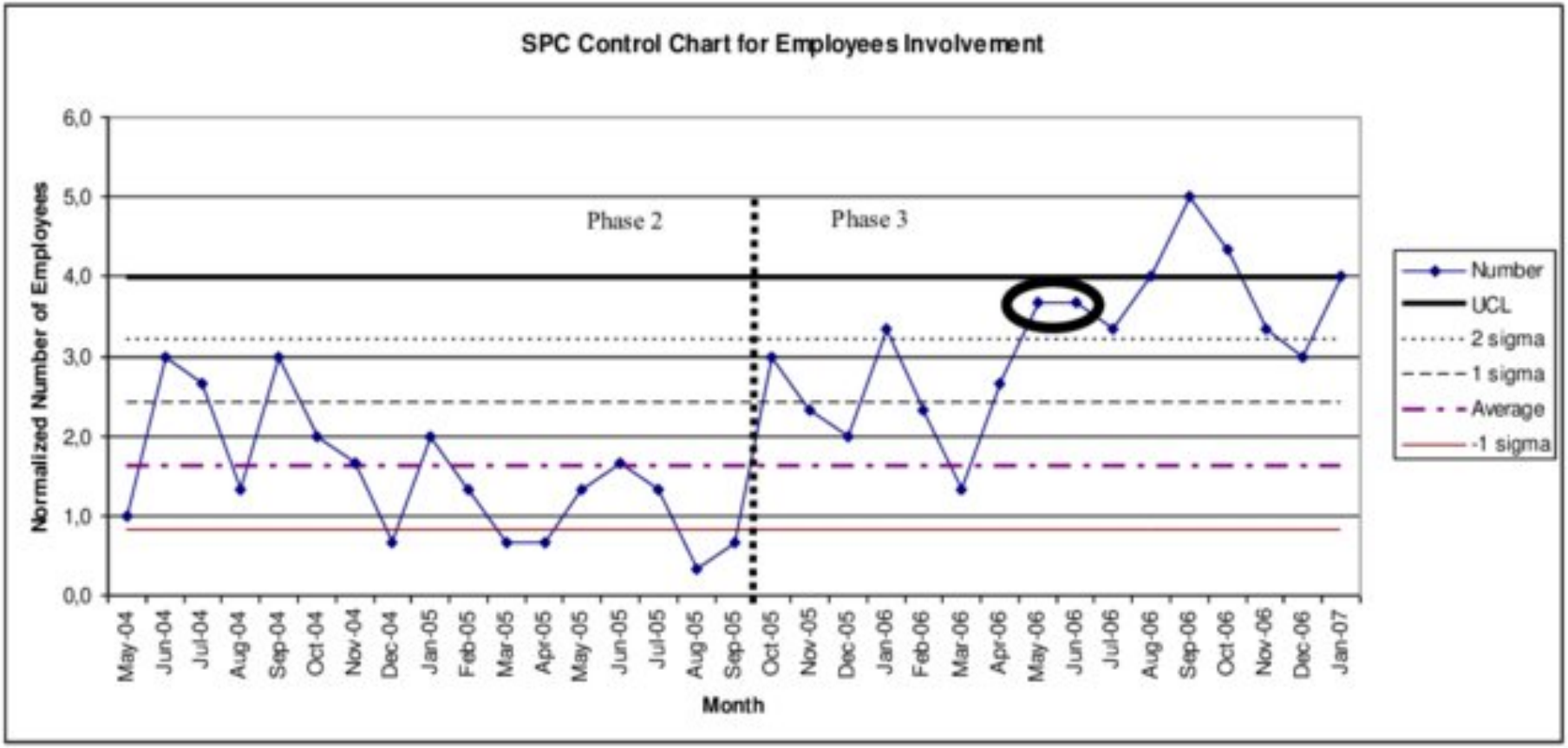
Language for Mathematics in Vocational Contexts

Professional development
Language of tables and graphs
Session 3 (of 3)

Utrecht University

To start with .....



Program

1. Starter
2. Role of communication in vocational situations (+graphs)
3. Examples from the module: rich communicative practices
4. Sharing outcomes of classroom experiment (homework)
5. Analysing student work and reflection
6. Evaluation

Homework

1. **Explore part 1 of the module. Select one of the communicative activities from this part and try this with your students (whole class or small group)**

   Write a brief report: what went well? What problems arose? What improvements would you make to overcome these? Include some examples (audio, video or written) of the work of your students.

2. **Look for examples of communication in vocational settings involving graphs, diagrams or tables.**
   Talk to your vocational colleagues or ask your students about their vocational practice.

3. **Optional:**

   Design a language sensitive line-graph activity fitting your class and try it out. Pay particular attention to the way you want to scaffold discussions

Bring all materials to session 3.

Sharing findings

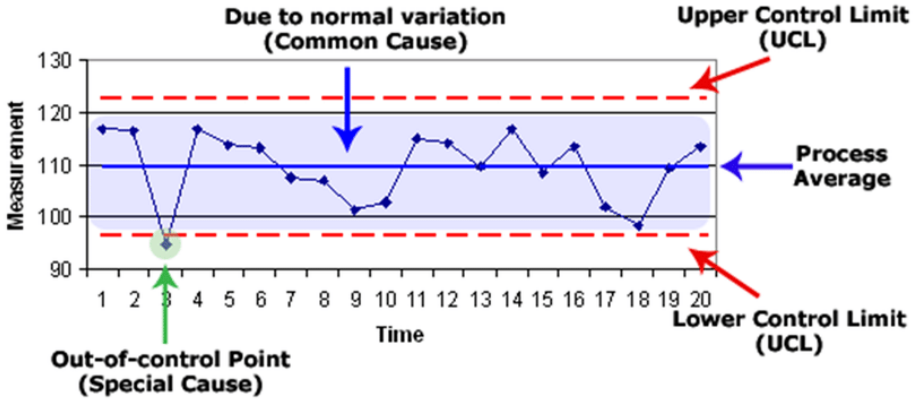
Examples of vocational settings involving tables, graphs diagrams. What type of communication occurs?

- health care

- industry (spc)

- agriculture

- food (preparation)



ESTIMATED FEED NEEDS OF DAIRY CATTLE - 365 days

Milk production		Dry Matter Intake		Yearly requirements*	
				Forage	Grain
lb/yr	lb/day	lb/cow/day	tons/cow/yr	lbs DM	lbs DM
28,000	92	61	11.1	11,133	11,133
26,000	85	55	10.0	10,038	10,038
24,000	79	53	9.7	9,673	9,673
22,000	72	51	9.3	9,308	9,308
20,000	66	47	8.6	8,578	8,578
18,000	60	45	8.2	8,213	8,213
16,000	52	43	7.8	7,848	7,848
Heifers, 1-2 yr	---	20	3.7	6,205	1,095
Heifers, 1 yr	---	12	2.2	3,723	657
Dry cows	---	25	4.6	7,756	1,369

* Values are per animal for 365 days. Assumes 50:50 forage grain for milk cows, and 85:15 for heifers and dry cows

Communicative practices with (vocational) graph & tables

with....	type	aim....	
colleagues			
boss			
assistants/ apprentices			
customers			
.....			

Types of language involved

- language of vocational situation -> specific 'jargon'
- mathematical language (related to graphs, tables)
- everyday language

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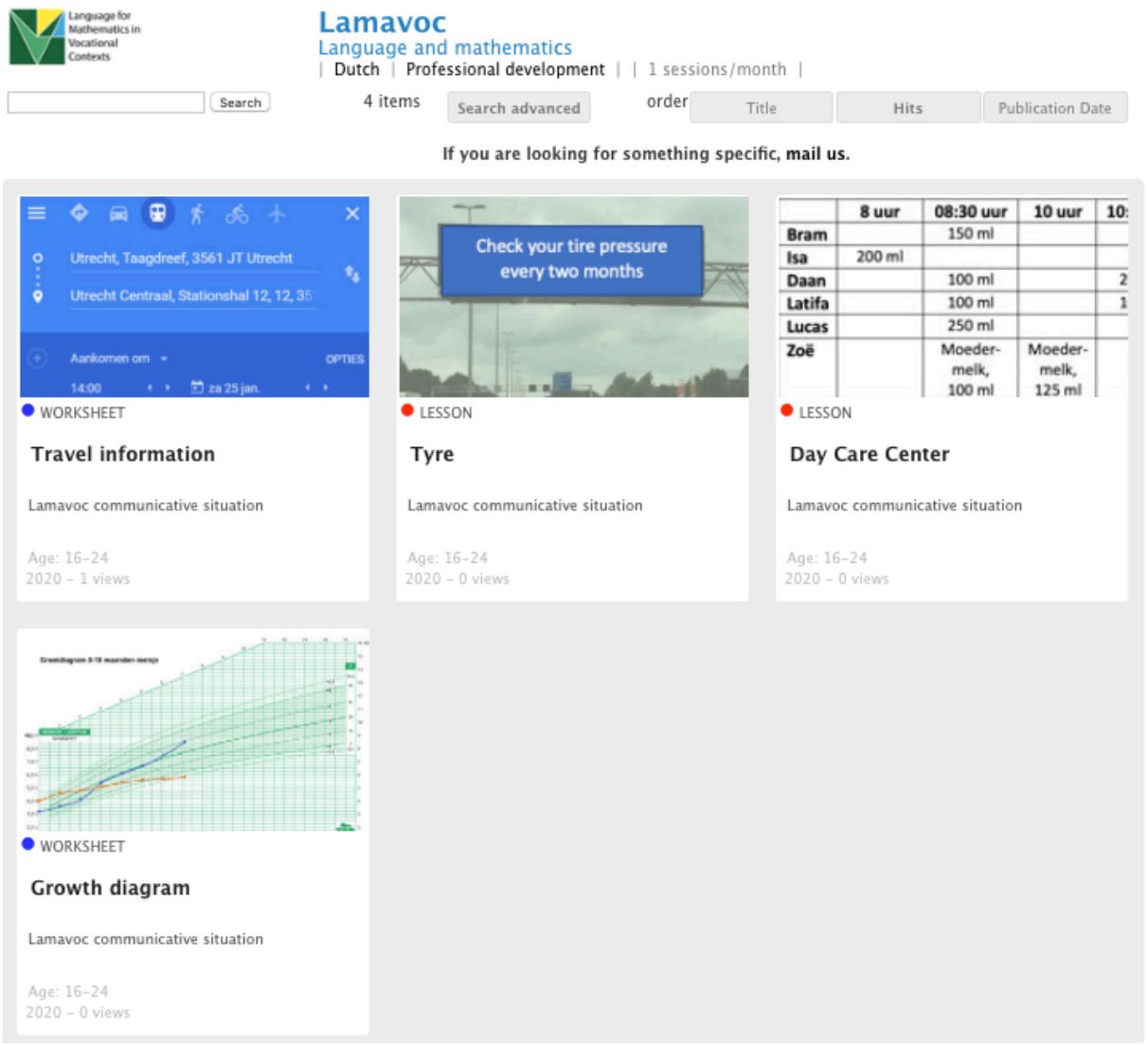
Three communicative situations on graphs/tables



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SITUATIONS	
A	**Tyre pressure** The context of tire pressure is introduced. Students study a large table with data on tire pressure. Next they do an activity in which they act as junior assistants working at a gas station explaining to customers how they can find the correct tire pressure for their car form the table at the gas station. The product is a script which can be used for a video-clip, a podcast or an acted out role-play.
B	**Growth diagrams** A growth chart is used to follow a child's growth over time, for health purposes. Another presentation mode is the table, where you see the weight (and length) of a child every month. The weights of three babies have been recorded every month from their day of birth on. Look at the data in the table. What can you tell about these babies? The students are asked to fulfill the vocational task to advice parents about the growth of their babies. With audio recording of the actual conversations about the growth charts both students and teacher get feedback what the actual role is of the 'language of mathematics'.
C	**Travel information** In using public transport you need knowledge and skills about online information in order to make a plan for your travel. Information is shown in tables most of the times. In this situation you are asked to help elderly people, both interactively and by writing a manual (for your internship at a local government; the manual can also be a short video). You work in pairs or with three students.

Three communicative core tasks

- ***General structure of the tasks***
  - Exploring the context and its language
  - Exploring the mathematical concepts and the mathematical language
  - Preparing the communication (e.g. writing a script)
  - Communicative practice (role-play, podcast, blog/vlog, ...)
  - Reflecting

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Sharing experiences

- Form small groups of teachers who tried the same communication assignments in class

- Share the experiences
  - What went well (for your students)?
  - What were problems? Where these related to language? To mathematics?

- Share among small groups
  - What was similar?
  - What was different?

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Tire pressure - an example

The context of tire pressure is introduced.

Students study a large table with data on tire pressure.

Next they do an activity in which they act as junior assistants working at a gas station explaining to customers how they can find the correct tire pressure for their car form the table at the gas station.

The product is a script which can be used for a video-clip, a podcast or an acted out role-play.

Table

Try to find your car and pressure in the table

TOYOTA				
Prius	1.8 HSD / 1.8 Plug-in	195/65 R 15 H	2,5	2,9
2009►		215/45 ZR 17 Y	2,9	3,3
RAV4	2.0 VVT-i	215/70 R 16 H	2,2	2,2
2006-2013	2.2 D-4D	225/65 R 17 H	2,2	2,2
RAV4	2.0 VVT-i	225/65 R 17 H	2,3	2,3
2013►	2.0 D-4D	215/70 R 16 H	2,3	2,3
	2.2 D-4D	225/65 R 17 H	2,3	2,3
Starlet	1.3i	145/80 R 13 T	2,6	2,6
1990-1999	1.3 GXi	165/65 R 14 T	2,6	2,6
Urban Cruiser	1.3 VVT-i	195/60 R 16 H	2,5	2,5
2009►		205/45 ZR 17 Y	3,0	3,0
Verso	1.6 VVT-i	215/55 R 17 V	2,7	2,6
2007►	1.8 VVT-i	185/65 R 15 H	2,3	2,3
	2.0 D-4D	185/60 R 16 H	2,3	2,3

Analyse student work

Use worksheet 1

- On this worksheet you find three examples of student scripts and calculations for the Tire pressure task.
- Evaluate each example for the requirements of the task.
  - Take into account all aspects: the vocational context, the communicative practice and the mathematics and its languages.
  - You may also use the following guiding questions:
    - What does each group of student appear to understand (of the context, math and the communicative task) ? How can you tell?
    - List errors and difficulties that are revealed by the students' scripts and calculations.
    - What feedback would you give each group?
    - In what way would you support the students working on this task?

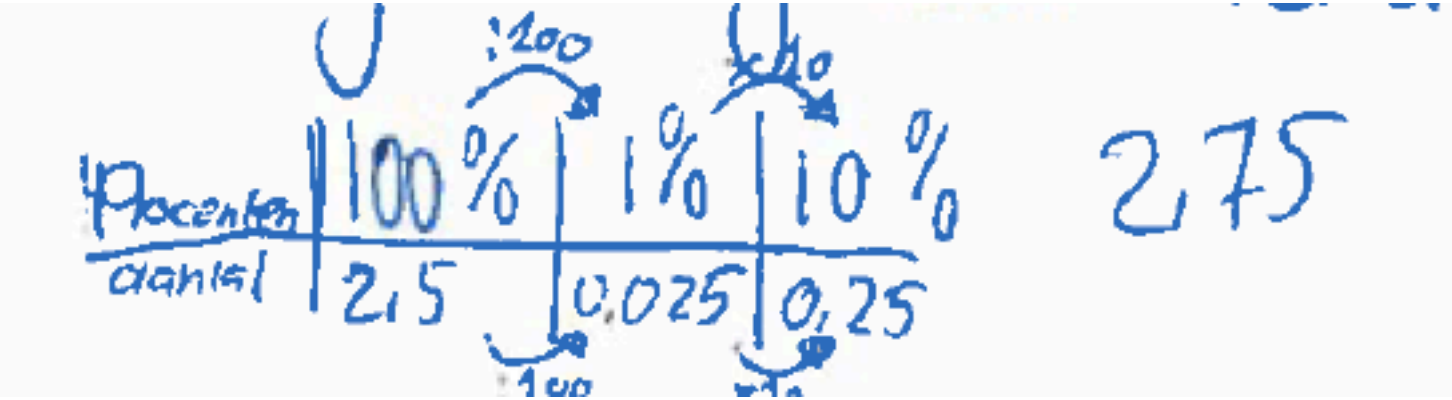
Sharing findings

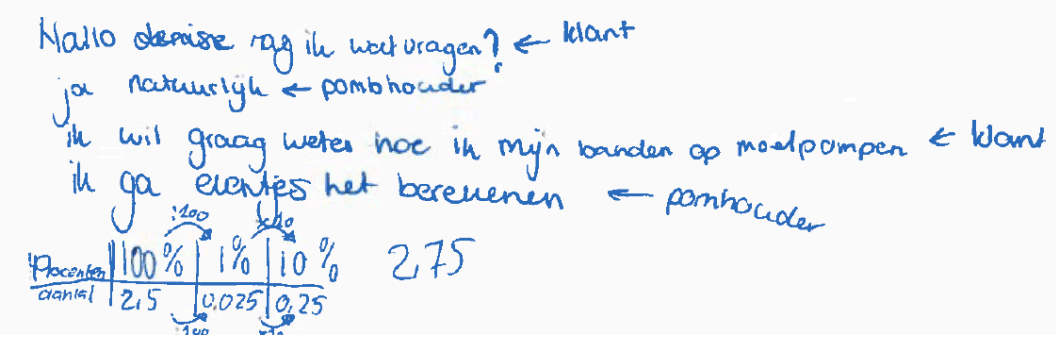
Use these questions to guide the discussion

- What does each group of student appear to understand (of the context, math and the communicative task) ? How can you tell?
- List errors and difficulties that are revealed by the students' scripts and calculations.
- What feedback would you give each group?
- In what would would you support the students working on this type of communicative practices?

Group 1

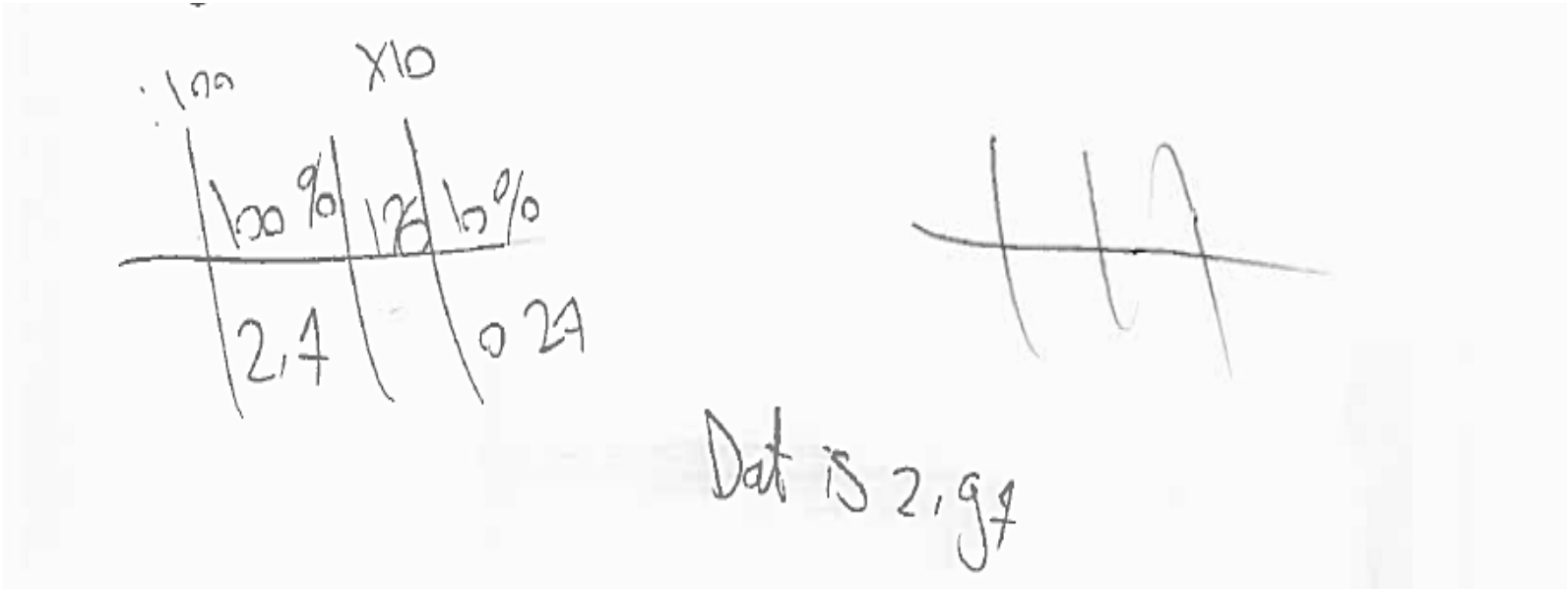
Hello, can I ask you something? <-customer
Yes of course <- gas station assistant
I want to know how to pump my tyres for extra pressure <-customer
I will calculate it for you <-gas station assistant)





Group 2

Customer: hello, can I ask you something?
PH: Yes, you can
Cust: I don't know how to pump my tyres
Ph: can I ask you what kind of car you have?
Cust: Verso 2007 1.6
Ph: V= 2,4 A =2,6 [V is front axle. A is back axle]
But an additional 10% is needed. I will calculate this
[see table and answer 2.97]



Group 3

Customer: I don't know how to pump up my tyres
Pump assistant: What kind of car do you have and does it have summer or winter tyres?
C: Yaris full hybrid, summer tyres
PA: I will take a look in the system
C: Very well
PA: I have looked and you need 2.42 front and also back, sir
C: Thanks for your effort. Do have a pack of chewing gum for me?

Evaluation

- Discuss the value of this type of tasks for .....
  - mathematical understanding
  - vocational competencies
  - language proficiency

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Evaluation of the pd course

What have you learned about

- Language sensitive math teaching on the topic of graphs and tables?

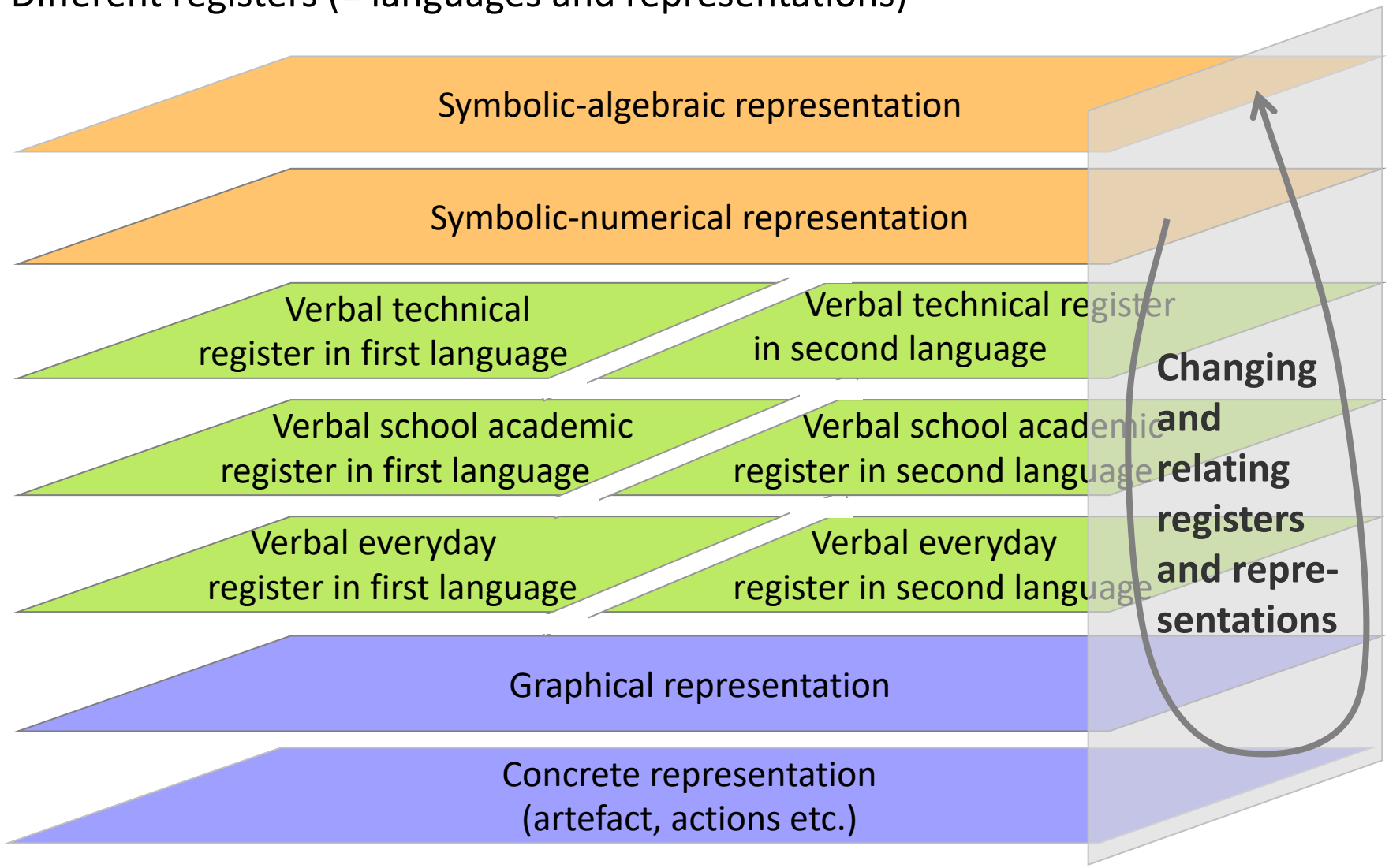
- Communicative practices in vocational settings using graphs and tables

- The relation between developing conceptual understanding in mathematics and language

What is relevant in language-responsive math classrooms?

(Prediger & Wessel 2011, 2013; Prediger, Clarkson, & Bose 2015)

Different registers (= languages and representations)



Jobs for teachers in language-responsive math classrooms

Five jobs

- Noticing language
- Demanding language
- Supporting language
- Developing language

Identifying mathematically relevant language demands

Typical misunderstandings

Language-responsive means reducing all language demands

All students are trained to use formal terms like numerator and denominator

Important principles

Rich discourse practices instead of isolated words

Focus on conceptual understanding and explaining meaning

Offensive rather than defensive approach (pushing language)