

Collaborative Learning Assessment

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Background

Thesis Supervision



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Thesis subject

Exploring the Influence of Individual Characteristics on Collaborative Problem-Solving Processes in Adult Learning Teams

Central Concepts

Computer-Supported Collaborative Learning (CSCL)

Learning processes

Multimodal Learning Analytics



Collaborative Learning Assessment

A Multi-Dimensional View on
Assessment for Collaborative Learning
With Research Insights and Perspectives

Content of the presentation

- Introduction (3 min.)
- Multi-Dimensional view (5 min.)
- Applications from the STEAMS project (4 min.)
- Applications from the course Educational Technology (4 min.)
- Ongoing research (5 min.)
- Discussion & Conclusion (2 min.)



Literature overview

Introduction

Why collaborative learning?

Changing competency trends

“Skills gaps continue to be high as in-demand skills across jobs change in the next five years”

(World Economic Forum, 2020)



Analytical thinking and innovation



Active learning and learning strategies



Complex problem-solving



Critical thinking and analysis



Creativity, originality and initiative



Leadership and social influence



Technology use, monitoring and control



Technology design and programming



Resilience, stress tolerance and flexibility



Reasoning, problem-solving and ideation

Source: Future of Jobs Report 2020, World Economic Forum.

Changing Competency Trends

Framework of 21st Century

Digital Skills (van Laar et al., 2017), e.g., communication



collaboration



critical thinking

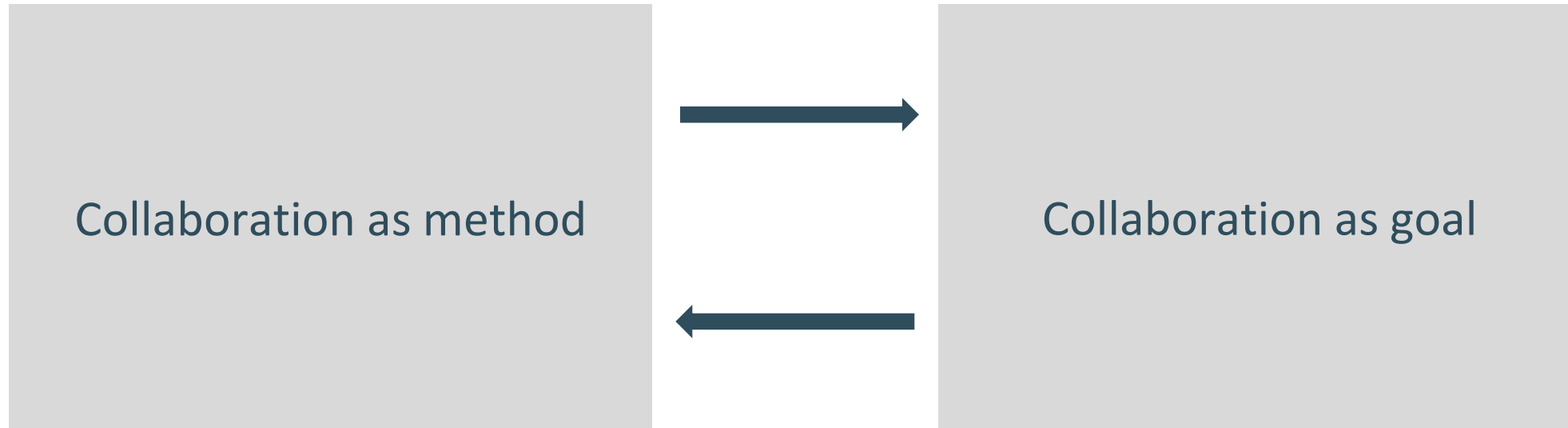


problem solving



(AES, 2022)

Collaboration



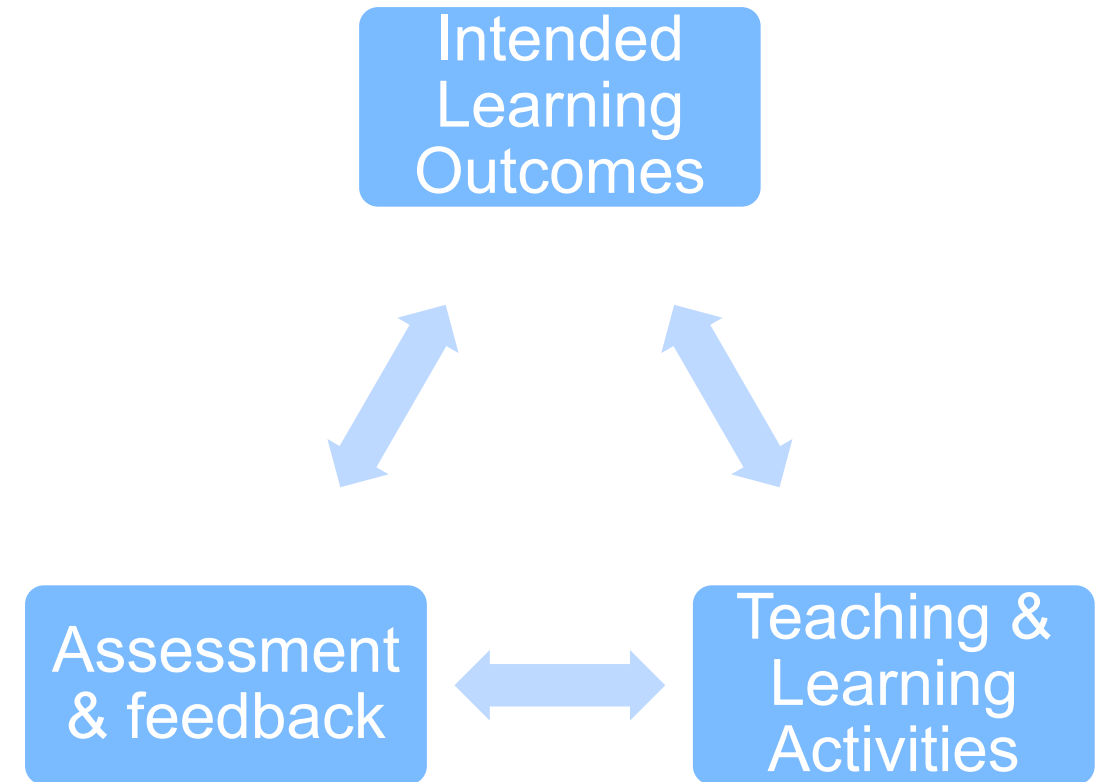
Introduction

When using collaborative learning (as a method or as a goal)

Assuring alignment with assessment and feedback (cf. constructive alignment (Biggs, 1996))

“Understanding and using appropriate assessment processes must be part of the overall learning design” (Lock & Johnson, 2015, p. 61)

Important to have sufficient insights in the different modalities, possibilities, advantages, and disadvantages



Assessment: A multi-dimensional approach

Multiple dimensions

In line with literature

1. **Teacher or peer assessment** (Harris & Brown, 2013; Rotsaert et al., 2017)
2. **Formative or summative assessment** (Dixon & Worrell, 2016)
3. **Product or process assessment** (Valcke, 2018)

Dimension 1 – Who?

Teacher-led

“Any assessment activity that is carried out by a teacher in supporting candidates’ learning and assessing his/her knowledge based on a well defined standard/rubrics”.

(Halawa et al., 2017, p. 88)



Peer-led

- Evaluation conducted by peers within/between the collaborative learning group.



Other

Self-led (e.g., Stančić, 2020)

Computer-led

Dimension 1 – Who?

E.g., meta-analysis on academic writing performance (Huisman et al., 2019)

- Peer feedback vs no feedback: large effect ($g = 0.91$)
- Peer feedback vs. self-assessment: medium effect ($g = 0.33$)
- Peer feedback vs. teacher feedback: medium effect ($g = 0.46$)



Dimension 1 – Who?

However (Stančić, 2020),

- Stressful and uncomfortable for many
- Low perceived competence for giving peer feedback

Moderating role of the nature of peer feedback (Xiao and Lucking, 2008)

- Combination of qualitative and quantitative feedback



Dimension 2 – Why? What is its function

Formative

gather information for adjusting the activities in which learners are engaged. (Black & William, 1998)

i.e., through observation of authentic performance (Valcke, 2018)

Summative

Assess competencies at the conclusion of a teaching unit

(Dolin et al., 2018)



Dimension 2 – Why? What is its function

Formative and summative assessment as a continuum (Dolin et al., 2018)

Positive results of formative assessment (Black and William, 1998, Hattie, 2008)

Need for more focus on formative assessment (Karaçöp & İnaltekin, 2023)



Dimension 3 - Product vs. Process Assessment

Product

Evaluation of the final outcome or deliverable of a collaborative task.

Process

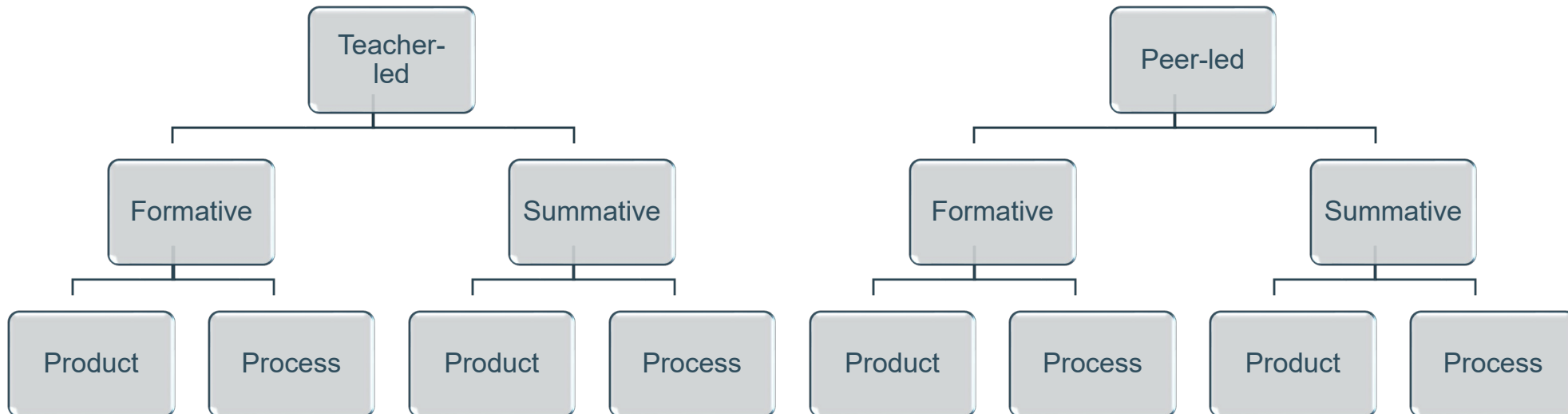
Evaluation of the collaborative process itself, including teamwork, communication, and problem-solving

e.g., in the context of motor skill development (Payne & Issacs, 2017)



Multi-Dimensional

Theoretically: eight possible combinations: $2^3 = 8$



Applications for collaborative learning

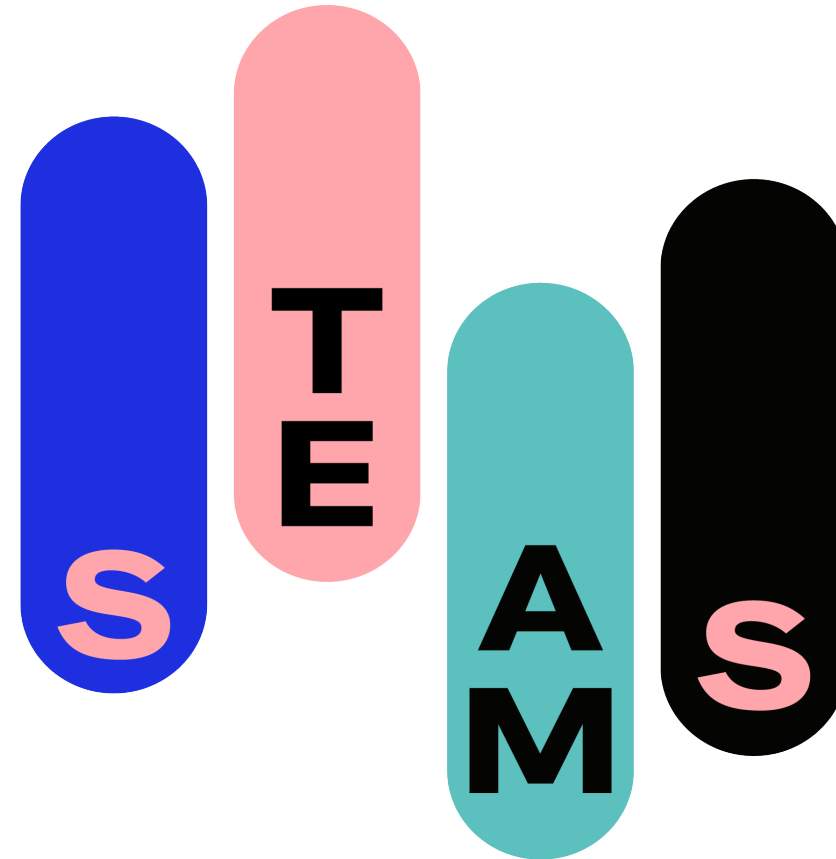
A. Insights from the STEAMS project

The STEAMS project

Supporting TEamwork in
AMbient learning Spaces

Focus on supporting
collaborative learning

processes (e.g., Buseyne et al., 2023a)



Use of validated questionnaires

Based on validated questionnaires

E.g., Team Flow Monitor (Van den Hout, 2018)



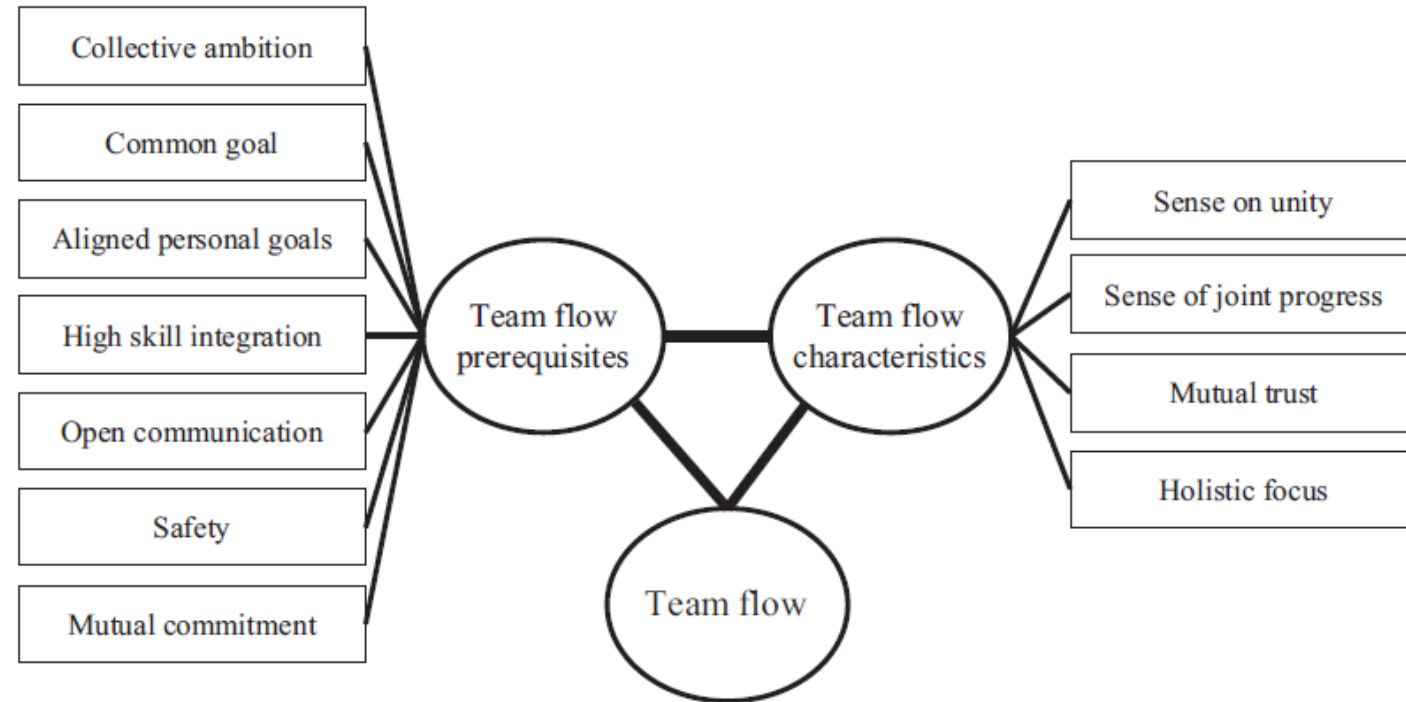
Survey data



Use of validated questionnaires

a collective state of flow experienced by a group, marked by the enjoyable sense of immersion and optimal interaction among team members during a task that relies on **mutual dependence**, and which is **suitably challenging**

(Peifer et al., 2021; Pels & Kleinert, 2022)



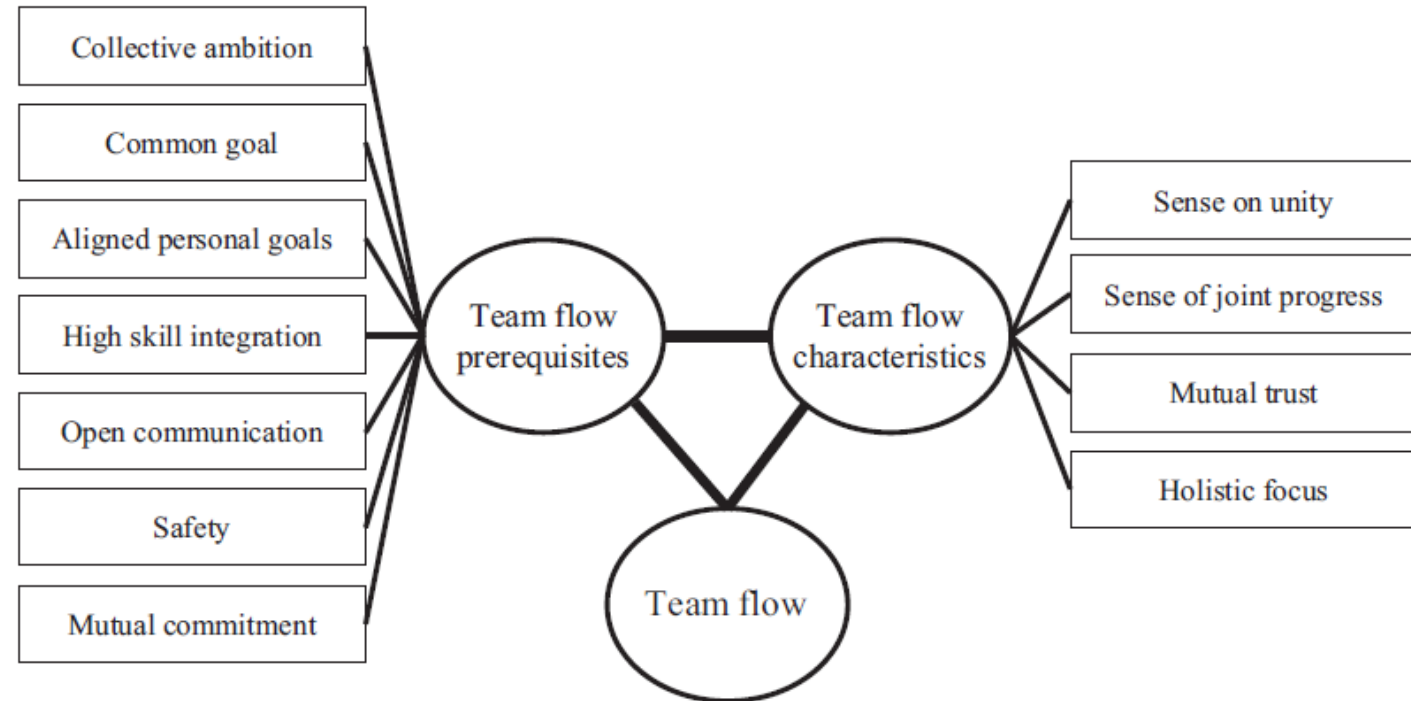
Van den Hout et al., 2018

Use of validated questionnaires

Multiple related concepts

- **Team trust**
(Sarker et al., 2003)
- **Team cohesion**
(van Vianen & De Dreu, 2001)

Various questions about team flow integrated in a collaborative online learning environment



Van den Hout et al., 2018

A) Peer-led Formative Process Assessment

The screenshot shows the EDUbox Teamwork interface. At the top, there are tabs for 'Leer', 'Test', 'Codeer', and 'Hack room'. Below the tabs, the 'EDUbox Teamwork' header shows a progress bar at 18%. The main content area is titled 'Steams' and includes a 'Widgets' section with 'Group Composition'. A 'Progress' section lists five steps: 1. Aligneren, 2. Handelen, 3. Groeien, 4. Communiceren, and 5. Vragen. A tree icon represents '0 Task(s) Completed'. Below the tree are two gauges: 'TEAM SPIRIT' and 'GOAL METER', both showing a needle pointing to the right and a green checkmark below them. The bottom of the interface has a navigation bar with a menu icon, a gear icon, and a user icon, along with the text '14/72'.

Samenwerken kan je leren

SAMENWERKEN KAN JE LEREN

Niet alleen nu, maar ook in je **latere leven** zal samenwerken belangrijk zijn. Meer nog: we zullen steeds meer moeten samenwerken! De gemakkelijke taken worden immers als eerste overgenomen door robots en algoritmes, zodat **de moeilijke problemen overblijven voor ons**. En die los je best in **team** op.

Maar wist je dat maar **17 procent** van alle teams in bedrijven écht goed samenwerkt?

Gelukkig kan je dat wel leren! Met enkele tips en tricks. Onthoud wel dat het zelfs in de beste teams soms een:

Wil je beter worden in samenwerken? Ga dan sne

Different items
e.g., “we relied on each other when making the assignment”

Score from 1 to 5

Real time visualization through group widgets

vrù

FTPRPF
e-Academy for visionaries

AUGMENT

B) Teacher-led Summative Process Assessment (1)

Assessment about team's performance

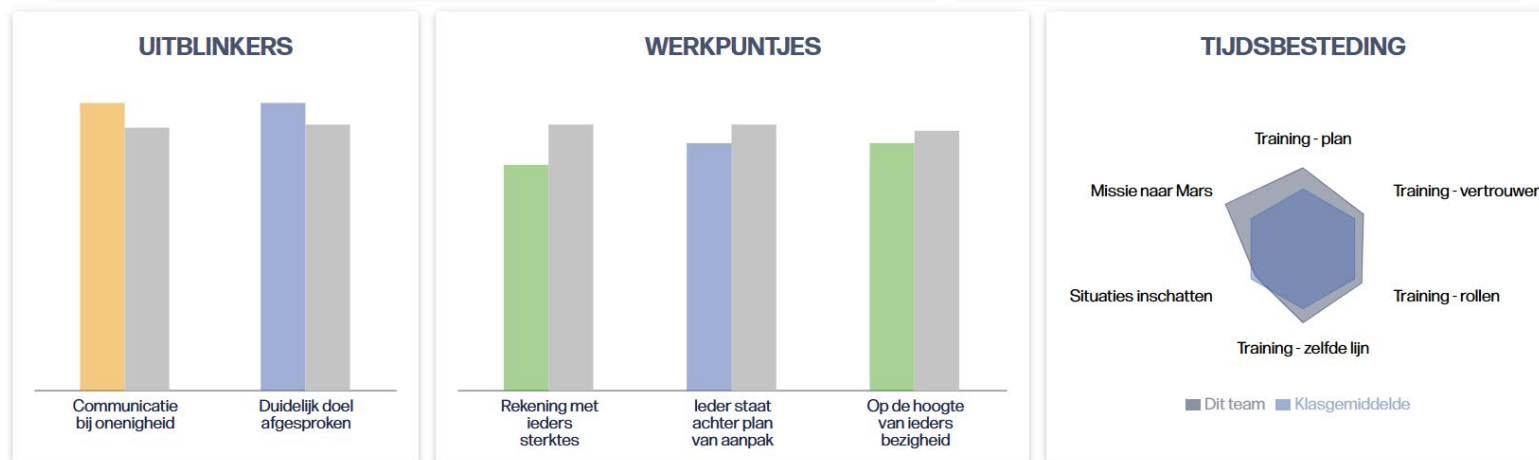
Master Thesis on dashboards for CPS processes
(Millis, 2023)



Survey data



Progress data



B) Teacher-led Summative Process Assessment (2)

Coach interface for assessment of group processes based on a rubric

The screenshot shows a web-based assessment interface. At the top, there are navigation tabs: "Group Compositor", "Dashboard", "Experience Dashboard", and "Coach interface" (which is selected). Below the tabs, there is a "Lab session date:" dropdown menu set to "August 22, 2022". The main content area displays the assessment for "Groep 1 - Labtest 3 (Apollo, Mercurius, Nike, Pluto)" with a "total score: 94". The assessment consists of five categories, each with a horizontal slider and a score box:

Category	Score
Taakverdeling	3
Plan van aanpak	3
Communicatie	3
Aligneren	3
Teamklimaat	4



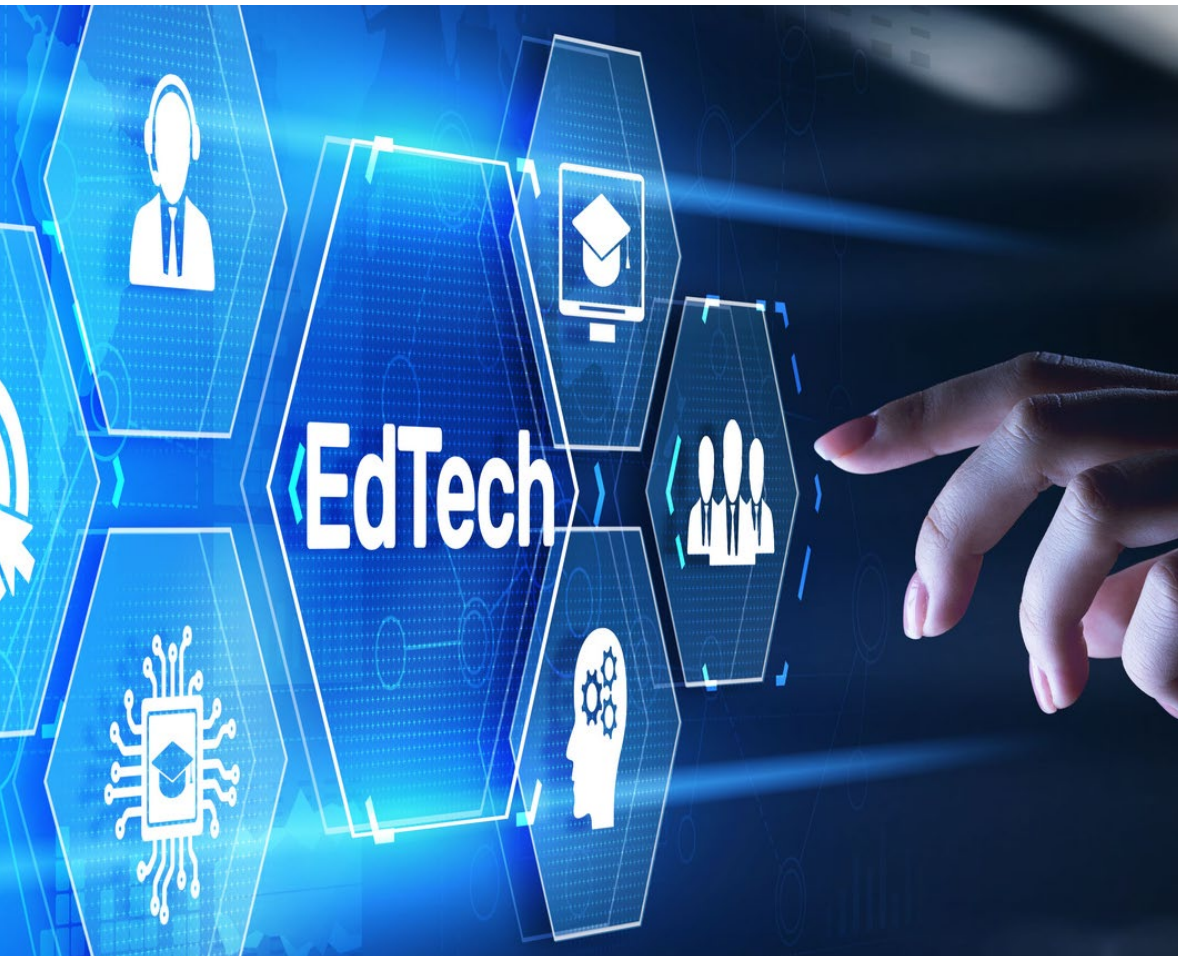
Manual observations



Applications for collaborative learning

B. The course Educational Technology

The course Educational Technology



Cooperation/Collaboration

In groups of four students

Students get an educational tool

They need to write a wiki page about the tool

Integrating theory learned during the course

(e.g., about adaptive learning)

Via various design principles

Student-led Formative Product Assessment

Interim feedback on the different products by other teams



Teacher-led Summative Product Assessment

Rubric including several dimensions

- use of various educational-technological concepts
- In-depth application of the concepts
- Style of the wiki page
- Application of multimedia principles

Total of 20 points



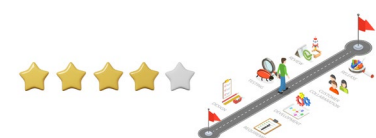
Peer-led Summative Process Assessment

Online questionnaire – Likert Scale

Score per team member & written feedback

8 dimensions:

- Commitment and involvement
- Taking initiative
- Follow-up of agreements and efficiency
- Communication
- Personal contribution: content-wise
- Personal contribution: design/form
- Listening to others
- Group atmosphere



Peer-led Summative Process Assessment

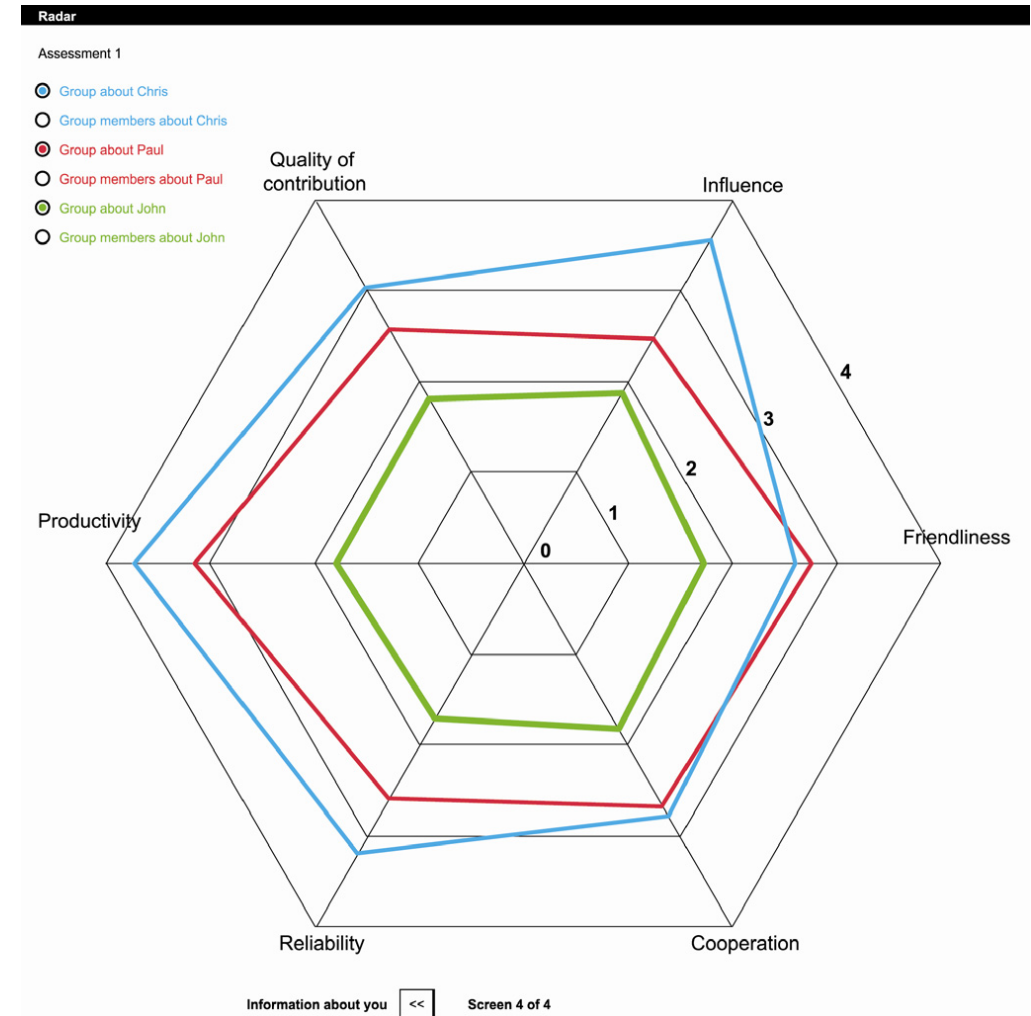
Link with previous research
(e.g., Phielix et al., 2011)

Radar visualization

Multiple dimensions



Survey data



Combination

Combination of

- Teacher-led Summative Product Assessment (A) and
- Peer-led Summative Process Assessment (B)

Teacher score (A) X Correction factor

$$\text{Correction factor} = B_{\text{Individual}} / \text{Average } B_{\text{Team}}$$

e.g., $14 \times 0.9 = 12.6$

e.g., $14 \times 1.2 = 16.8$

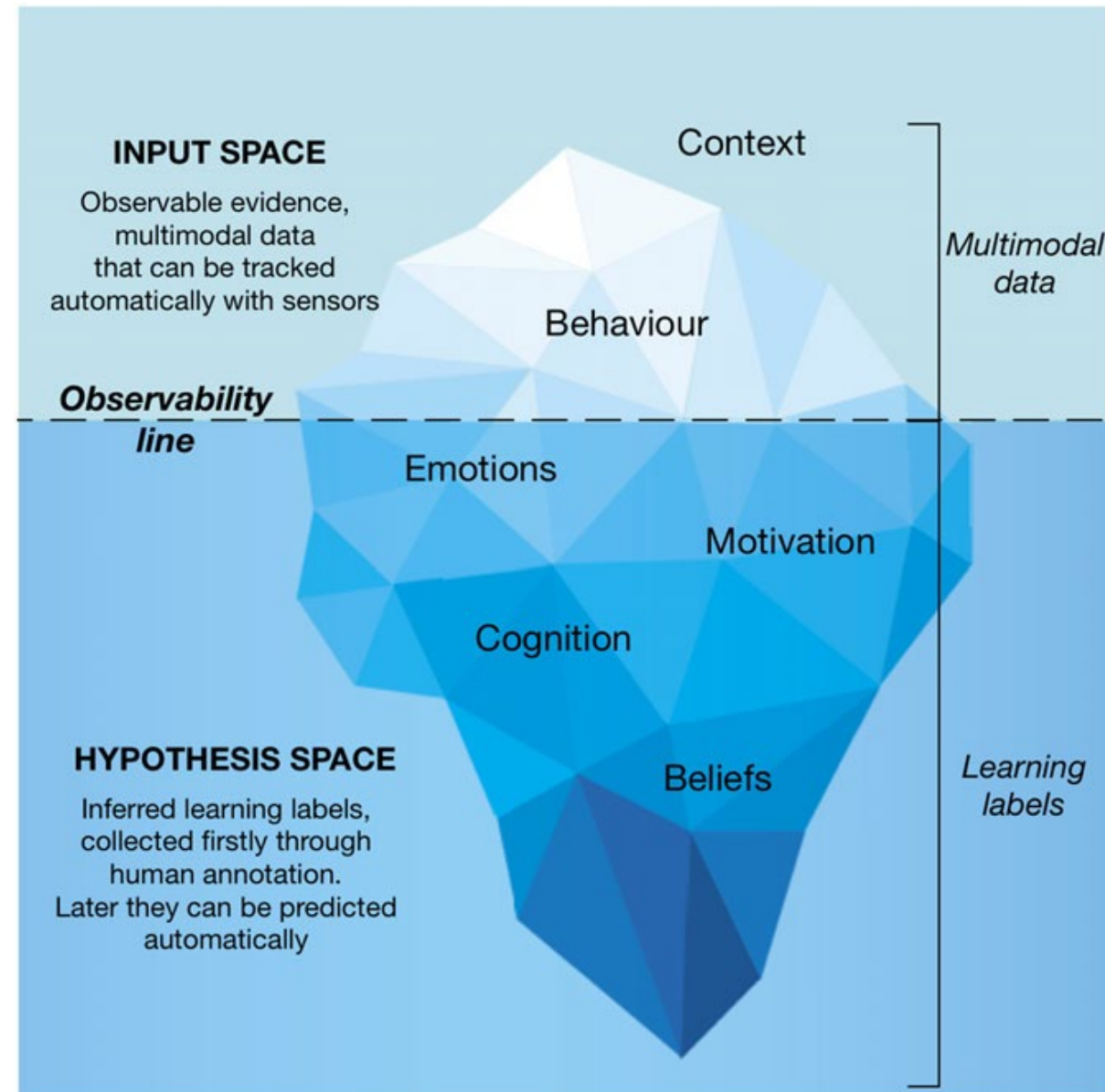
Ongoing research

Supporting Formative Process Assessment

Semi-automated systems for process assessment (and feedback)

Based on observations of collaborative processes

Use of learning analytics



CPS processes

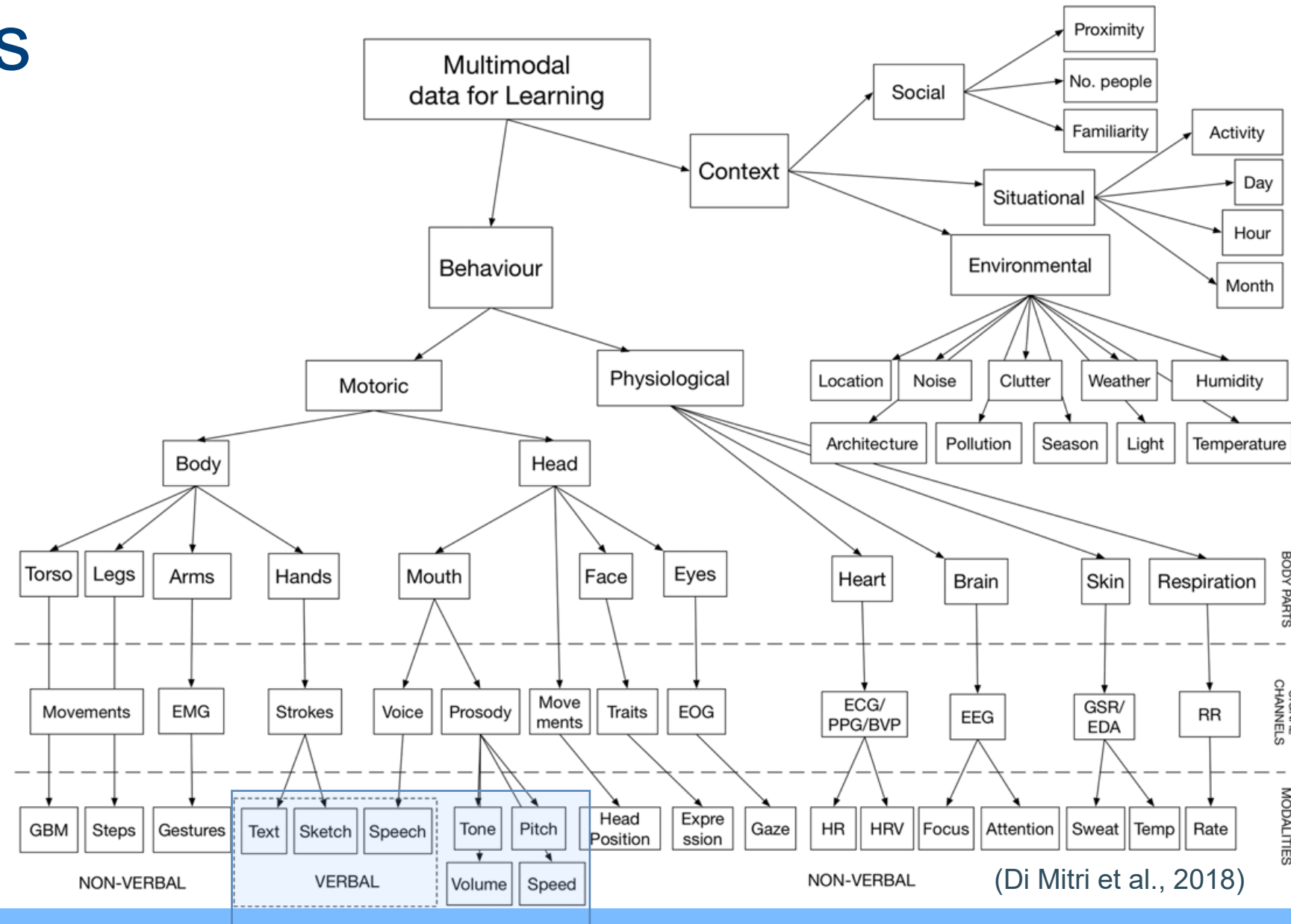
Observational data

Previous research
is limited

(Graesser et al., 2020; Scoular,
2017, Stewart et al., 2023)

New techniques
(e.g., automatic
speech recognition)

(Tan et al., 2022)



Central question

How can we apply learning analytics to get insights in CPS processes?

- Focus on interactions between learners
- Verbal and non-verbal aspects

In the paper:

- Discussing the techniques
- Giving insights in our data

ORIGINAL ARTICLE

British Journal of
Educational Technology



**Assessing verbal interaction of adult learners
in computer-supported collaborative problem
solving**

CPS training context



International Journal *of* Designs for Learning

2023 | Volume 14, Issue 1 | Pages 43-58

PRODUCTIVE FAILURE AS A METHOD FOR LEARNING ABOUT EFFECTIVE COLLABORATIVE PROBLEM SOLVING

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Audio Data

- Audio on group-level
- Audio on individual level
- Video per group



Four methods

Theories and methods

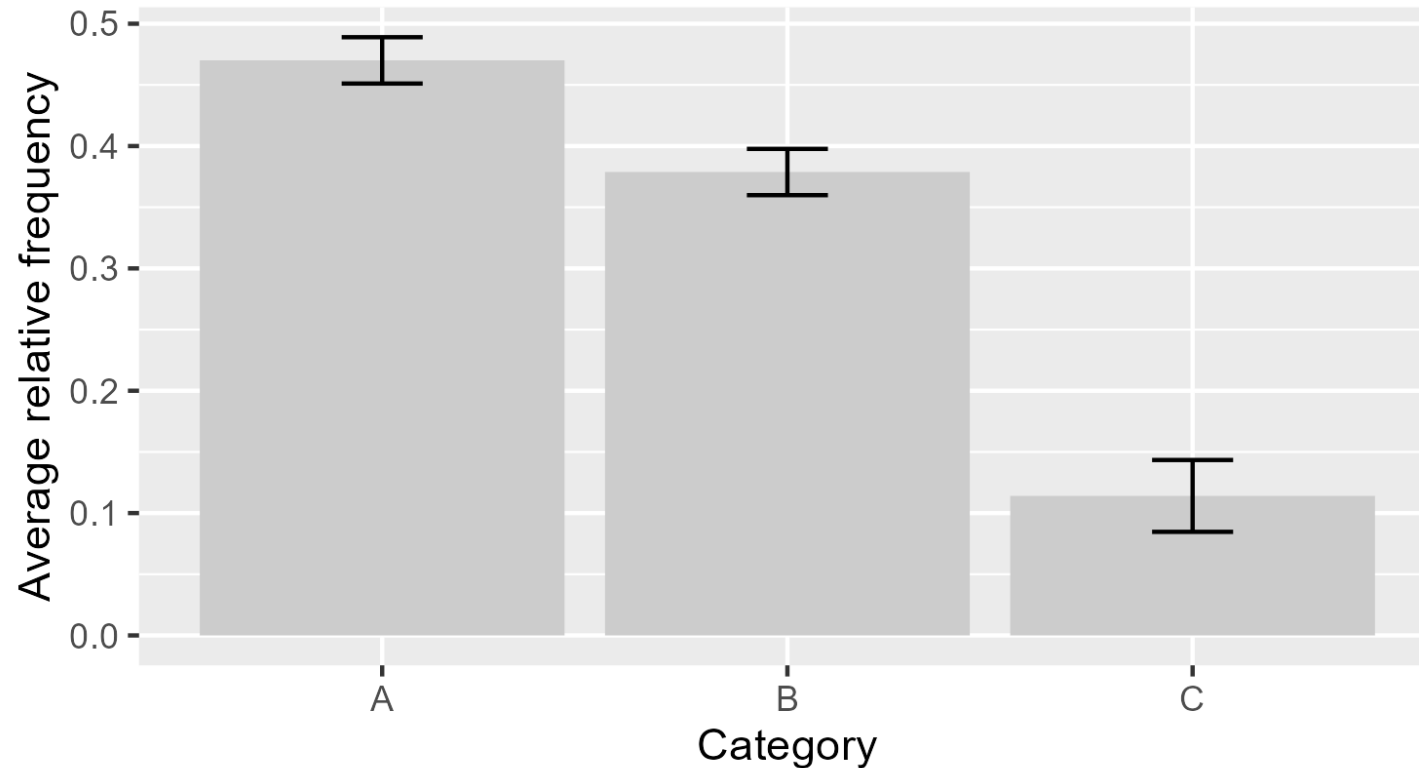
(1) Content analysis

- Multiple frameworks
(Sun et al., 2020, 2022)

Category	Sub-category	Item
A: Establishing, constructing and maintaining shared knowledge and understanding	A1: Sharing knowledge and understanding of problems and solutions	Proposing appropriate solutions or introducing new appropriate information related to the problem Talking about givens and constraints of a specific task Building on others' ideas to improve solutions
	A2: Establishing common ground	Asking for further clarification Giving feedback on the understanding of what the other is saying and asking questions Eliciting feedback from the one who is listening Clarifying any information needs and responding to questions Evoking turn taking by means of explicit handovers Repairing misunderstandings
B: Negotiating and coordinating for task completion and problem solving	B1: Responding to others' ideas or proposed solutions	Providing reasons to support a potential solution Questioning, correcting or pointing out others' mistakes Confirming to support a potential solution
	B2: Monitoring execution	Talking about or discussing the results
	B3: Time management	Monitoring time
	B4: Technical coordination	Using the technical tools
	B5: Discussing strategies	Discussing the general group strategies
C: Maintaining team function and organization	C1: Taking initiatives to advance collaboration processes	Asking if others have suggestions Asking to take action before anyone on the team asks for help Complimenting or encouraging others Apologizing for one's mistake(s) Proposing to ask or asking for help outside of the group
	C2: Coordinating task division	Defining (sub-)tasks and talking about the adoption of these tasks

Types of interactions

Relative Frequency of the Categories



A: Establishing, constructing and maintaining shared knowledge and understanding;

B: Negotiating and coordinating for task completion and problem solving;

C: Maintaining team function and organization.

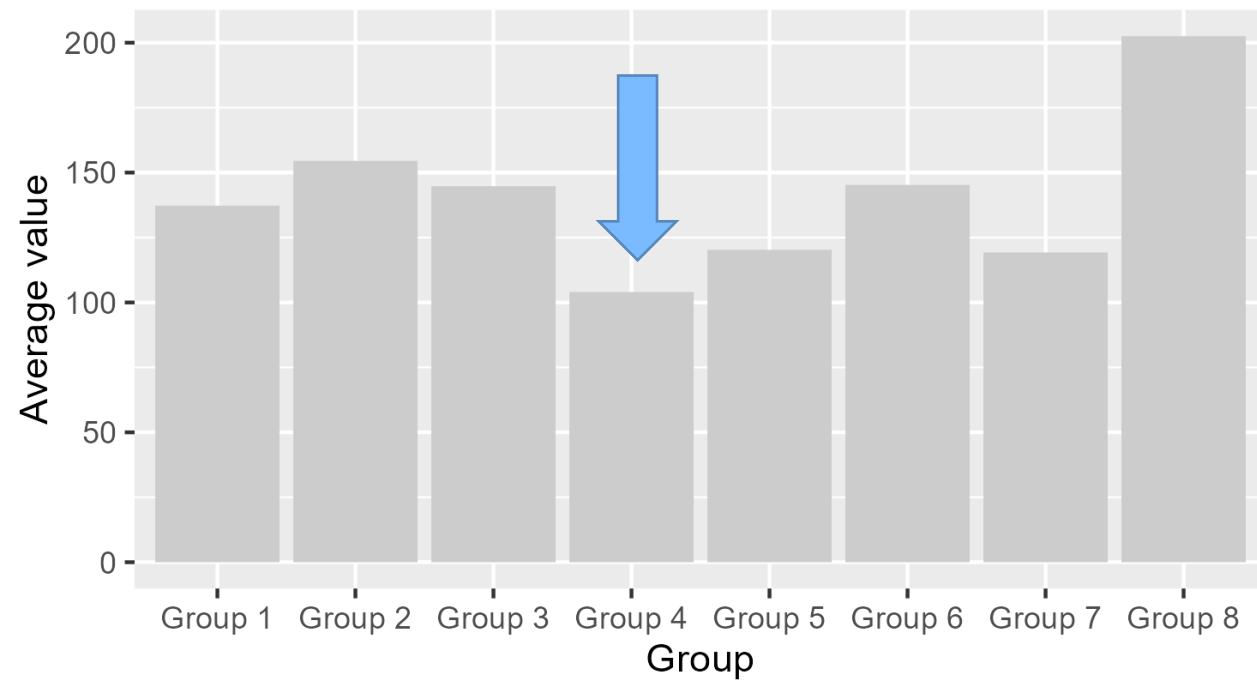
Four methods

(2) Linguistic inquiry and word count (LIWC);

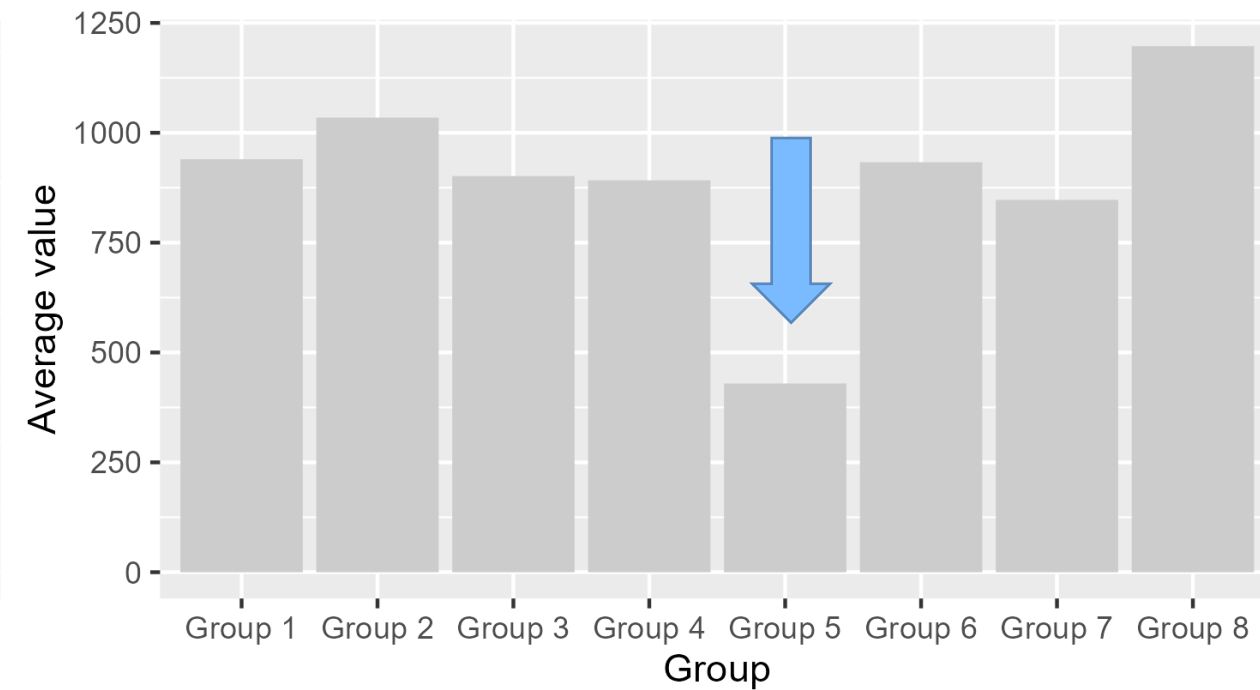
- Further opportunities
 - Pronoun use: self or collective orientation of a person in a group
(e.g. Atabek & Yildiz, 2010; Yazdi-Amirkhiz et al., 2014)
 - Word count for measuring the conversational engagement
(Tausczik & Pennebaker, 2010)

Distribution of participation (between)

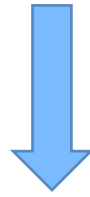
Utterances Count



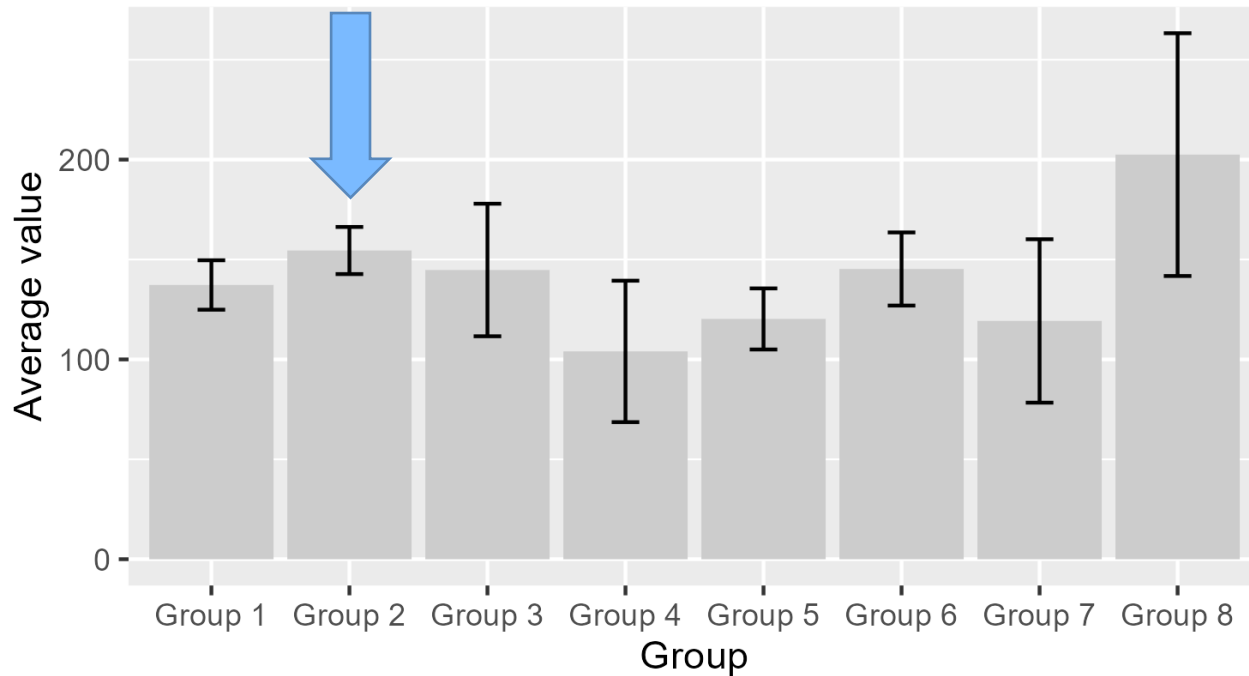
Word Count



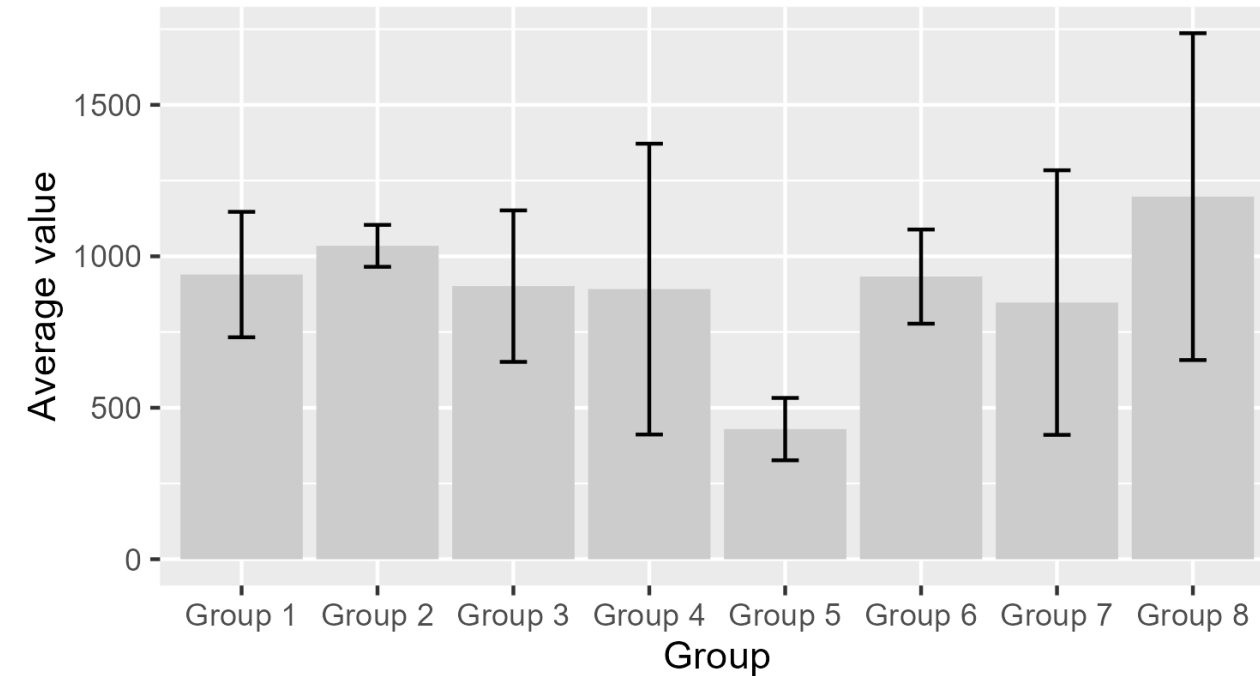
Distribution of participation (within)



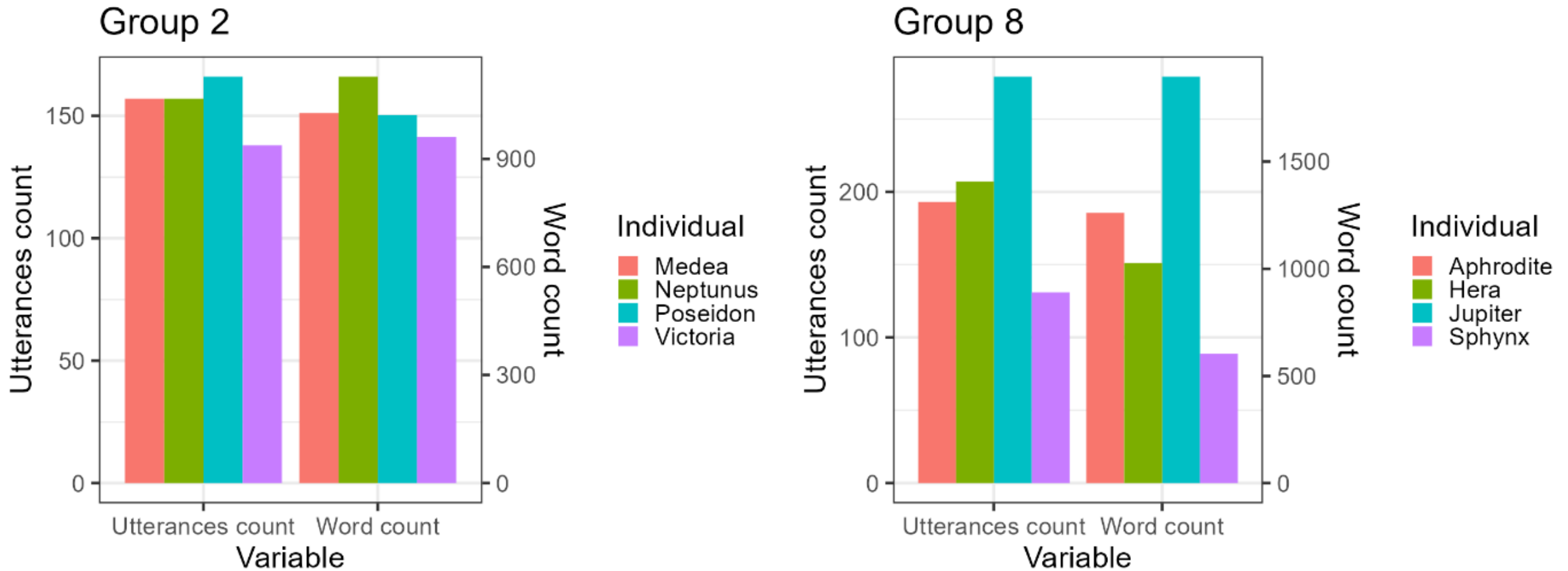
Utterances Count



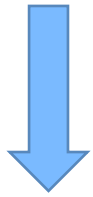
Word Count



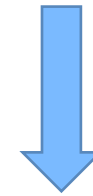
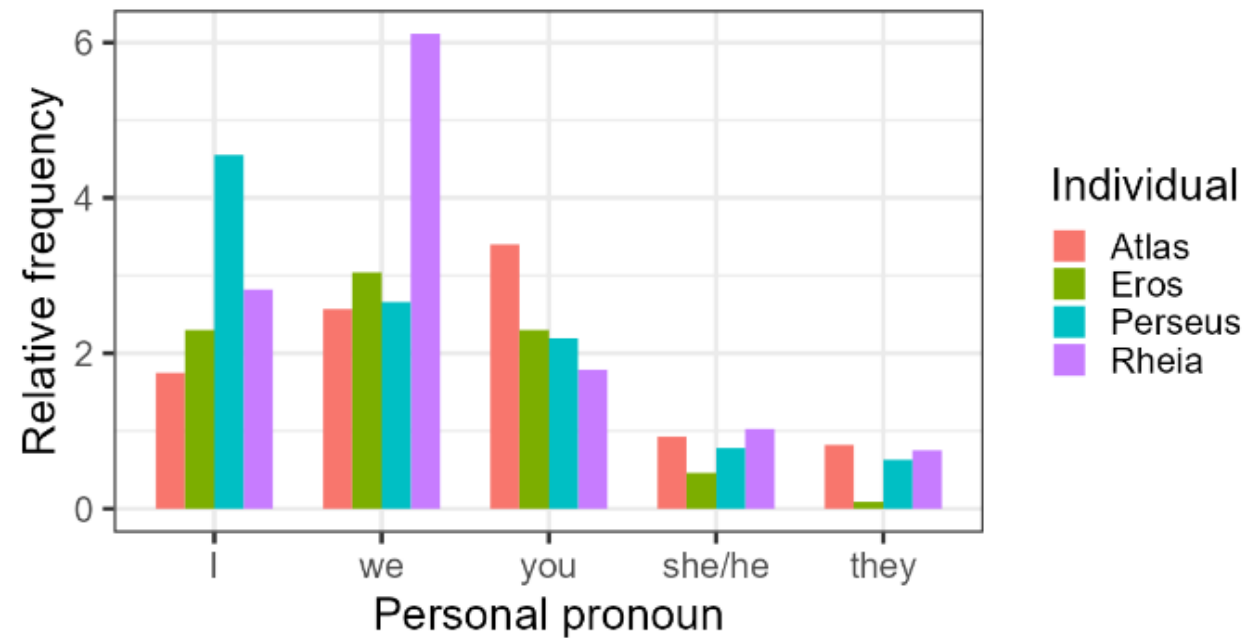
Distribution of participation (within)



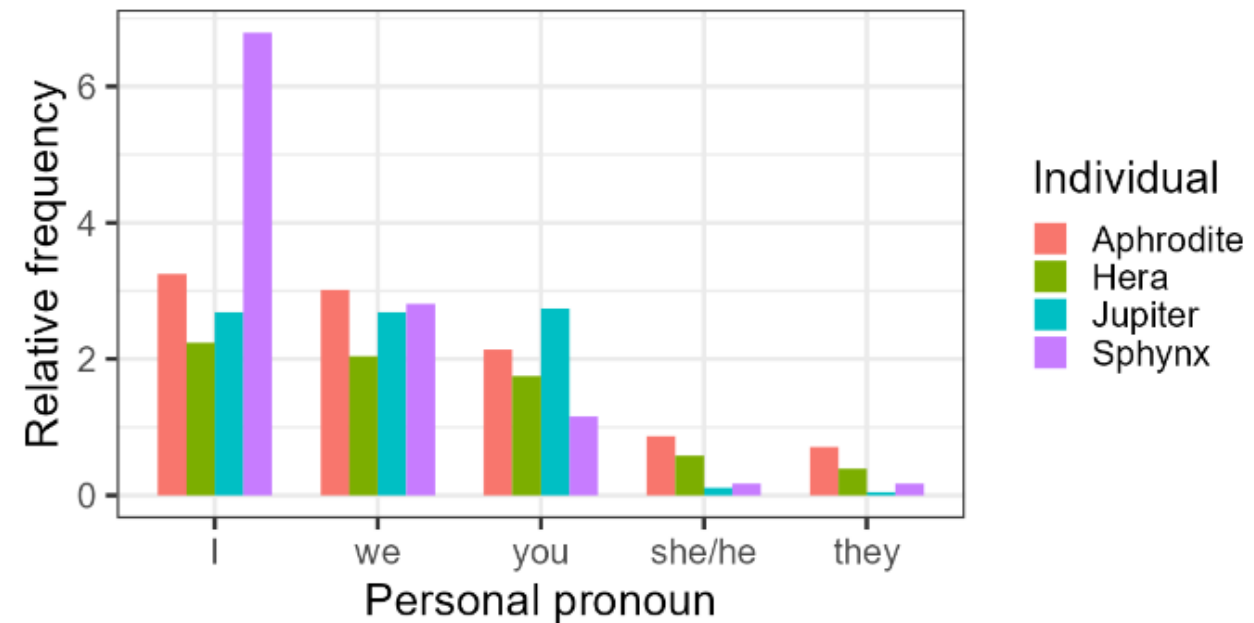
Positioning (through pronoun use)



Group 1



Group 8



Discussion & Conclusion

Conclusion

Importance of diversifying assessment in collaborative learning

Various ways of assessment and feedback for collaborative learning

Integration of various validated questionnaires for peer-feedback

Various ways of teacher-led formative assessment, but not always feasible

Importance of visualization of data for feedback

Shift towards system-led feedback or hybrid forms of feedback

Emerging research on assessment/feedback through observational data

Sources

Sources

