Epistemic challenges and emotional scaffolding:

Multimodal analysis of engineering students' group discussions on wicked problems

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EMOTE: The (Un)Emotional Engineer — Emotional Positioning and Scaffolding in Teaching and Learning about Wicked Sustainability Problems (2021-2024)

Rough outline

Background

- expansive learning theory
- epistemic challenges in learning with wicked problems
- emotional scaffolding & emotions in higher education

Multimodal analysis & results

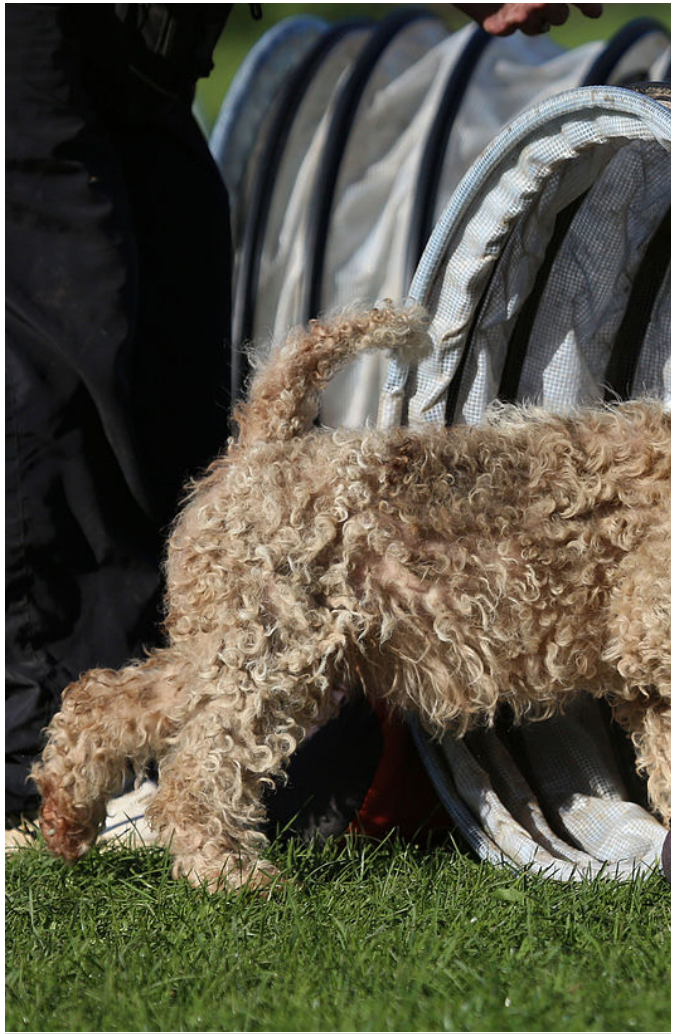
An attempt to make sense of the results

Discussion (but feel free to ask questions anytime)

Theory: Expansive learning

a prerequisite for dealing with wicked problems

- Socio-cultural theory: Learning in and through social interaction
- Cultural-historical-activity theory (CHAT): Learning as resolving tensions in an activity system (e.g., a work place)
- Introduces a third metaphor for learning
  - Sfard 1998: Learning as **acquisition** or **participation**
  - Engeström 2016: Learning as ***co*-creation** of new knowledge, visions, processes, artefacts, agency, … : “learning what is not yet there”



Analytic concepts

Epistemic challenges in learning with wicked problems

- Lack of knowledge
- Uncertainty/unknowability
- Ambiguity/value conflicts
- Limits of rationality
- Context dependence

<u>Secondary challenges:</u>

- Risk of failure/losing face
- Lack of time/resources

(Holmén & Lönngren, forthcoming; Lönngren, 2017)

“Stages” of epistemological development

Absolute knowing	Knowledge is certain; focus on knowledge acquisition & “correct” reproduction
Transitional knowing	Some knowledge is uncertain, authority can be unreliable; focus on understanding
Independent knowing	Knowledge is mostly uncertain; relativism: everyone creates their own truths; focus on establishing subjective views
Contextual knowing	Knowledge is contextual, judged based on evidence applicable to context; focus on criteria for making choices despite uncertainty

(Baxter-Magolda, 1992; Owens, 2020)

Educational scaffolding

Based on socio-cultural theory: focus on learning in interaction between teacher and student (or among students)

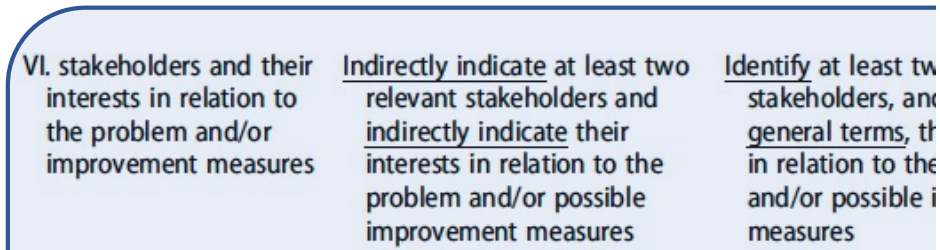
- Temporary support, allows learners to perform tasks they would not be able to do on their own, “zone of proximal development.”
- Gradual transition to more independent learning, “fading”
- 3 types: cognitive, metacognitive, affective/emotional

(van de Pol et al. 2010, Wood et al. 1976)

Why cognitive scaffolding is not enough

+ Clarifies expectations
+ Provides structure for task
+ Triggers reflection on specific issues
+ Facilitates self-assessment

- Tames the process (checklist)
- Divides the task into isolated parts
- Reduces creativity/personal meaning making



VI. stakeholders and their interests in relation to the problem and/or improvement measures	Indirectly indicate at least two relevant stakeholders and indirectly indicate their interests in relation to the problem and/or possible improvement measures	Identify at least tw stakeholders, an general terms, th in relation to the and/or possible i measures

Example: Detailed assessment rubric for written reflection on how to deal with the wicked problem of Dengue fever in sub-Saharan Africa

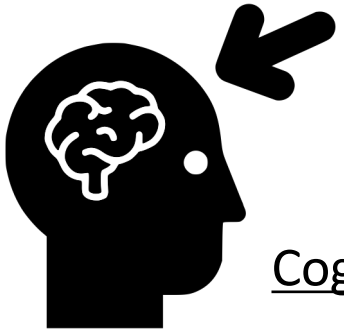
"the strong cognitive scaffolding ... may have provided affordances for learning how to use … and to understand the criteria in the rubric, while … limiting affordances for learning to use a holistic, flexible and creative approach when addressing WPs."

(Lönngren, Adawi, & Svanström, 2019)

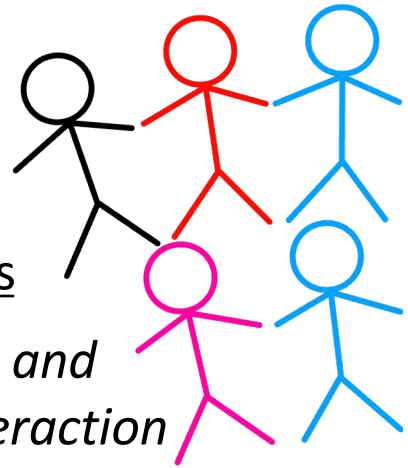
Emotional scaffolding

- Aims to **construct emotional conditions** that can facilitate desired learning
- Distributed across time, space, artefacts, people, …; e.g.:
  - validating/normalizing experiences, reassuring, challenging, …
  - “emotional life belts”: water bottles, framework, post-its, task, …
  - convergence: “emotional rest”
  - connection: handing over material to teacher

(Holmén & Lönngren, forthcoming)



What are emotions?



Cognitive appraisal theories

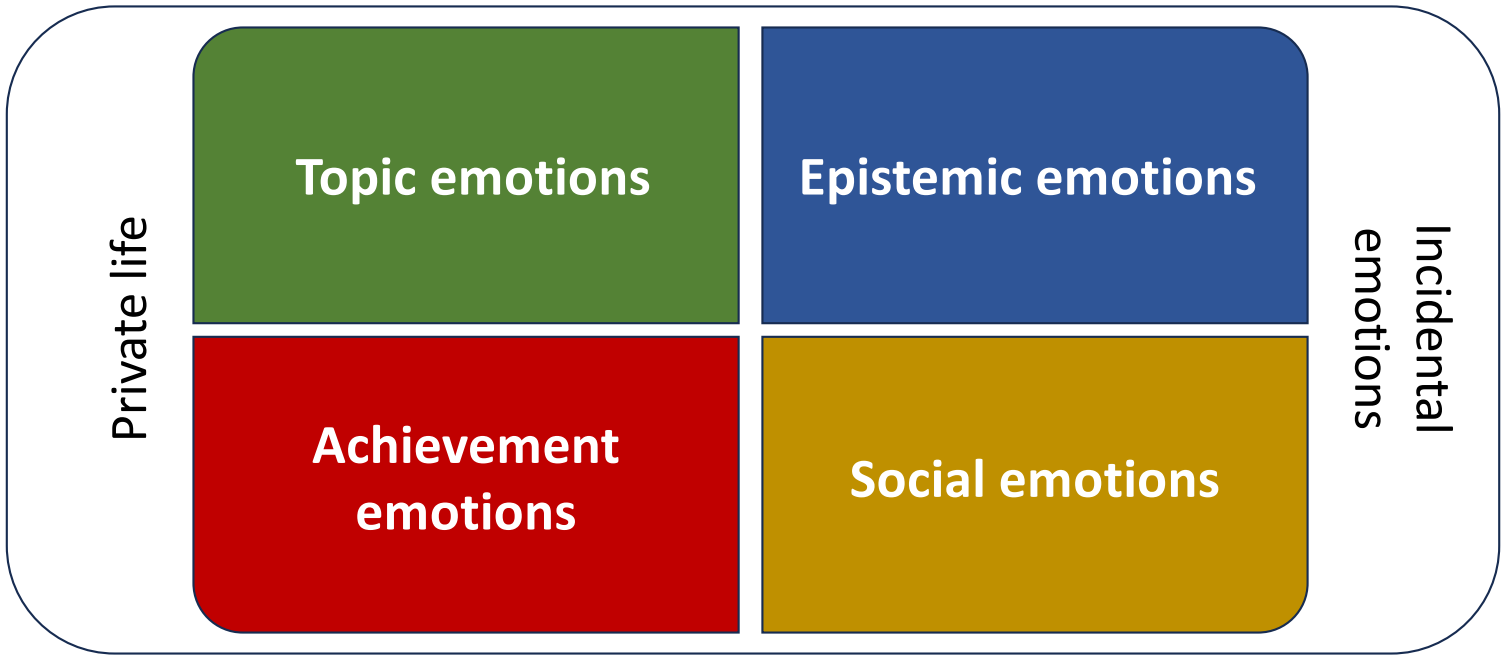
- Emotions are e*xperienced and expressed by individuals*
  - Based on how the individual values objects or processes
- Corresponds to everyday understanding of emotions in many Western cultures
- Research: analyze what is *inside participants' heads*

Social interaction theories

- Emotions are *expressed and interpreted in social interaction*
  - Relationships influence who expresses which emotions, and how emotions are interpreted
  - Expressed emotions influence social interaction
- Research: analyze *interaction*

Lönngren, Direito, Tormey, & Huff (2023). Emotions in engineering education. In Johri (Ed.), *Intern. Handbook of Eng. Ed.*

Emotions in higher education ("academic emotions")

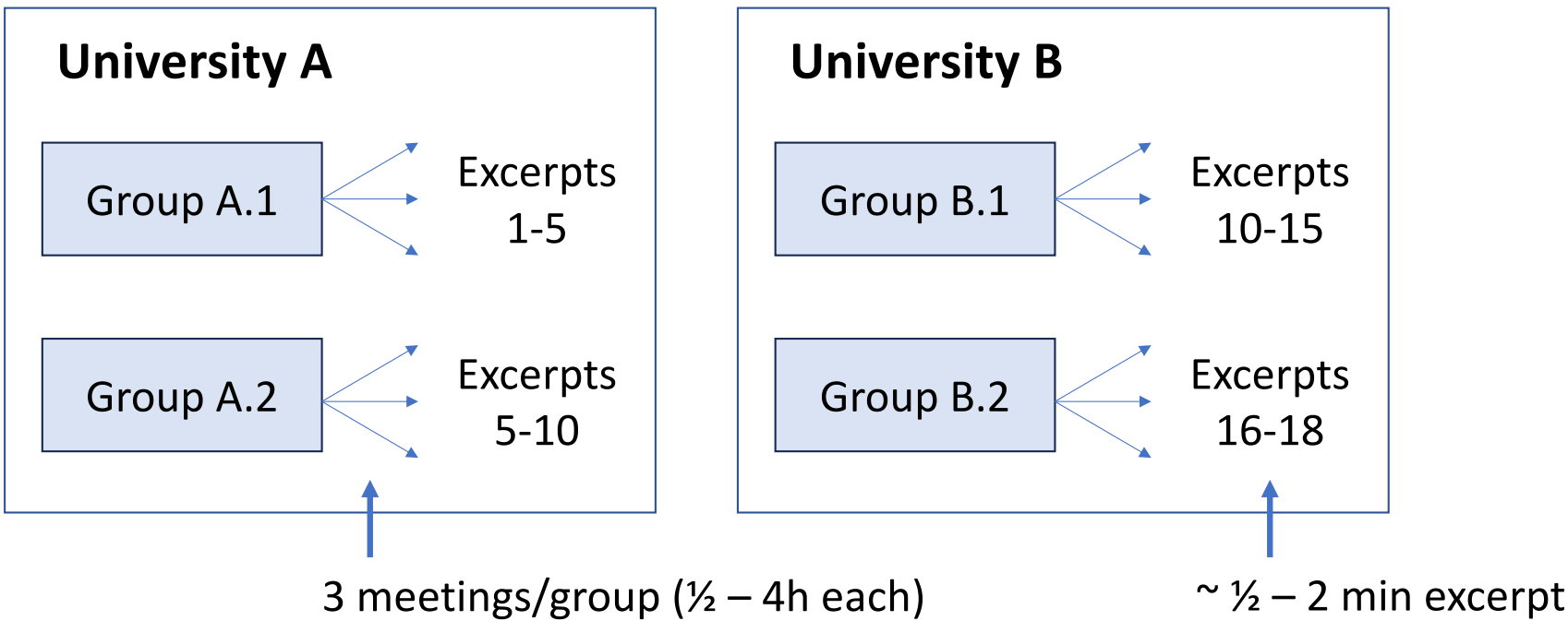


(Pekrun, R. & Linnenbrink-Garcia, L. 2014)

Research questions

1. What emotions do students express when they face challenges in expansive learning?
2. How can emotional expressions facilitate and/or hinder expansive learning?
3. How can emotional scaffolding contribute to creating emotional conditions that facilitate expansive learning?

Empirical data:
Video-recorded student group work on wicked problems



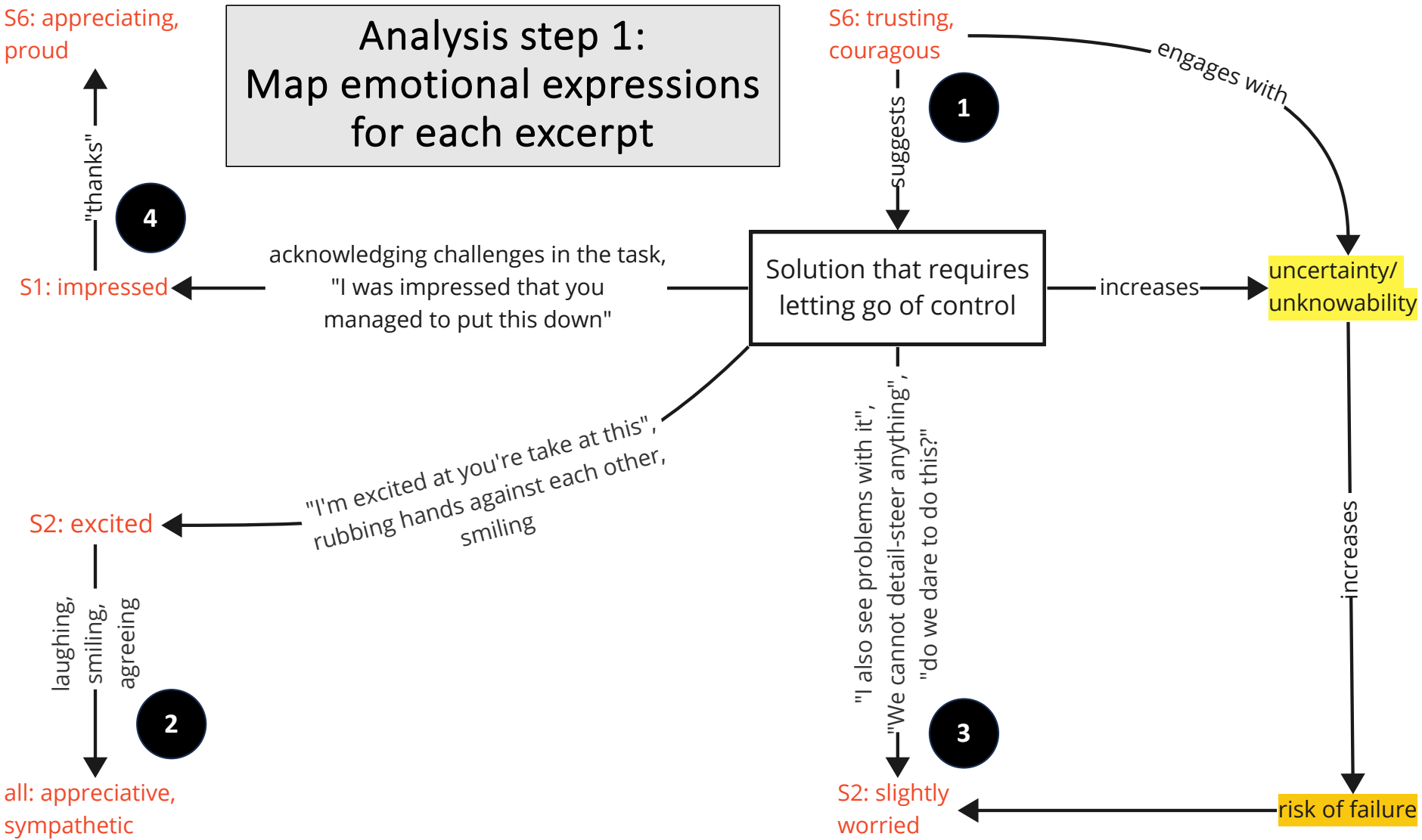
Multimodal analysis:
Mapping emotional expressions and their objects

Separately for each excerpt

1. Map emotional expressions during excerpt
2. Narrative description

Combine maps for all excerpts

3. Map emotional expressions for each analytic concept
4. Organize analytic concepts based on expressed emotions


Analysis step 1:
Map emotional expressions for each excerpt
S6: appreciating, proud
"thanks"
4
S1: impressed
acknowledging challenges in the task, "I was impressed that you managed to put this down"
Solution that requires letting go of control
S6: trusting, courageous
suggests
1
engages with
increases
uncertainty/ unknowability
increases
risk of failure
"I also see problems with it", "We cannot detail-steer anything", "do we dare to do this?"
3
S2: slightly worried
"I'm excited at you're take at this", rubbing hands against each other, smiling
S2: excited
laughing, smiling, agreeing
2
all: appreciative, sympathetic

Analysis step 2:
Narrative description for each excerpt

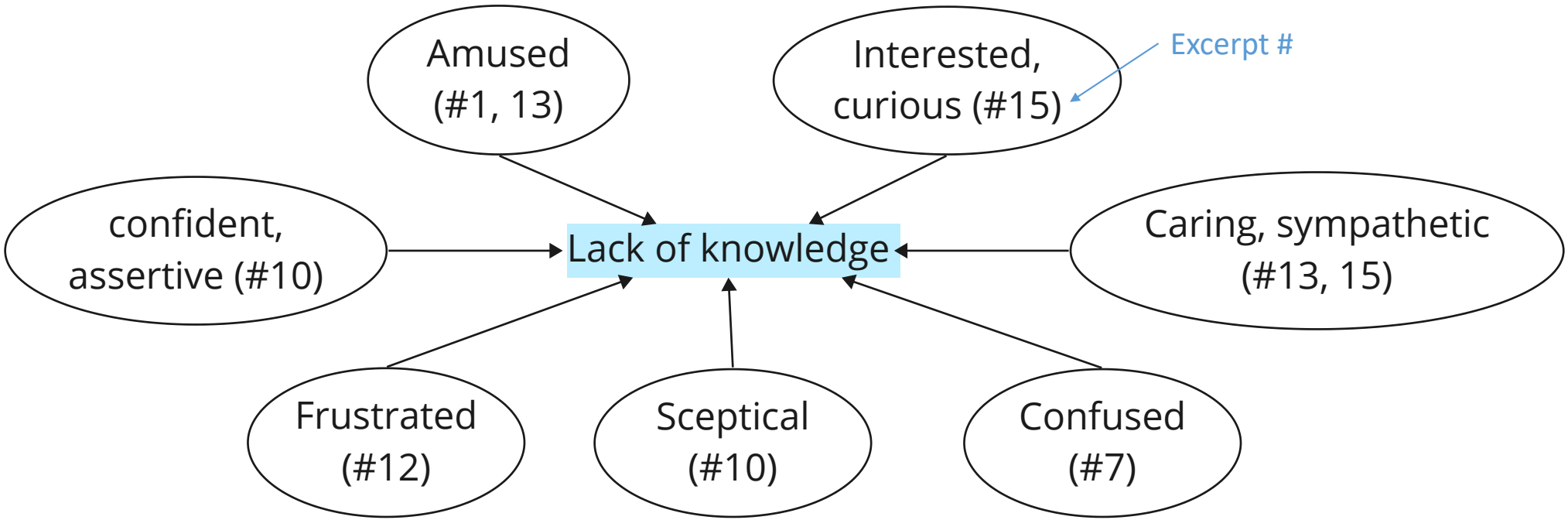
Emotions | Objects of emotion | Analytic concepts | Narrative descriptions

+ key insights

+ possible emotional scaffolding

frustrated, dismissive	difficult content	risk of failure/loosing face	svårt att mäta subjektiva värderingar, kan leda till misslyckanden om man försöker. dels utmaningar att förstå ords innehåll, kan inte riktigt skilja på vad som är ett ords innehåll och vad som är inneboende svårigheter i uppgiften (Att mäta subjektiva värderingar). De uttrycker frustration och nedlåtande attityd mot uppgiften, att det är flummigt och inte går att mäta, vilket minskar risken för att tappa ansiktet för det är inte deras fel utan uppgiften som är flummig/svår. de andra... flera i frustration, men också de som skrattar med dem som är frustrerade och skämtar med dem och förstärker ännu mer, då minskar de ännu mer risken att misslyckas.	* u
appreciating, accepting, indifferent	descriptions, explanations	limits of rationality	de pratar om att det är svårt att mäta subjektiva värderingar och så validerar dem varandra i det. sedan är det någon som säger att det vore bra om det fanns metoder men tre i gruppen ganska överrens om att det finns inte. fjärde studenten lägger fram ett förslag på hur man skulle kunna göra så tar dem inte upp det heller. de verkar vara mer frustrerade över att det är så svårt att mäta subjektiva värden, samtidigt som de också skrattar och skämtar att det är så svårt, vilket på något sätt lättar frustrationen över att det är så svårt och minskar risken för att de ska tappa ansiktet. de bekräftar både. de validerar både när de säger att "vi behöver metoder för att mäta", "det är svårt att mäta" och när de försöker beskriva metoder för att mäta. De tar sig aldrig an knäckfrågan, utan bekräftat motsatserna samtidigt. det borde finnas, eller försöker beskriva sätt. samtidigt "det är svårt" och "det går inte". de tar sig inte an att de håller med båda delarna. knäckfrågan är egentligen, går det att mäta eller inte, när går det, varför går det inte, varför går det. de håller bara med. jo det är svårt, jo det vore bra. hänger ihop med risk of failure, bekräftar varandra oavsett vad de säger, utan att tycka det är ngt problem. rent praktiskt hade varit bra om göra de uppmärksamma på motsatserna. men det kankse också hade hjälpt om man byggt trygghet i gruppen, trygga i varandra. samtidigt säger de inte emot varandra. flum ;inte dem som gör fel utan systemet som är fel. känslor riktas validerande mot varandra. fastnar i samspelet som emotional object of learning, tar sig inte an wickedness.	* * * * lo

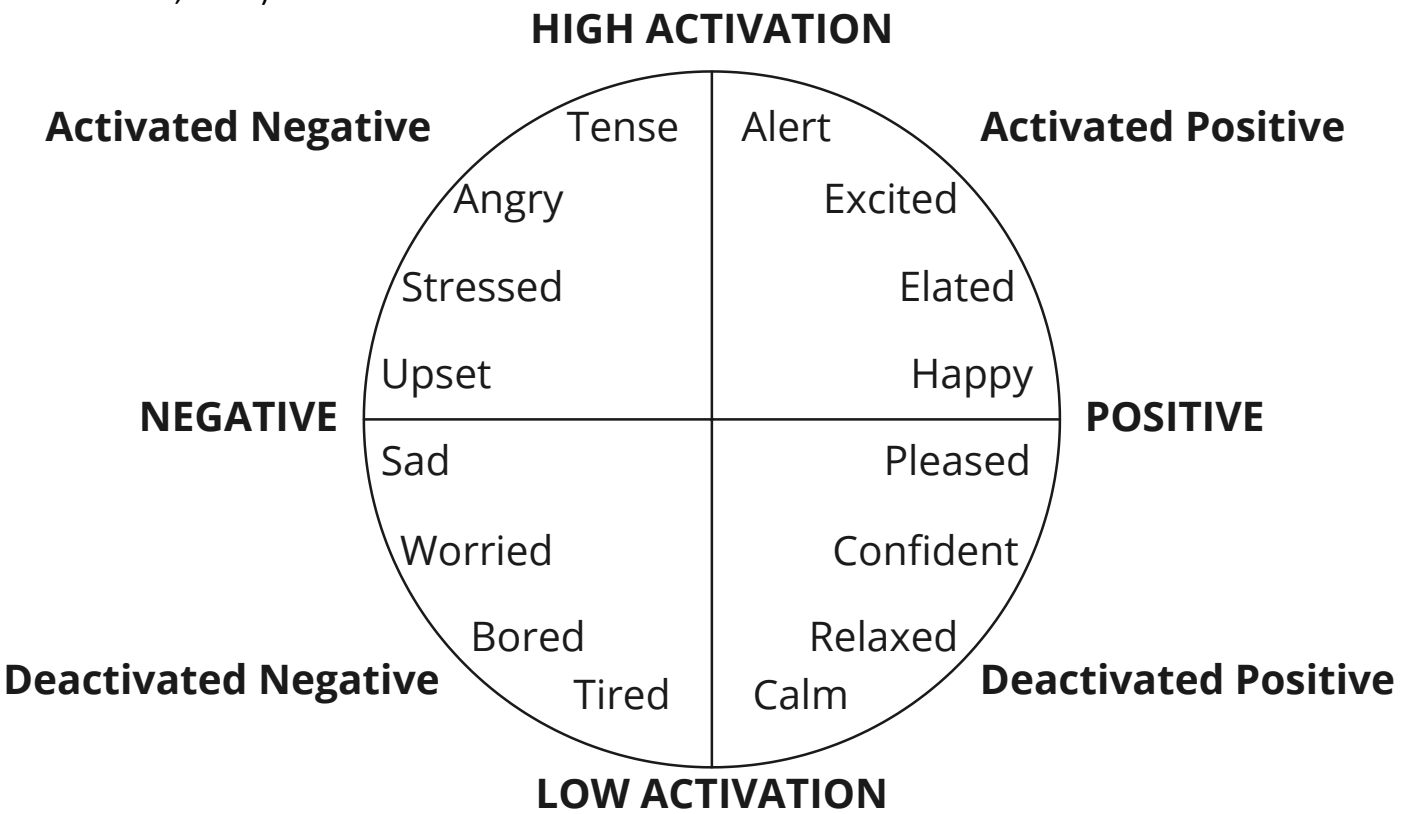
Analysis step 3:
Map emotional expressions towards each analytic concept



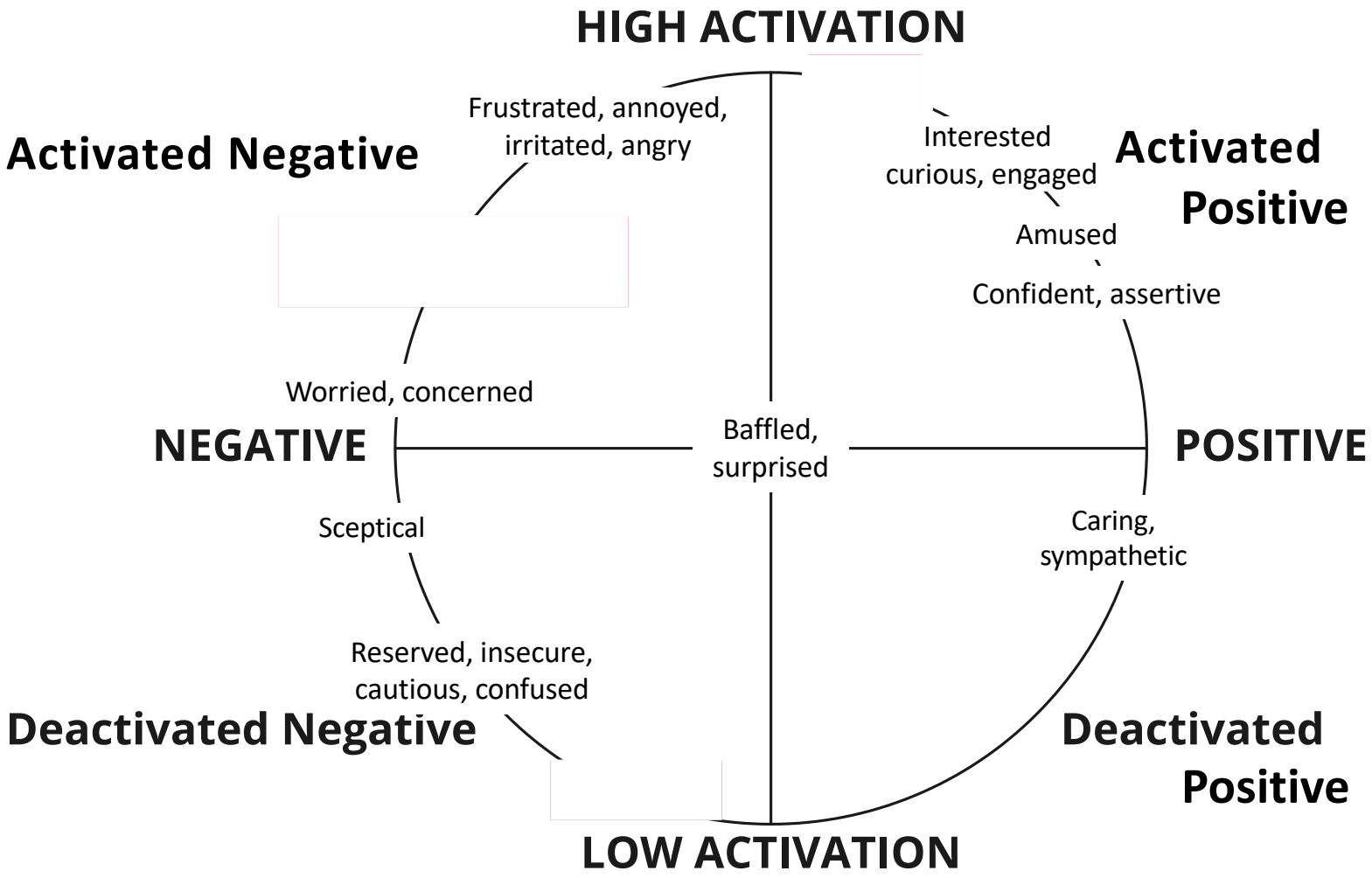
(Holmén & Lönngren, forthcoming)

Circumplex model of emotions

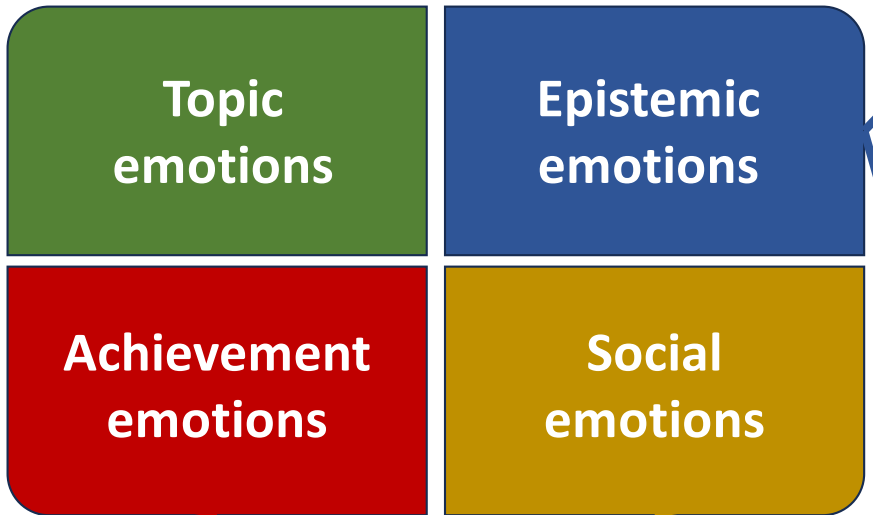
(adapted from Barrett & Russell, 1998)



Analysis step 3:
Map emotional expressions towards each analytic concept (example: lack of knowledge)



Analysis step 4:
Organize analytic concepts based on expressed emotions



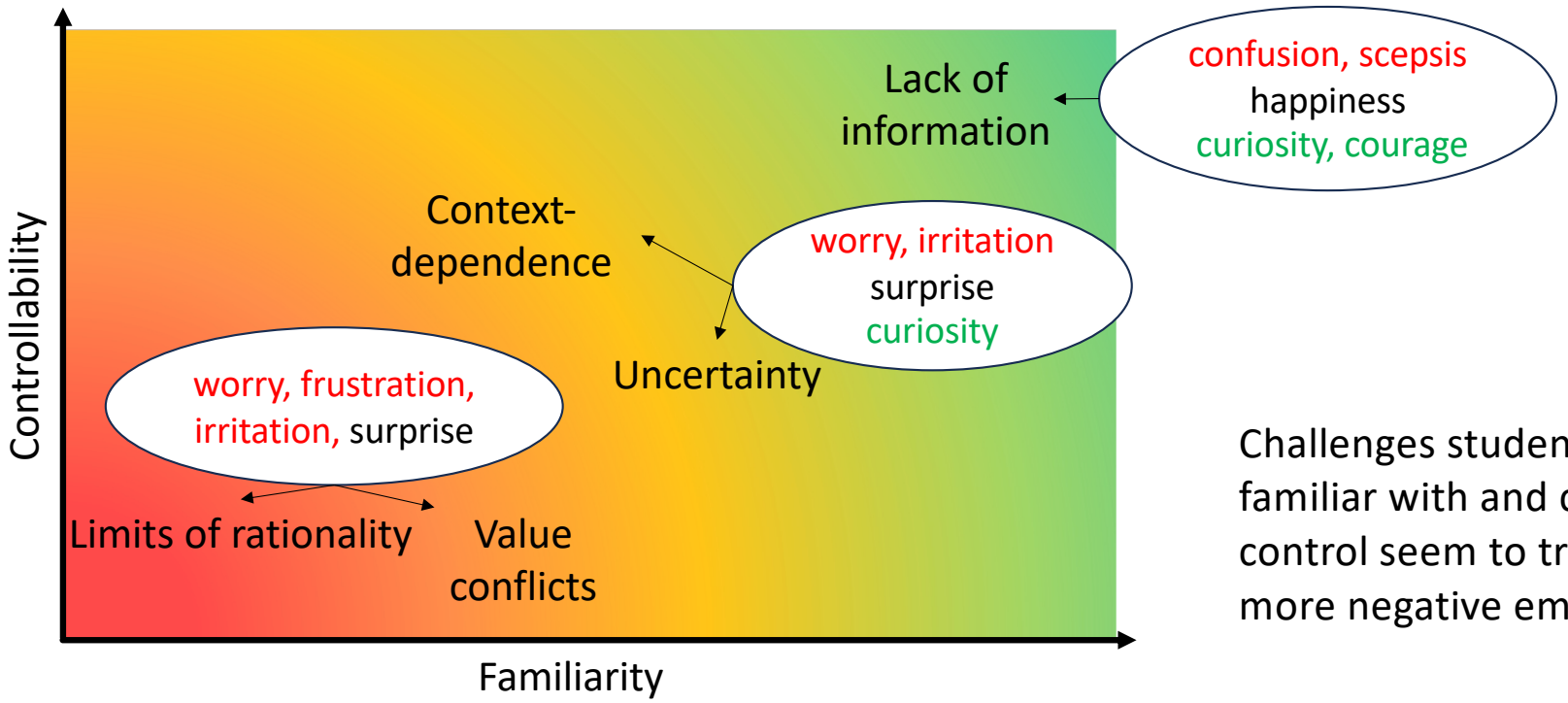
Cluster 1: Epistemic challenges with high controllability
- Lack of knowledge
- Context dependence

Cluster 2: Epistemic challenges with low controllability
- Uncertainty/unknowability
- Ambiguity/value conflicts
- Limits of rationality

Cluster 3: Achievement/social challenges
- Risk of failure/losing face
- Lack of time/resources

(Holmén & Lönngren, forthcoming)

Analysis step 4:
Organize analytic concepts based on expressed emotions



Challenges students are not familiar with and cannot control seem to trigger more negative emotions

(Holmén & Lönngren, forthcoming)

How can emotional scaffolding contribute to creating emotional conditions that facilitate expansive learning?

The same types of emotional interaction can facilitate *and* hinder learning!

- Laughter: easing tensions vs avoiding engagement
- Confidence: facilitating persistence vs shutting off alternative approaches
- Worry: continue exploring vs avoiding engagement
- Excitement: facilitating engagement vs avoiding critical reflection
- …

(Holmén & Lönngren, forthcoming)

An attempt to make sense of the results:

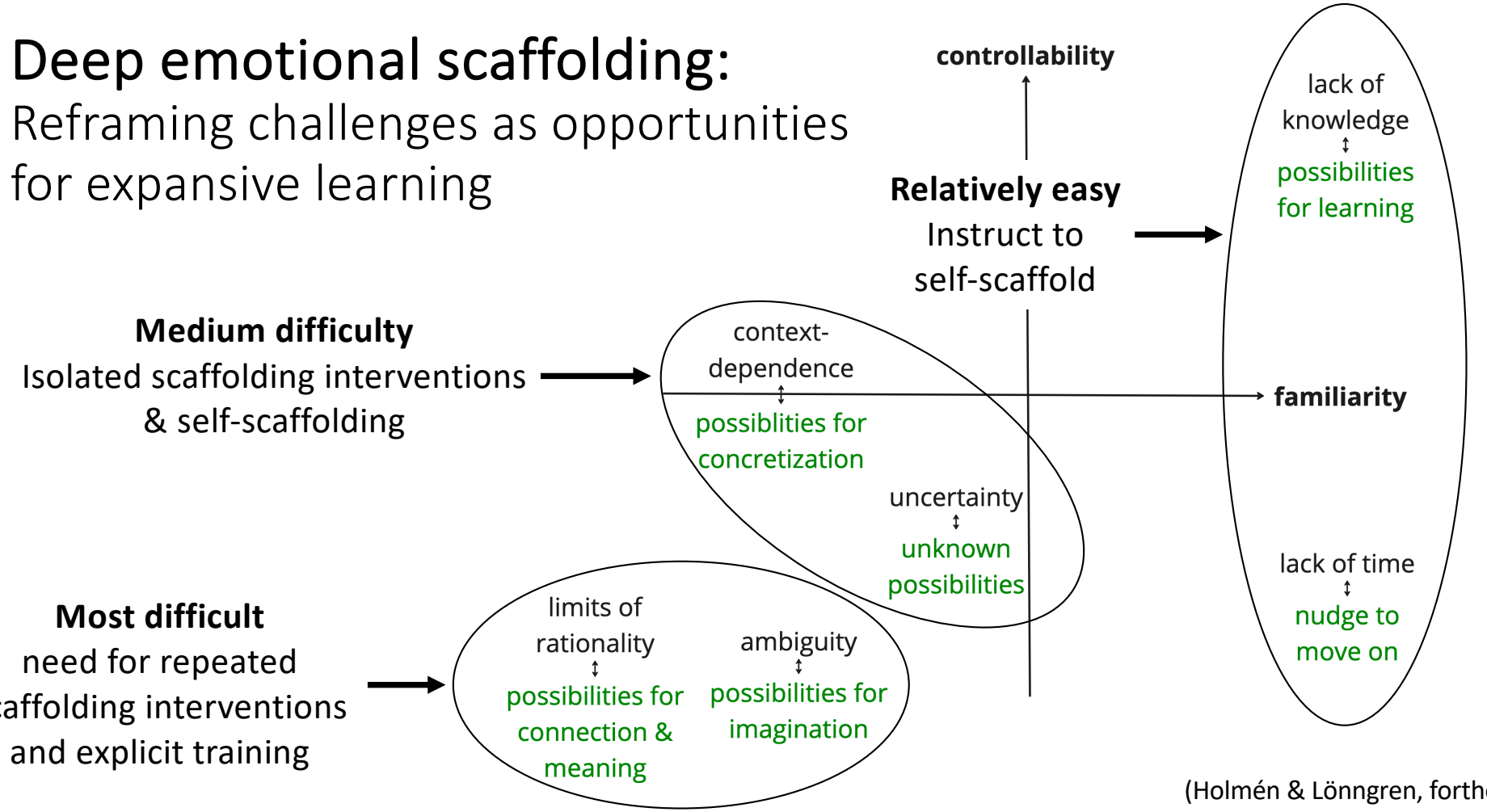
Emotional scaffolding as targeting different leverage levels

Level	Example strategies
Superficial	• Have fun • Stimulate engagement with the topic/task/group
Shallow	• Reassure • Reduce perceived risk of failure/losing face
Medium	• Help manage/reinterpret negative emotions • Stimulate positive emotions • Normalize experience of challenges
Deep	• Reframe challenges as opportunities • Stimulate positive visions for the topic/learning/societal development/professional identity/…

(Holmén & Lönngren, forthcoming)

Deep emotional scaffolding:

Reframing challenges as opportunities for expansive learning



(Holmén & Lönngren, forthcoming)

Summary

RQ1. What emotions do students express when they face challenges in expansive learning?
All sorts, but challenges students are not familiar with and cannot control seem to trigger more negative emotions.

RQ2. How can emotional expressions facilitate and/or hinder expansive learning?
The same types of emotional interaction can facilitate *and* hinder expensive learning, depending on the specific learning situation.

RQ3. How can emotional scaffolding contribute to creating emotional conditions that facilitate expansive learning?
Emotional scaffolding can target different levels. Deep scaffolding can aim to reframe challenges as opportunities for expansive learning and co-creating positive futures.

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