



# Are we together or not? Sequential interplay of monitoring and physiological synchrony during a collaborative exam

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# Why monitoring is needed in collaboration?

**Monitoring of progress over time are critical to a group's collaborative progress** (Järvelä, Malmberg & Koivuniemi, 2016; Volet, Vauras, Salo, & Khosa, 2017 ; Ku, Tseng, & Akarasriworn, 2013).

## Monitoring triggers interaction

- **Reciprocal contributions to discussions focusing on collaborative progress** (Barron, 2001; Dillenbourg, 1999).
- **Joint attention**

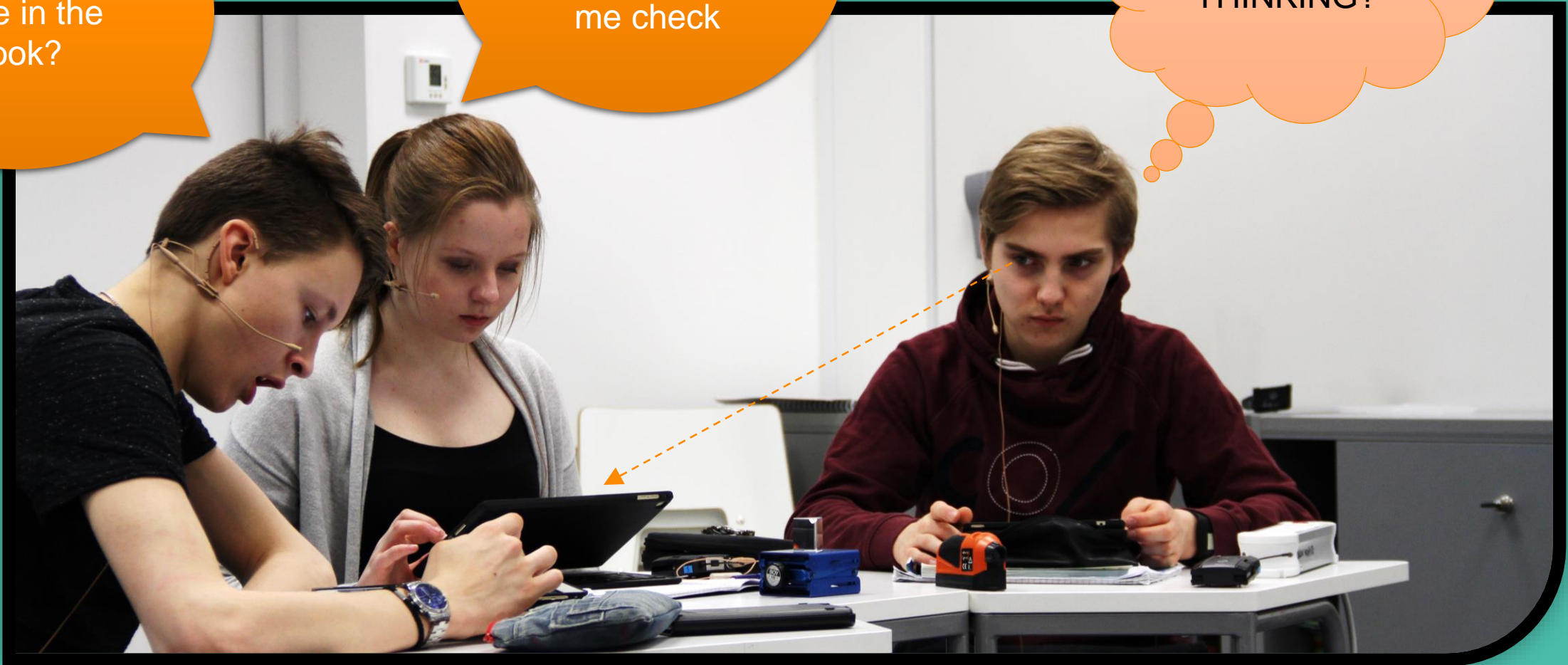
Monitoring in collaborative learning is the result of individual regulation, it is difficult to evaluate how mentally “in tune” group members truly are.

# Imagine a group of students

What was the value in the book?

I think it was 1 or something...Let me check

WHAT AM I THINKING?



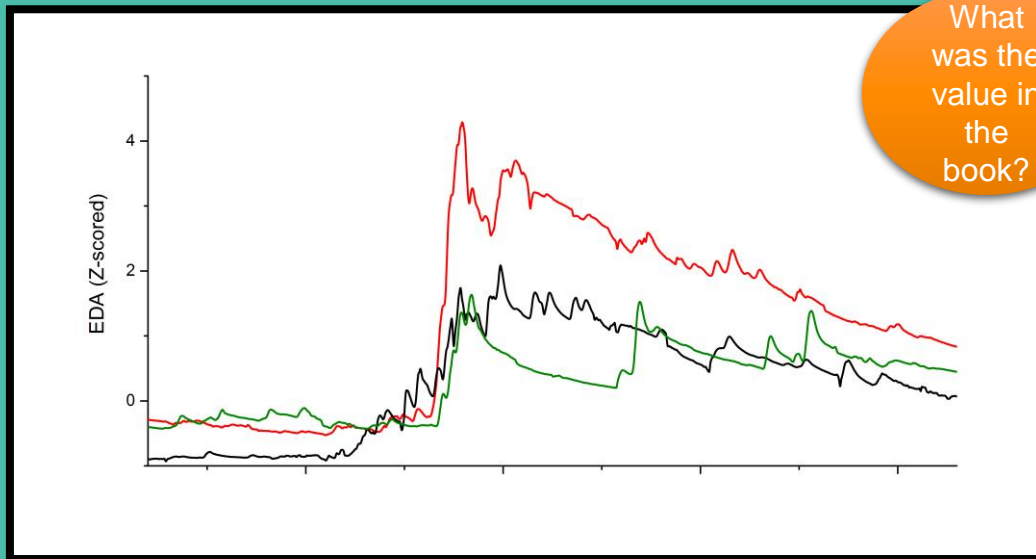


# Physiological synchrony

Physiological synchrony is determined from individual students activity of autonomic nervous system like electrodermal activity (EDA) (Kreibig, 2010).

Observed association (or interdependency) between two or more students' physiological processes.

Individuals in a group are working on the same activity and are also all "in tune" mentally (Popov, van Leeuwen & Buis, 2017)



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WHAT AM I THINKING?



Periods of intense social interaction produce shared patterns of physiological signals among collaborators (Ahonen, Cowley, Torniaainen, Ukkonen, & Vihavainen, 2016)



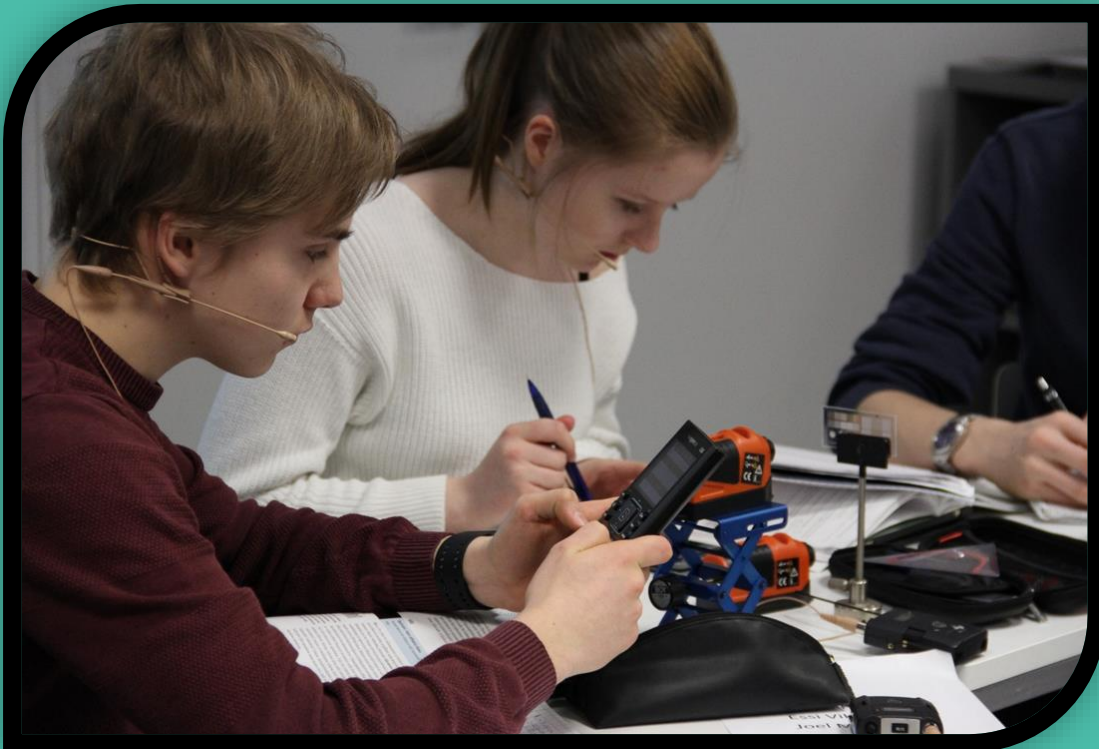
# Aim

To investigate whether and how individuals in a group are in synchrony with the same activity if it is not observable in verbal interactions, especially when the focus is to understand processes of monitoring in the context of collaborative learning.

- 1. What do physiological signals indicate about individual students' monitoring processes?**
- 2. How does physiological synchrony and its interplay with monitoring connected during a collaborative exam situation?**



# Participants, context and data collection



Four groups of three members, aged 15 to 16 years.

Advanced physics course – Collaborative exam (28 minutes and 55 seconds (*Std* = 53s).

## TASK

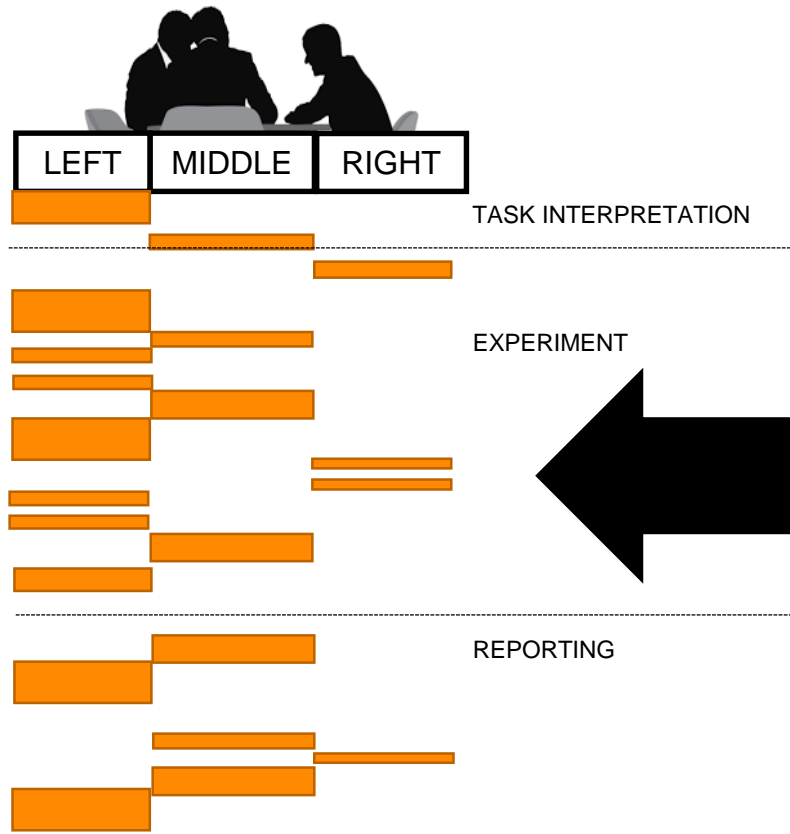
Calculate refractive index of light for water

- 1) Read task instructions
- 2) Set up the experiment
- 3) Report the calculation process

## DATA COLLECTION

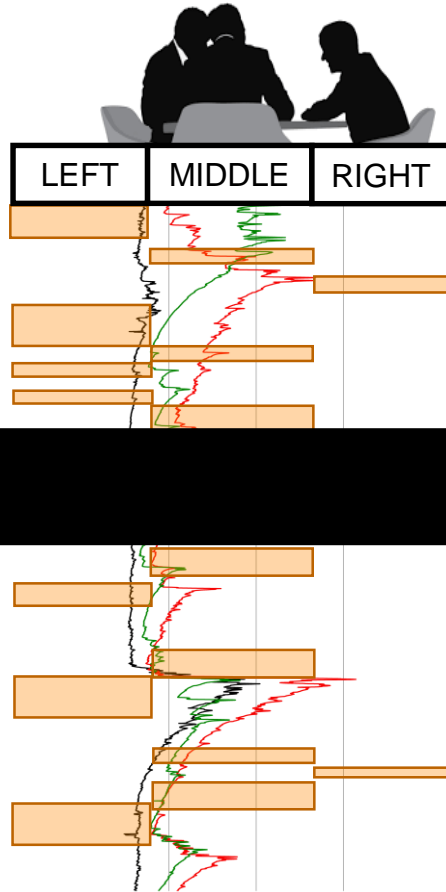
- 1) Video observations
- 2) Electro Dermal Activity (EDA)

## 2. Work phase



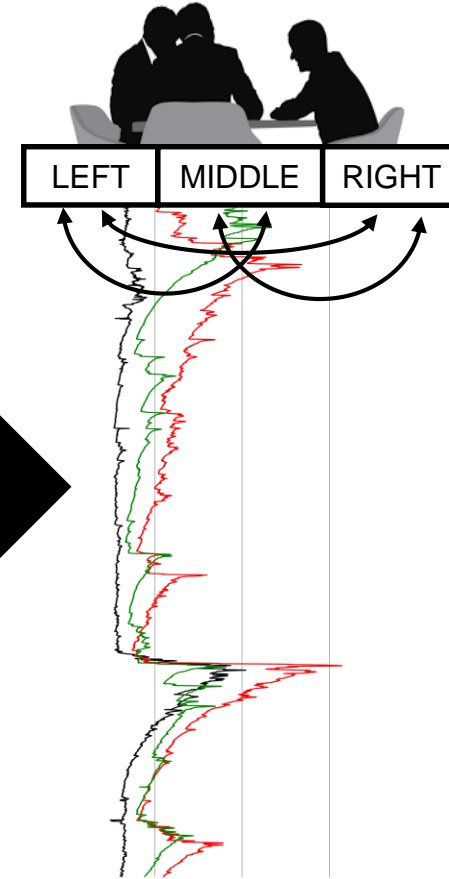
(Azevedo & Witherspoon, 2009; Schunk, 1991, Wolters, 2011)

## 3. Eda Peaks



(Benedek & Kaernbach, 2010)

## 4. SSI Index



(Marci, Ham, Moran, & Orr, 2007)

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**What do physiological signals indicate about individual students' monitoring processes?**





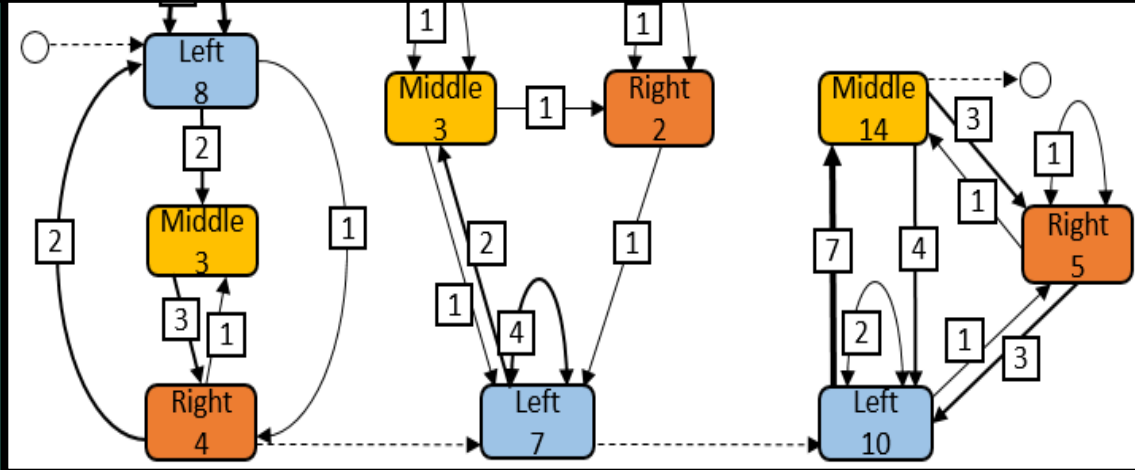
Monitoring activity correlated ( $r = .663, p < 005$ ) with the number of EDA peaks

	Monitoring ( <i>f</i> )	Monitoring Duration ( <i>Mean</i> )	Monitoring Duration ( <i>Total</i> )	EDA Peaks*
Left student	25	0:00:04	0:01:30	434
Middle student	20	0:00:03	0:01:06	403
Right student	11	0:00:03	0:00:36	343
<i>Group 1 Total</i>	56		0:03:12	1180
Left student	21	0:00:05	0:01:48	405
Middle student	26	0:00:05	0:02:09	260
Right student	3	0:00:03	0:00:10	118
<i>Group 2 Total</i>	50		0:04:16	783
Left student	39	0:00:04	0:02:34	601
Middle student	14	0:00:04	0:00:53	507
Right student	12	0:00:04	0:00:49	398
<i>Group 3 Total</i>	65		0:04:16	1506
Left student	23	0:00:04	0:01:20	493
Middle student	10	0:00:03	0:00:33	405
Right student	38	0:00:05	0:02:47	517
<i>Group 4 Total</i>	71		0:04:40	1415

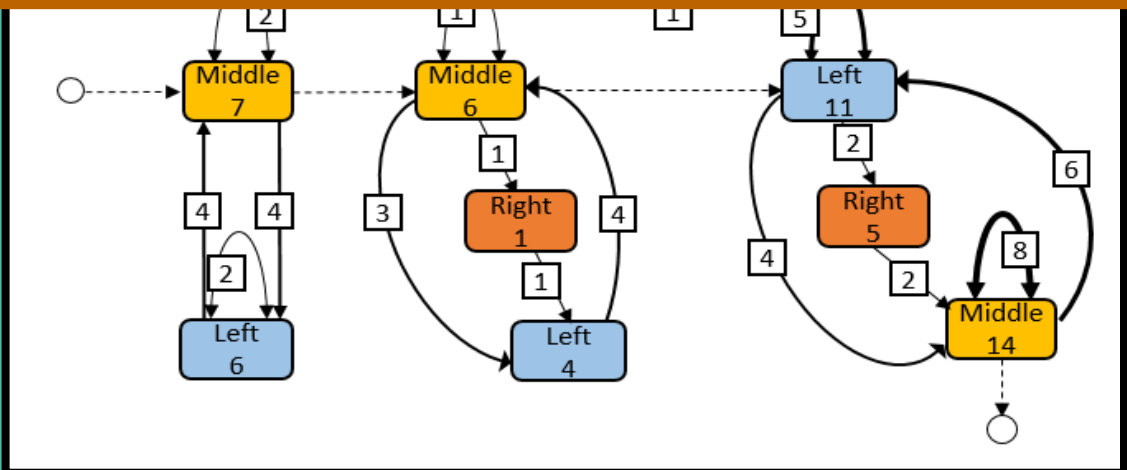


**How does physiological synchrony and its interplay with monitoring connected during a collaborative exam situation?**

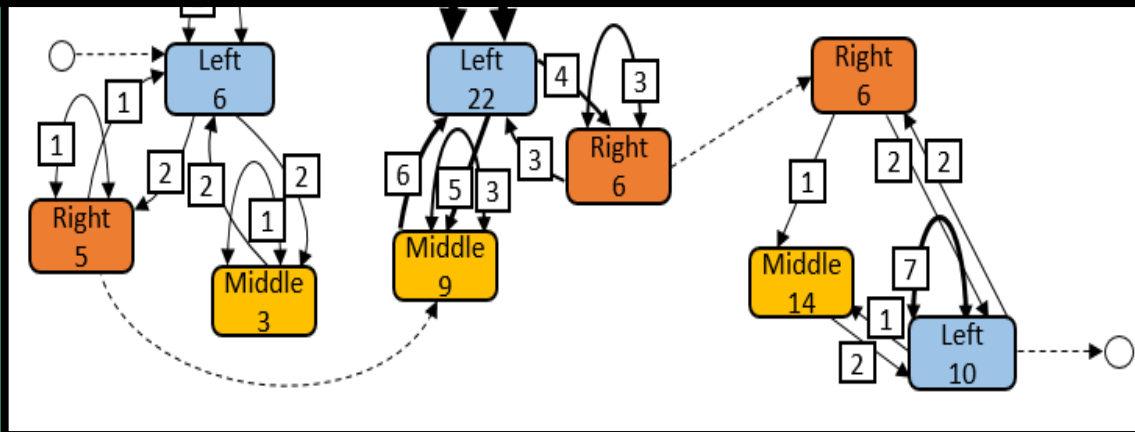
Each student contributed to joint monitoring during each work phase.



The right student did not contribute to the joint monitoring during the task interpretation phase.

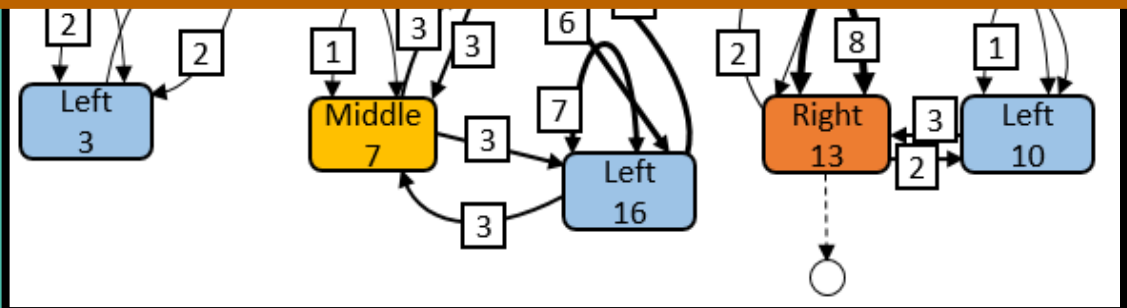


During the task interpretation phase and the experiment phase, neither the middle student's nor the right student's monitoring was not followed by for the other.



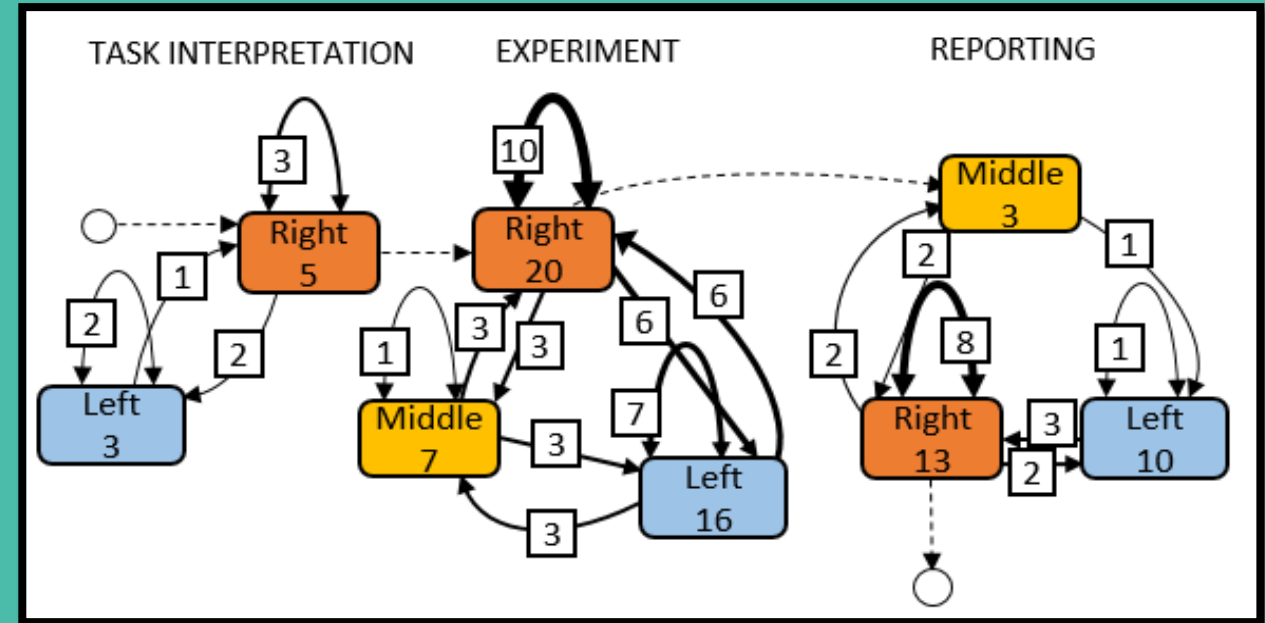
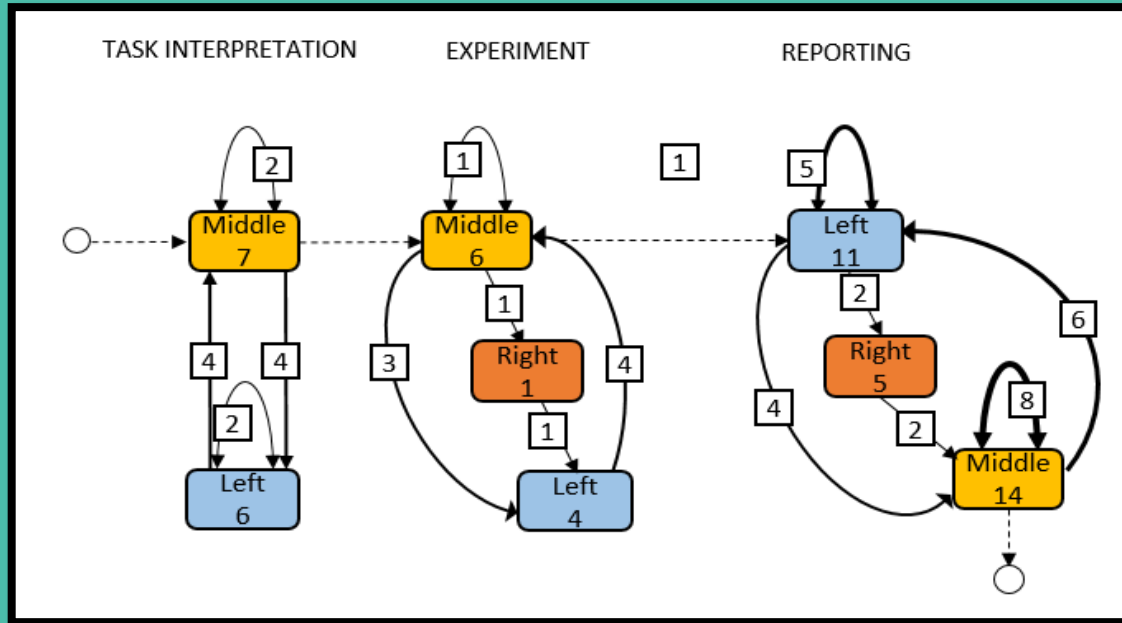
The right student did not contribute to the joint monitoring during task interpretation.

During the experiment and reporting phases, each student's monitoring was followed by the monitoring of other group members.





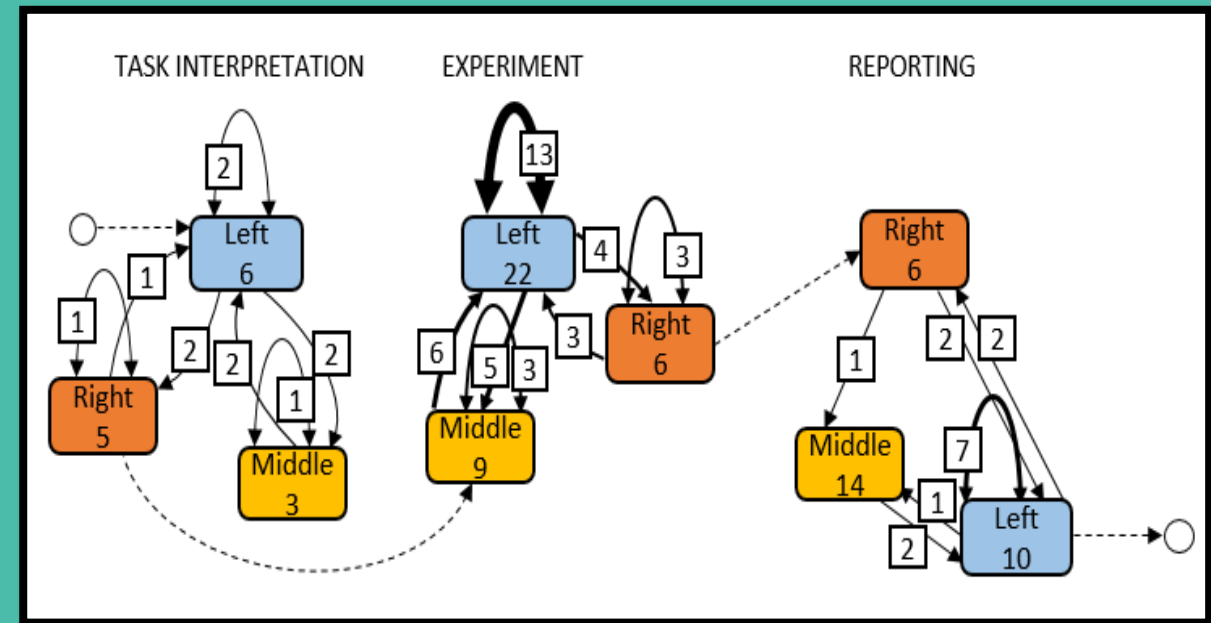
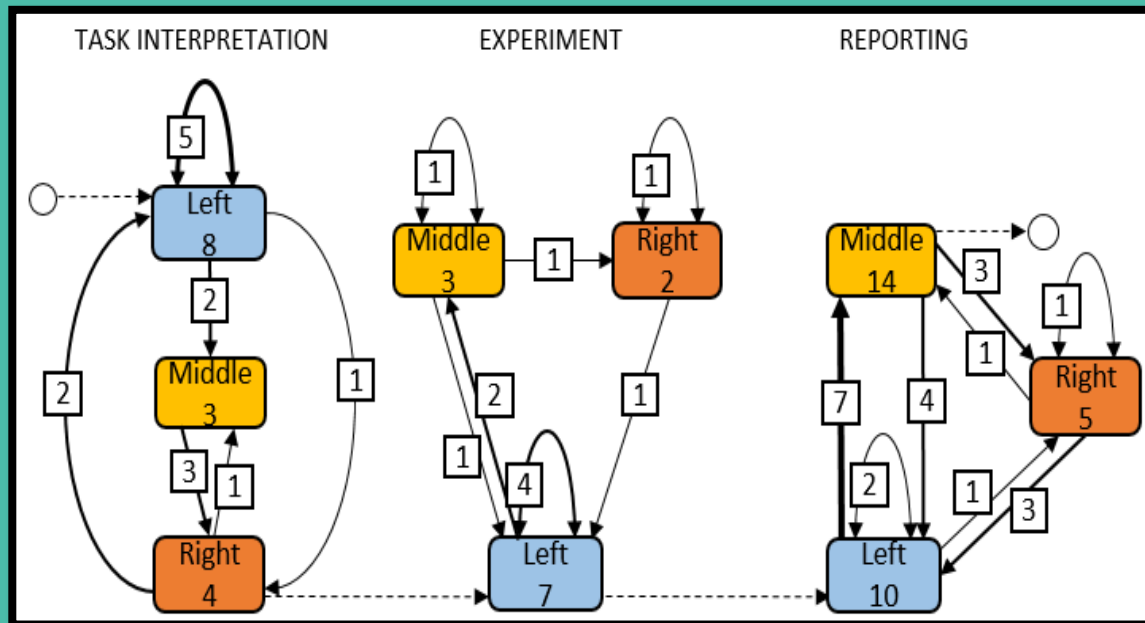
# + Physiological synchrony



Student pairs	Monitoring interplay	SSI	confidence interval
Left–middle	12 + 13	0.311*	0.110
Middle–right	2 + 1	0.342*	0.092
Left–right	2 + 1	-0.521	0.133

Student pairs	Monitoring interplay	SSI	confidence interval
Left–middle	4+3	0.151*	0.110
Middle–right	5+5	0.201*	0.124
Left–right	10+9	0.262*	0.108

# - Physiological synchrony



Student pairs	Monitoring interplay	SSI	confidence interval
Left–middle	11 + 5	-0.034	0.108
Middle–right	7 + 2	-0.146	0.116
Left–right	6 + 2	-0.048	0.108

Student pairs	Monitoring interplay	SSI	confidence interval
Left–middle	10 + 9	-0.018	0.104
Middle–right	1 + 0	-0.044	0.090
Left–right	8 + 6	-0.153	0.101



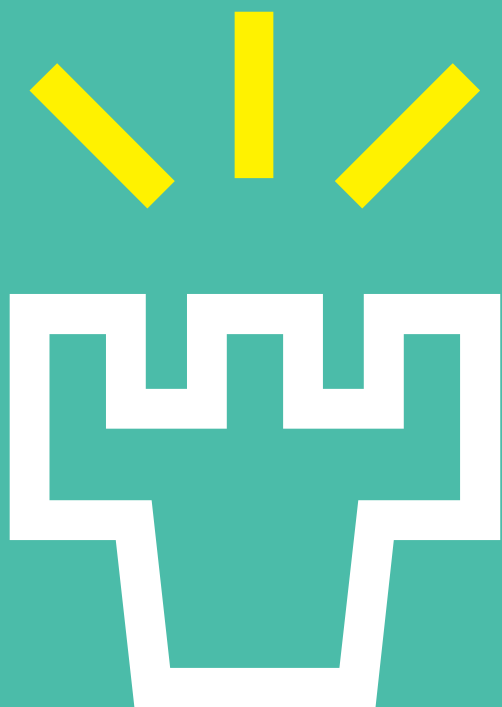
# Summary of the findings

- All the students did not engage in joint monitoring during each phase of the learning process.
- Monitoring activity was reflected in EDA peaks.
- The connection between sequential interplay of monitoring and physiological synchrony is not clear.
- Monitoring does not reveal about “sharedness”, but more about “active mind” which was shown in this study (Järvelä, Hadwin, Malmberg & Miller, 2017).



# Discussion and conclusions

- Earlier studies indicate that physiological synchrony reflects cohesion in a group and social presence (Järvelä, Kivikangas, Katsyri & Ravaja, 2013; Mønster et al., 2016).
- Despite interactions and exchanges in monitoring play a role in stimulating transitional and flexible regulation (Volet, Vauras, Salo & Khosa, 2017) it is not enough to assume that this exchange would lead to sharing regulation (Järvelä, Hadwin, Malmberg & Miller, 2017).
- More evidence is needed about physiological synchrony and how (and if) it is related to jointly evolving regulative acts.



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THANK YOU!  
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