

FRAM-as-imagined and FRAM-as-done: Aligning the gap by learning from users

Tarcisio Saurin, Niklas Grabbe, Riccardo Patriarca,
Arie Adriaensen, Yuxuan Zhao

Background

- **Growing number** of FRAM users across several sectors
 - Adaptations and additions to the method
 - Complementary and perhaps conflicting interpretations
- Likely **gap** between FRAM-as-imagined and FRAM-as-done
 - **As imagined** = five steps set out by Erik Hollnagel
 - **As done** = implementation by a given user; always unique to some extent

Objectives

- (1) To uncover tacit knowledge from FRAM users
- (2) To assess differences between beginners and experts
- (3) To identify opportunities to improve FRAM guidelines and education

Method – three stages

(1) Survey questionnaire: 37 respondents

- Clarity of 14 key FRAM concepts and ideas

Clarity and Understanding of Key FRAM Concepts

For each topic or statement, please rate how clear it is for *FRAM beginners* and for *FRAM experts* using a 5-point scale (1 = strongly disagree, 5 = strongly agree). If you cannot judge, select "N/A".

Feel free to add comments about each topic (not mandatory).

1. The difference between a FRAM model and an instantiation is clear. *

Please choose the appropriate response for each item:

	1 - strongly disagree	disagree	neither	agree	5 - strongly agree	N/A
Beginners	☐	☐	☐	☐	☐	☐
Experts	☐	☐	☐	☐	☐	☐

- Self-rated FRAM expertise (1, 2 for beginner; 3, 4, 5 for expert)
- Free-text field to expand the responses

(2) Follow-up interviews

- 17 interviewees
- Approximately 15 hours of recordings
- Not limited to the survey questions, new issues emerged

(3) Data analysis (preliminary)

- Descriptive statistics
- Thematic analysis using ChatGPT 5.5 model for the identification and grouping of emergent themes (inductive approach)

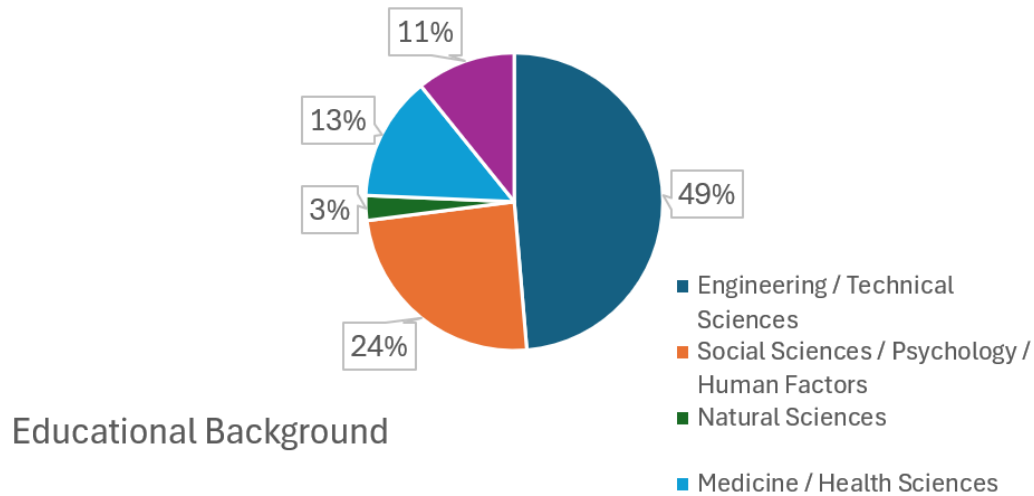
PRELIMINARY RESULTS

Survey results – profile of respondents

- Self-rated expertise (mean) = 3.7 (1 for beginner and 5 for expert)
 - 37 respondents
 - 30 responses regarding clarity for experts and 37 regarding clarity for beginners
- 8 years using FRAM (mean), and 60% has taught FRAM courses



Survey results – profile of respondents

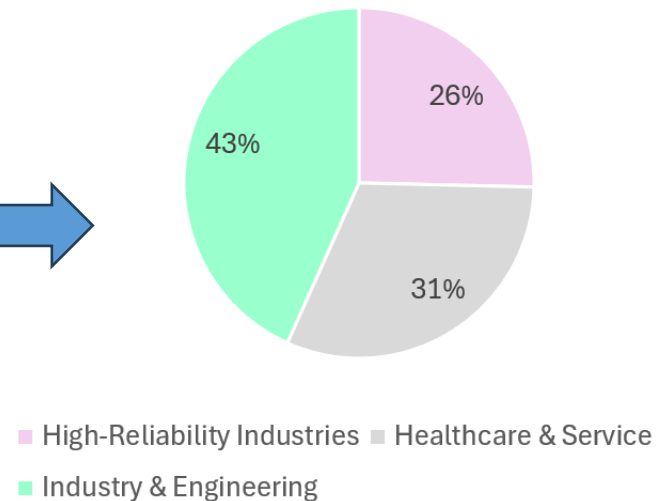


Industry and engineering: manufacturing, construction, software

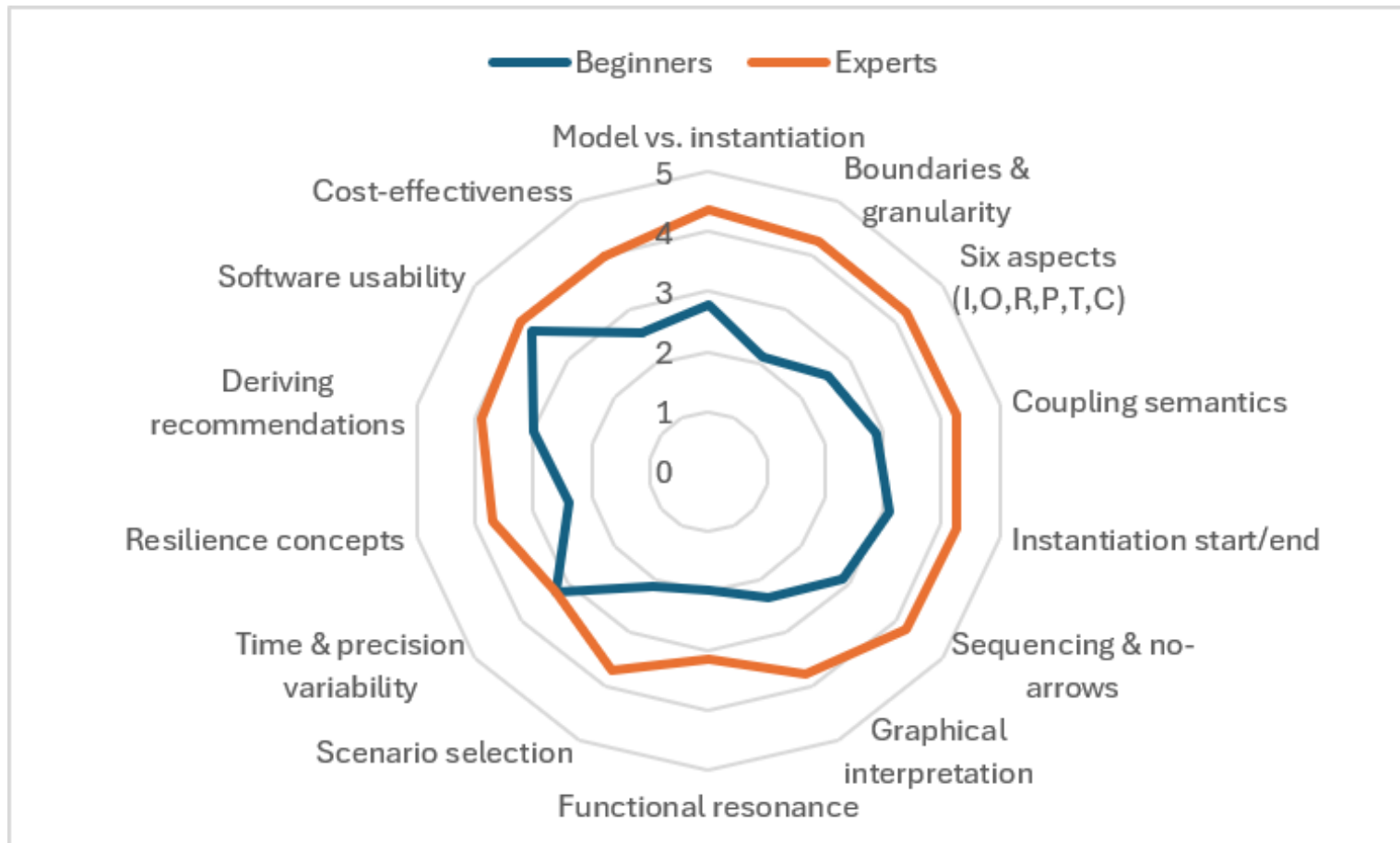
HRO: aviation, oil & gas, nuclear, space, military



Main applications



Survey – means for clarity

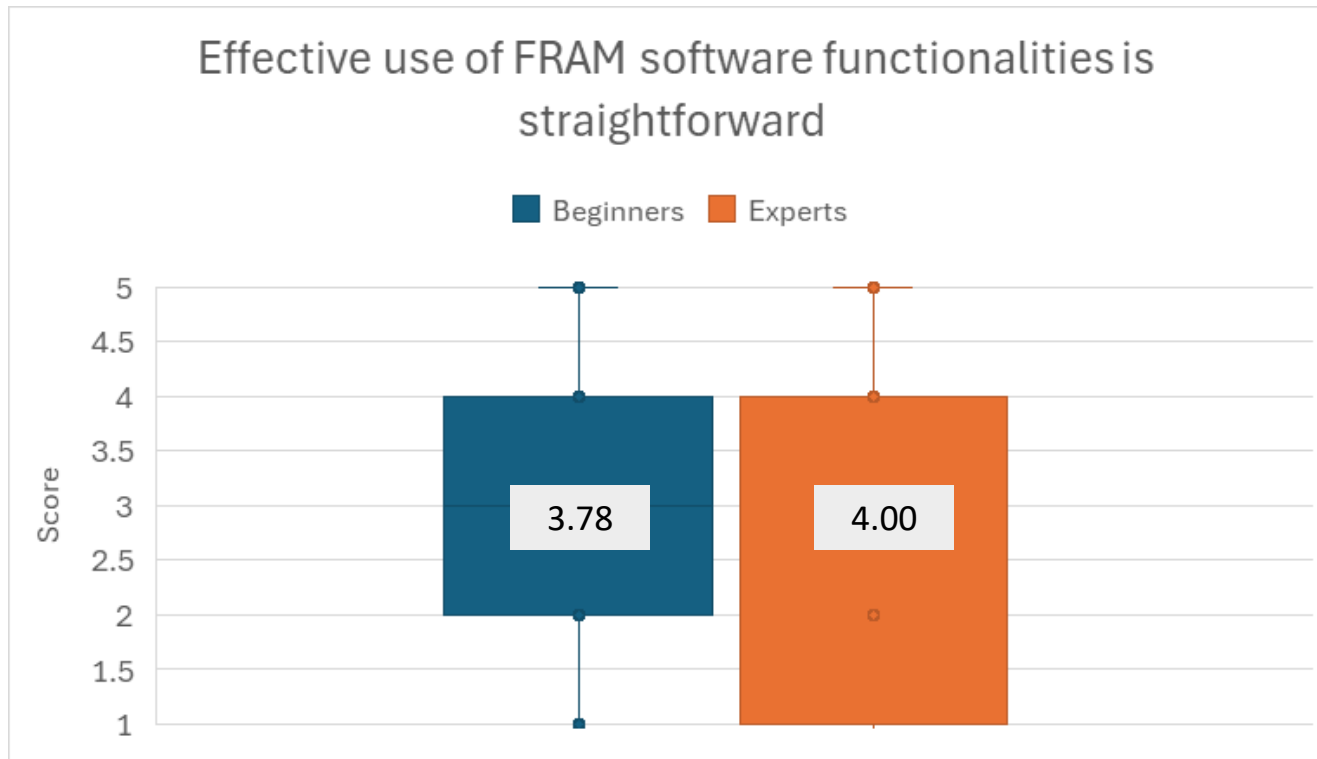


Overall M clarity for beginners = 2.70
Overall M clarity for experts = 3.93

Clear for both experts and beginners (just 1 question)

*This is **okay**, at least for now, although there is room for improvement*

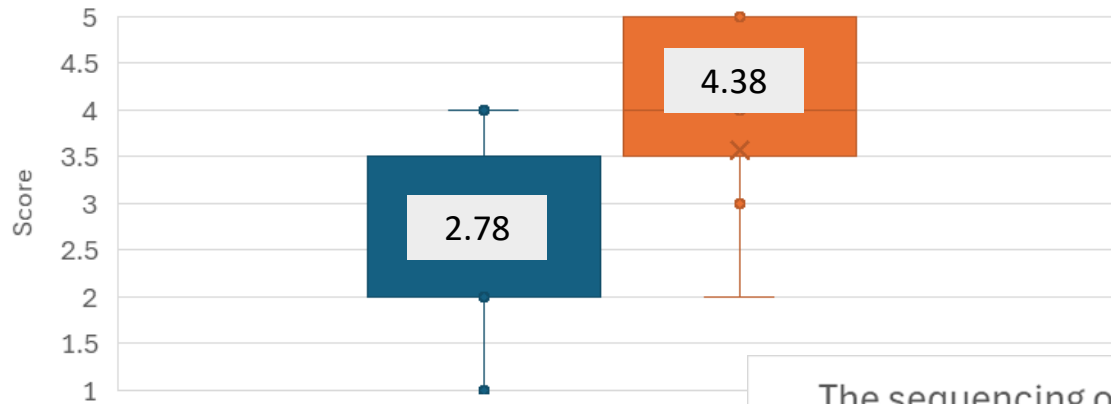
***Can it change** with new softwares?*



Clear for experts and unclear for beginners (9 questions)

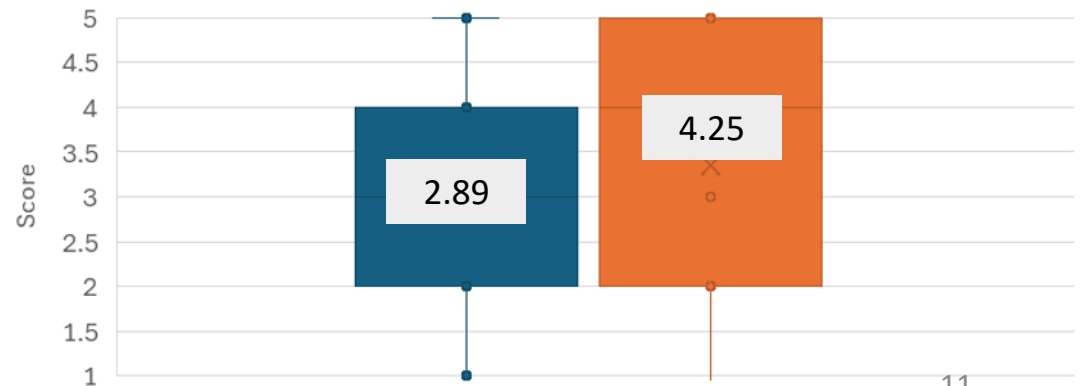
The difference between a FRAM model and an instantiation is clear

■ Beginners ■ Experts



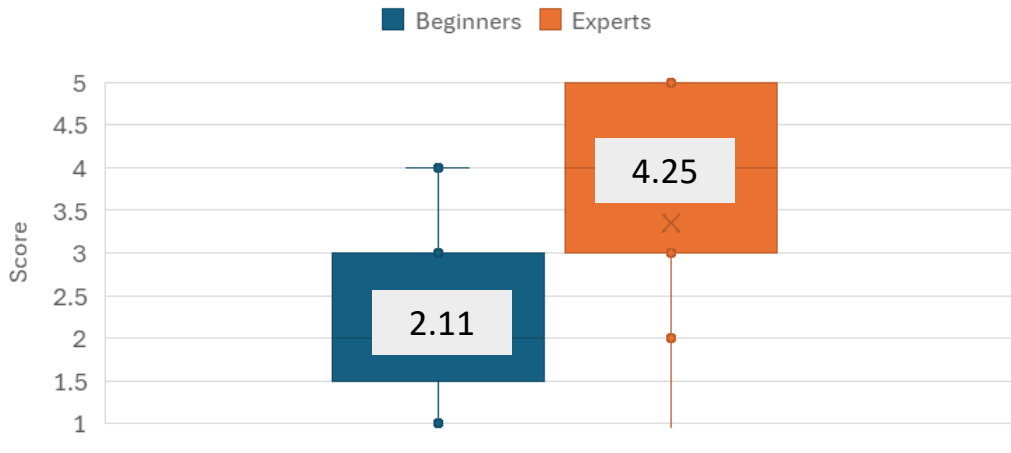
The sequencing of functions and the idea of no arrows on connections are easy to understand

■ Beginners ■ Experts



Clear for experts and unclear for beginners

Defining model boundaries and the granularity of functions is straightforward



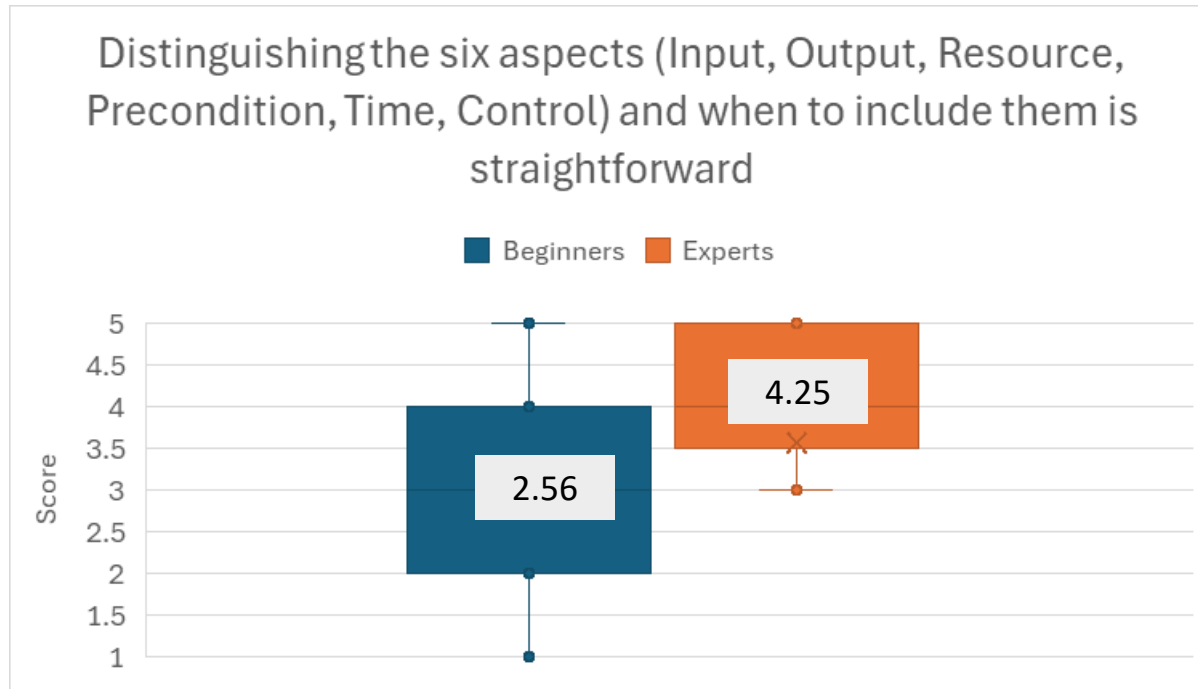
For granularity decisions, most experts rely on experience, readability, and the modeling purpose

"FRAM models should fit on a PowerPoint slide"

*Defining the **purpose and scope of the analysis (step 0)** is crucial*

Unclear scope leads to uncontrolled model growth and inconsistent granularity

Clear for experts and unclear for beginners



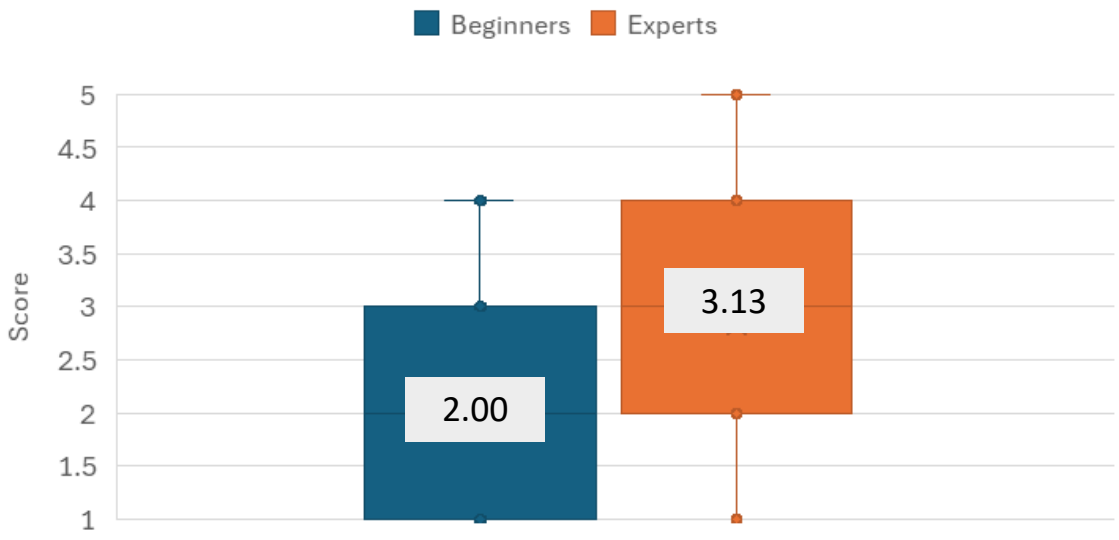
Why are these topics unclear for beginners?

How can we make them clearer?

Revision of handbooks, papers, alongside practical examples?

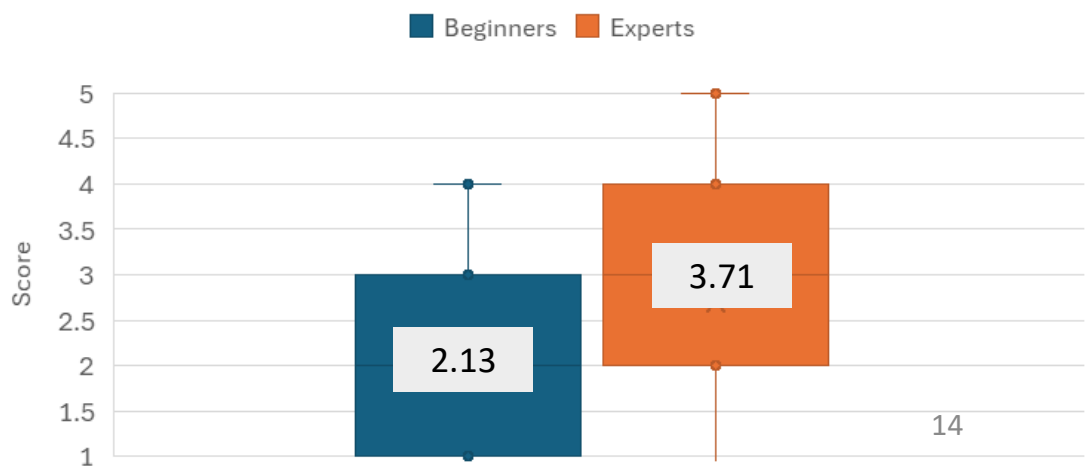
Difficult for both experts and beginners (4 questions)

Identifying instances of functional resonance is clear



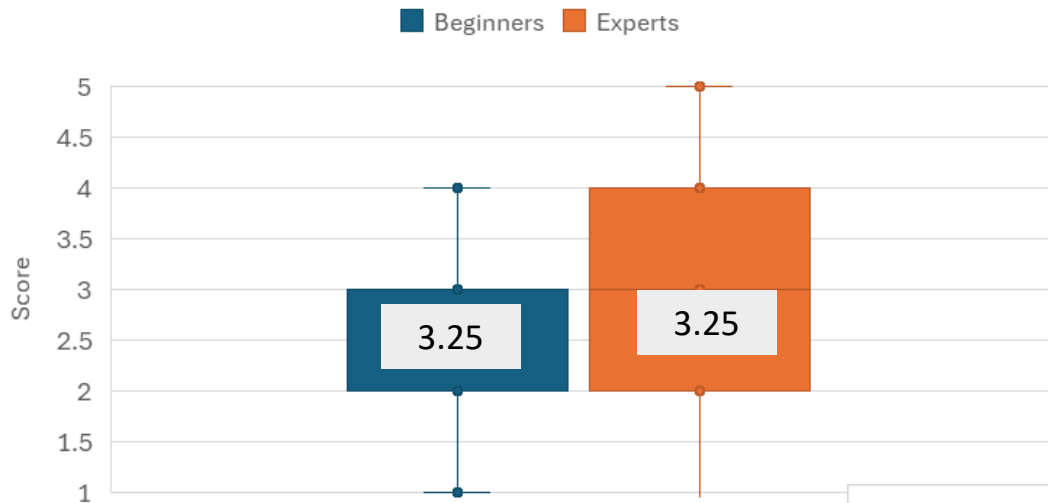
“discussing functional resonance in healthcare settings often loses the audience”

Choosing relevant scenarios and deciding how many instantiations are enough is straightforward



Difficult for both experts and beginners

Assessing time and precision output variability is clear



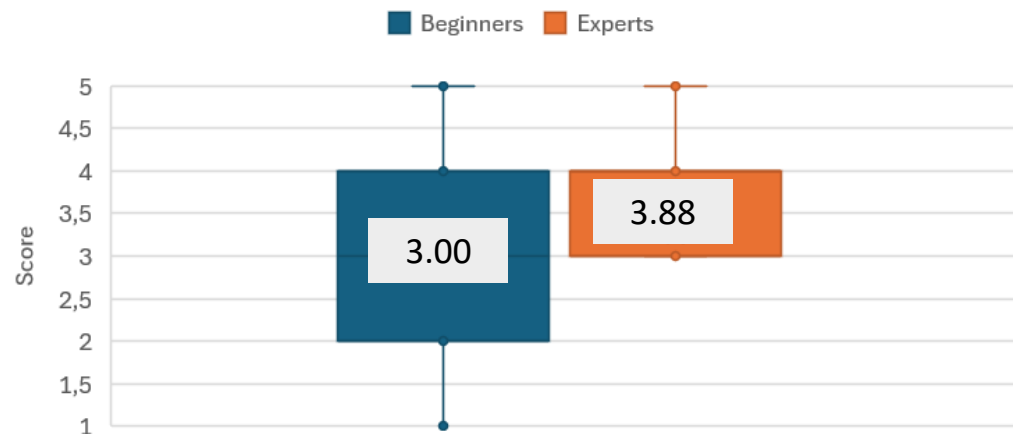
Why is it difficult even for experts?

How can we make it clearer?

*Should we revisit the **key premises** underlying these concepts and steps?*

*Could those who think this is **crystal-clear** help the others?*

Deriving recommendations for system improvement from FRAM modelling is straightforward



PRELIMINARY THEMATIC ANALYSIS

4 themes will be explored next

1. Challenges in operationalizing concepts



- **Variability and functional resonance** are conceptually central but...
 - Practitioners struggle to assess, quantify, and communicate these concepts
 - Most practitioners do not explicitly model functional resonance

These topics appeared as difficult for both E and B in the survey

2. FRAM adaptations and good practices

- Most respondents **do not follow the FRAM steps strictly**
 - It is adapted depending on time constraints, audience, goals, and context



Examples of good practices

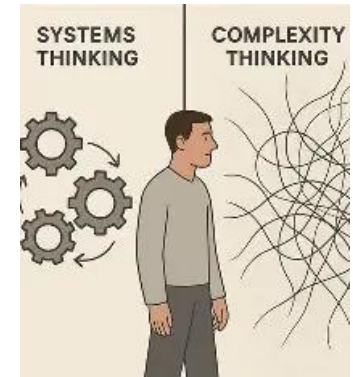
- Developing **WAI models from procedures and compare with WAD**
- **Collaborative low-tech modeling** before transferring to software
- Begin from an **operational “sticking point”** rather than from the entire process
 - The model is then **progressively expanded** backward and forward from that point

[illegible]

- Topic not addressed in the survey***

4. FRAM as an approach for understanding complexity

- FRAM is viewed as a **systems-thinking approach** for understanding WAD, rather than merely a modeling or problem-solving tool
 - **Systems thinking skills** (complexity thinking?) are crucial
- The **FRAM model** is not necessarily the main outcome
 - It is more about the **thinking process** and the learning possibilities



Conclusions

- (1) Substantial tacit knowledge has been **uncovered**
- (2) It can enhance **FRAM guidelines and education** (e.g., emphasis on developing complexity thinking and system modelling skills, repository of good practices)
- (3) Regarding experts versus beginners
 - **Keep what is clear** for both but be aware of the evolving theory and practice
 - **Revise training materials** for what is unclear for beginners – existing knowledge
 - **Revisit assumptions** underlying what is unclear for both – new knowledge

THANKS!