team Coordination ✓

H4b: Team Performance X

The less flexible the ICT-use the stronger the relationship between ICT-SMM and team coordination.

Discussion

- ICT-SMM seem to be another subtype of SMM in VT
- ICT-SMM seem to have an incremental value for team coordination and performance beyond teamwork- and taskwork-SMM
- ICT-SMM are more important for team coordination under specific conditions (flexibility in ICT-use)
- Organizations should promote ICT-SMM among their team members

- Limitations
  - Low reliability of measurement → Scale development of ICT-SMM
  - Cross-sectional data → Validate these results in another sample using a longitudinal design

- Future Research
  - For which teams are ICT-SMM relevant (% of ICT-use)?
  - Which aspects of ICTs are necessary to share?
  - Research on interventions for promoting ICT-SMM

Thank you for your attention!

Rebecca Müller (M. Sc.)

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Literature

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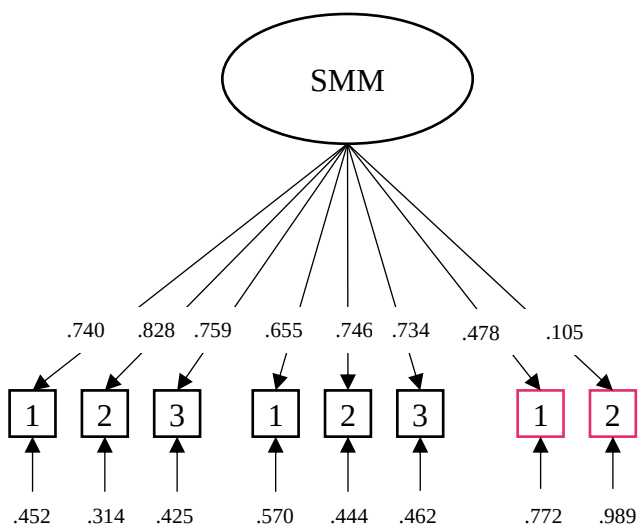
Items

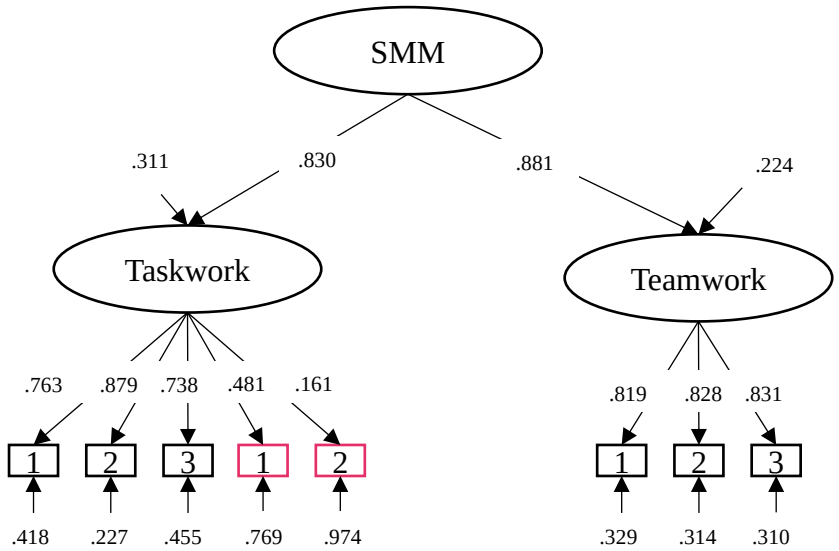
ICT-SMM	In our team, we agree which digital media are used for which purpose (e.g. e-mail, chat, telephone).”	α = .53 r_{wg} = .72
	It often happens that team members use a different digital medium in a particular situation/for a particular purpose than I would have done.	a_{wg} = .77 ICC = .15 / .32
Teamwork-SMM	I know the skills and competences of the individual team members.	α = .86
	I know how we allocate tasks and roles in our team.	r_{wg} = .83
	I know who in the team has special skills and expertise that are important for working on my own tasks.	a_{wg} = .78 ICC = .11 / .28
Taskwork-SMM	I know our team goals and progress in achieving them.	α = .83 r_{wg} = .74
	I know the strategies that our team follows in task execution.	a_{wg} = .73
	I know how the tasks of my team members relate to each other.	ICC = .21 / .38

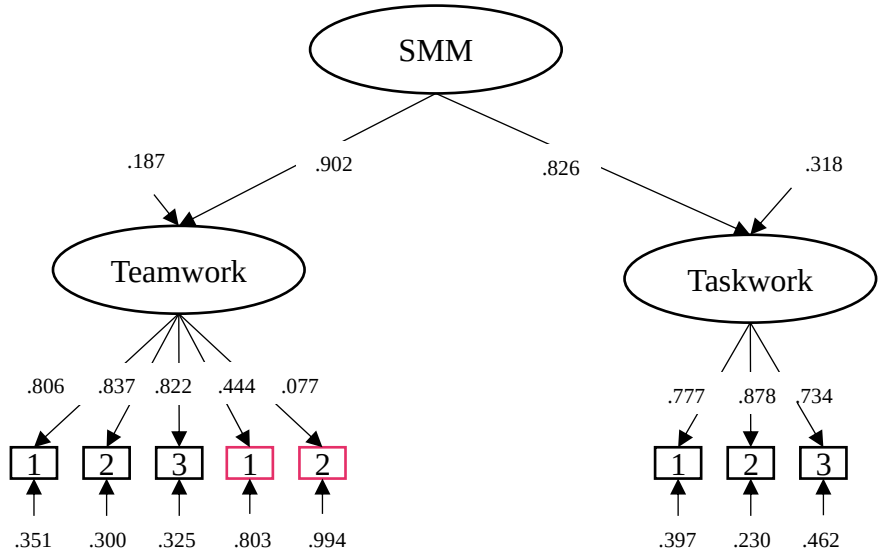
Items

ICT-flexibility	I can flexibly decide which digital medium I use for which task.	
Team Coordination	Our team worked together in a well-coordinated fashion.	α = .86 r_{wg} = .73
	We accomplished the task smoothly and efficiently.	a_{wg} = .77 ICC = .27 / .49
Team Performance	The team fully achieves its goals.	α = .88
	The team performs very well.	r_{wg} = .82
	The team meets or exceeds the team's expectations.	a_{wg} = .83
	Compared to other teams with similar tasks, this is a particularly powerful team.	ICC = .25 / .48

CFAs


SMM
.740
.828
.759
.655
.746
.734
.478
.105
1
2
3
1
2
3
1
2
.452
.314
.425
.570
.444
.462
.772
.989


SMM
.311
.830
.881
.224
Taskwork
Teamwork
.763
.879
.738
.481
.161
.819
.828
.831
1
2
3
1
2
1
2
3
.418
.227
.455
.769
.974
.329
.314
.310


SMM
.187
.902
.826
.318
Teamwork
Taskwork
.806
.837
.822
.444
.077
.777
.878
.734
1
2
3
1
2
1
2
3
.351
.300
.325
.803
.994
.397
.230
.462

Descriptive Statistics

	M	SD	1	2	3	4	5
1. ICT-SMM	4.72	1.12					
2. Team-SMM	5.68	0.91	.20*				
3. Task-SMM	5.19	1.08	.25***	.63***			
4. Flexibility ICT	5.33	1.11	.02	.18*	.17*		
5. Coord	5.19	1.15	.40***	.48***	.65***	.18*	
6. Perf	5.05	0.99	.29***	.50***	.60***	.11	.72***

Note. N = 141. ***p < .001, **p < .01, *p < .05, †p < .10.

Discriminant Validity:

- Average Variance Extracted (AVE) of ICT-SMM: 0.6889
- Correlation (ICT-SMM x Teamwork)² = 0.04
- Correlation (ICT-SMM x Taskwork)² = 0.0625