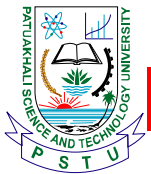# Operationalization of concepts

RSM 321 (Lecture 5)

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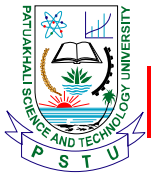Faculty of Disaster Management, PSTU

Jennifer Barrett (WUR)

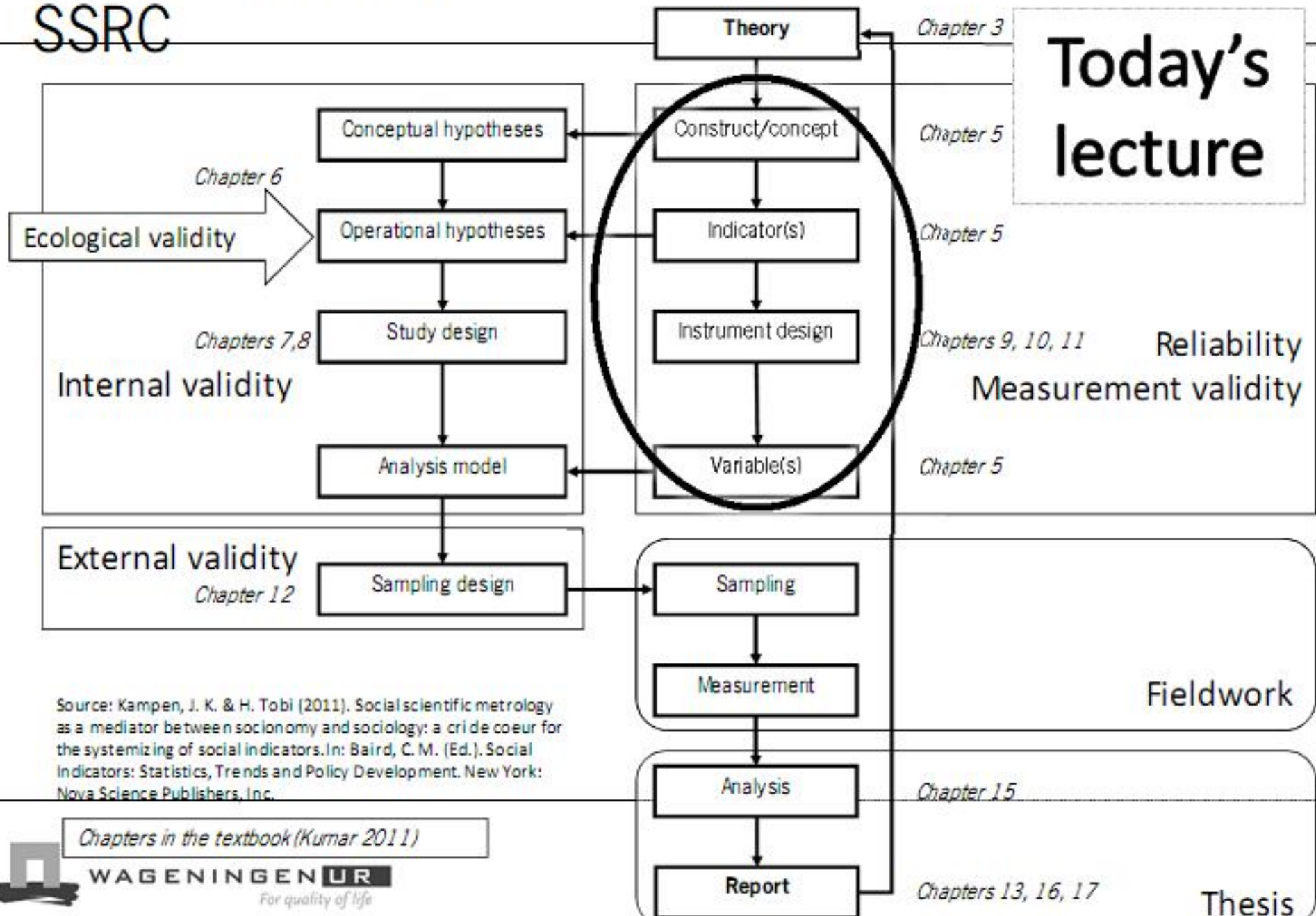Faculty of Disaster Management

Date: 19 AUG. 2013

Outline

❖ Operationalization of concepts

Scientific research cycle
SSRC

Theory — *Chapter 3*

Today's lecture

Conceptual hypotheses ← Construct/concept — *Chapter 5*

Ecological validity → Operational hypotheses ← Indicator(s) — *Chapter 5*

Chapter 6

Study design ← Instrument design — *Chapters 9, 10, 11* — Reliability

Chapters 7, 8

Internal validity — Measurement validity

Analysis model ← Variable(s) — *Chapter 5*

External validity — Sampling design → Sampling

Chapter 12

Measurement — Fieldwork

Source: Kampen, J. K. & H. Tobi (2011). Social scientific metrology as a mediator between socionomy and sociology: a cri de coeur for the systemizing of social indicators. In: Baird, C. M. (Ed.). Social Indicators: Statistics, Trends and Policy Development. New York: Nova Science Publishers, Inc.

Analysis — *Chapter 15*

Chapters in the textbook (Kumar 2011)

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For quality of life

Report — *Chapters 13, 16, 17*

Thesis

Key concepts of operationalization

- **Operationalization:** turning abstract concepts into observable and measurable terms that enable data collection

- **Concept (or construct):** a **theoretical idea** (a word, a term), e.g., a characteristic, a function, a behavior, an attitude or a cognition

- **Indicator:** A set of aspects/elements reflective of the concept

- **Variable (or item):** the actual measurement limited in time and place
- **Research instrument:** the tool used to obtain information about the empirical world
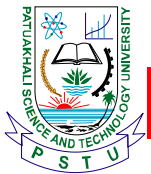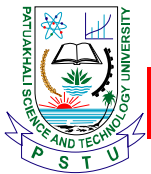
Three steps in operationalization

Concept → indicator(s) → variable(s)

Aspects/elements /components determined by

choice of conceptual framework and/or researcher's definition

Limited in place and time, determined by choice of instrument
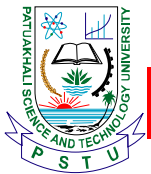
See pages 62-65 of Kumar.

Example of operationalization (1)

Example of a research project

Background:

- Turbidity of drinking water in developing countries
- Chemical treatments: expensive and unhealthy
- Biological method: pulverized seeds of the drumstick tree (*Moringa oleifera*), which is indigenous in many developing countries

Example of operationalization (1)

Drumstick tree (moringa oleifera)

← Plant with beans

Seeds ↓

Example of operationalization (1)

Research question:

- What is the effectiveness of pulverized drumstick tree seeds compared to other (chemical) methods of clearing water?

Example of operationalization (1)

Step 1: Concept to be operationalized
- Effectiveness (of a clearing method)

Step 2: Indicator(s) (a tree diagram may be helpful!)

- Effectiveness
  - Change in level of turbidity
  - Reaction time
  - Amount of active substance

Step 3: Variables
- Level of turbidity: measurement unit for turbidity is the FTU (Formazin Turbidity Unit)
- Duration of reaction time (seconds)
- Amount or concentration of active substance (pulverized seeds or chemical) in grams
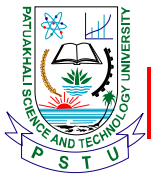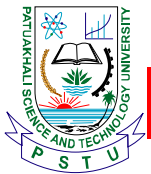
Example of operationalization (1)

Operational definition of <u>effectiveness of a method for clearing turbidity in drinking water</u>:

'The effectiveness of a clearing method is understood to be the time elapsing until the turbidity of 1 liter of water with initial turbidity level of x FTU decreases to x/2 FTU after being exposed to 1 gram of the active substance.'
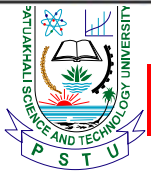
Example of operationalization (2)

Other example of a research project:

- Background: deterioration of wild bee populations.

- Wild bees are very important for pollination etc.

- Providing appropriate habitats may help to maintain the strength of the populations.

Research question:

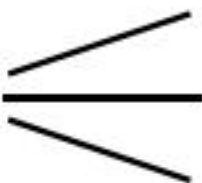- Do bees prosper more in bushy habitats than in grassy habitats?

Example of operationalization (2)
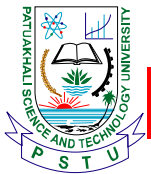
Step 1: Concept to be operationalized:
- Prospering of wild bees

Step 2: Indicator(s): (a tree diagram may be helpful!)

- Prospering
  - Abundance
  - Diversity

Step 3: Variables:
- Number of wild bees in a specific area and time period
- Number of different species of wild bees in a specific area and time period
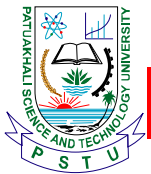
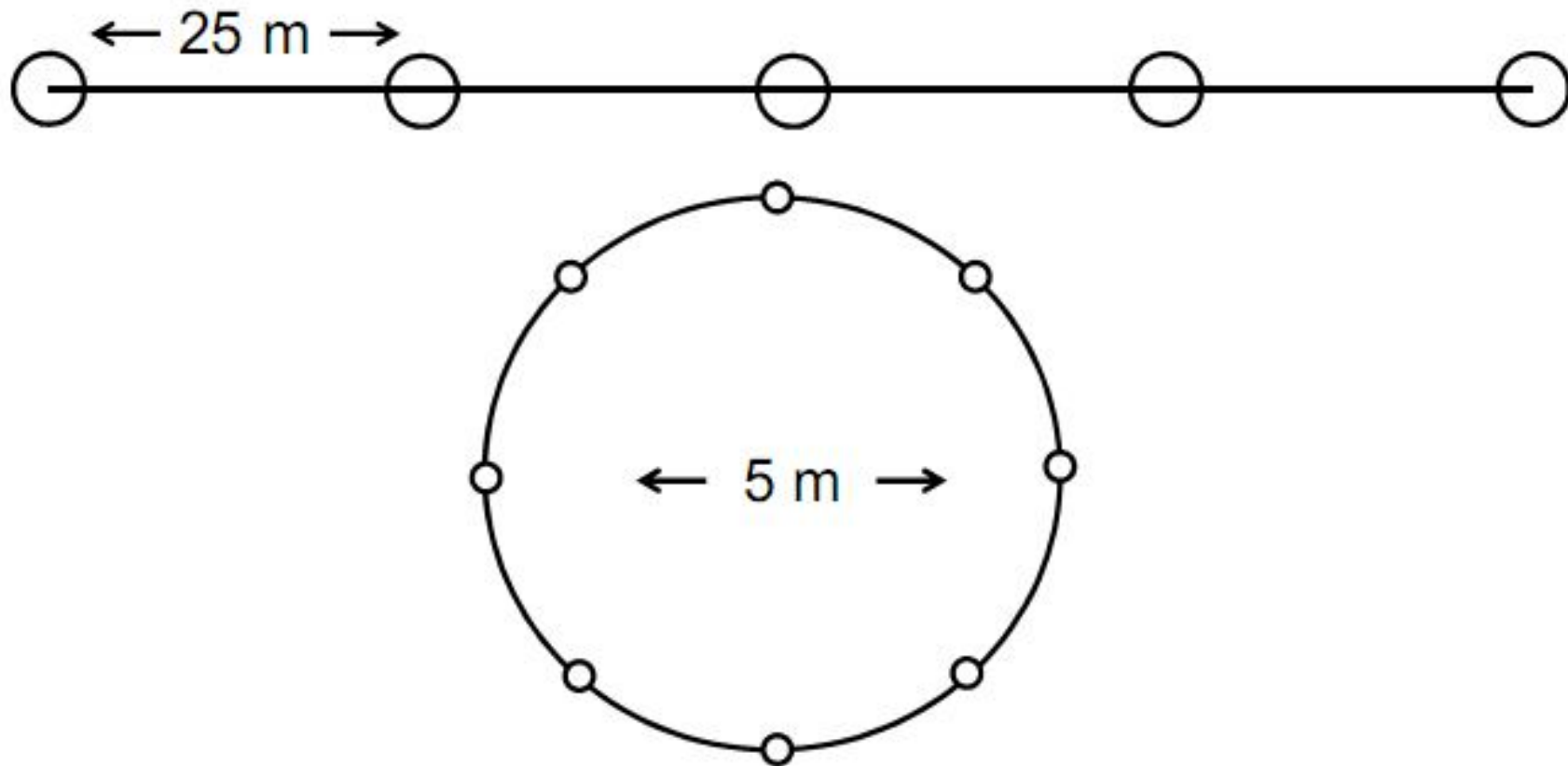# Example of operationalization (2)

Operational definitions:

'The <u>abundance</u> of wild bees in an area is understood to be the number of bees caught by means of a bee trap during 3 full days in July in that specific area.'

'The <u>diversity</u> of wild bees in an area is understood to be the number of species of bees caught by means of a bee trap during 3 full days in July in that specific area.'
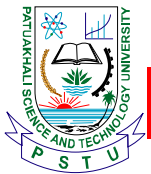
'An area is said to be <u>prosperous</u> in bees if at least 15 bees belonging to at least 2 different species are caught by means of a bee trap during 3 full days in July.'

Example of operationalization (2)
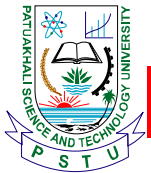

Measurement instrument

Operationalization of simple concepts

- One variable is usually sufficient
    - Turbidity of water
    - Age of trees
    - Number of liters of oil spilled in the Mexican gulf in 2010
   - Average temperature in an area during a certain period

Operationalization of complex concepts

- ...But, for complex concepts, more variables are necessary – at least one for each aspect of the concept
- Example 1: Concept 'Climate change'
  - Includes: temperature change, floods and droughts…, etc.

- Example 2: Concept 'Attitude towards climate change…'
  - Attitude consists of beliefs, willingness to pay, willingness to act, etc …

- Example 3: Concept: 'State of the environment'
  - the Dutch *MilieuCompendium* (www.compendiumvoordeleefomgeving.nl) uses about 150 indicators to measure the 'state of the environment' in the Netherlands!
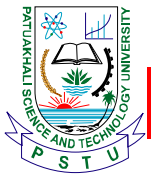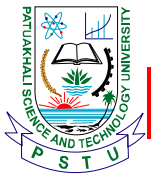
Operationalization of complex concepts

1. Use a tree diagram to make an overview of all the aspects of the concept

2. Select the aspects relevant to your research

3. Make further branches for each aspect until each branch represents a simple concept

4. Design the measurement instrument for each simple concept

5. Formulate the operational definition of the concept

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Example of operationalization (3)
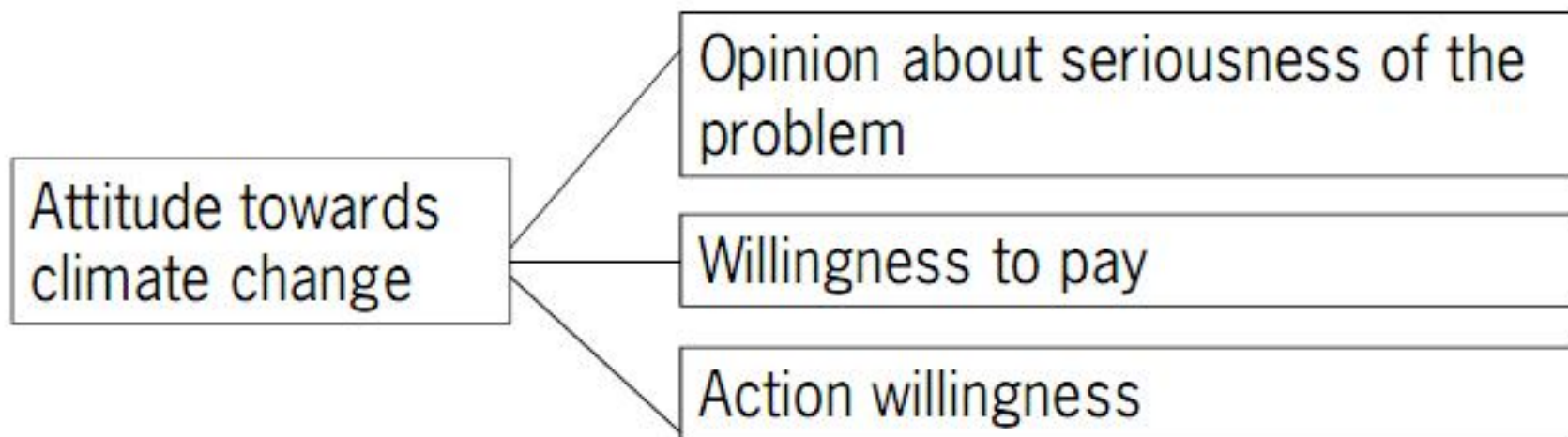
Concept: <u>Attitude towards climate change</u>

- Attitude towards climate change is an 'attitude concept' (several aspects instead of a single one)
  - agreement scales (or Likert scales) are useful (See Kumar chapter 10)

- Attitude towards climate change is a complex concept. You will not be able to include all aspects / indicators (practically impossible)
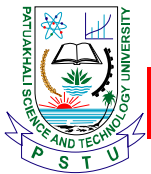
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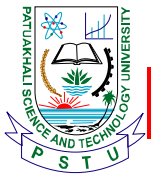
Example of operationalization (3)

- Make a tree diagram for aspects of the theoretical concept

```
                                    ┌─────────────────────────────────┐
                                    │ Opinion about seriousness of the│
                                    │ problem                         │
                                    └─────────────────────────────────┘
┌──────────────────┐               ┌─────────────────────────────────┐
│ Attitude towards │───────────────│ Willingness to pay              │
│ climate change   │               └─────────────────────────────────┘
└──────────────────┘               ┌─────────────────────────────────┐
                                    │ Action willingness              │
                                    └─────────────────────────────────┘
```

- Construct or assemble statements (or items) for each aspect

Example of operationalization (3)

I will present to you a number of statements. Please tell me for each statement whether you agree or disagree.

1=Strongly agree 2=Agree 3=Neutral 4=Disagree 5=Strongly disagree

1. The effects of climate change are worse than we realize.	1	2	3	4	5
2. Claims that current levels of pollution are changing the earth's climate are exaggerated.	1	2	3	4	5
3. Fighting climate change is less urgent than often suggested.	1	2	3	4	5
4. I would be willing to reduce the heating level in my home in order to fight climate change.	1	2	3	4	5
5. I would agree to an increase in taxes in order to fight climate change.	1	2	3	4	5
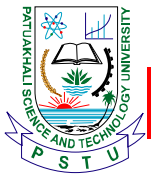
Characteristics of Likert scale

- **unidimensionality assumed**
  - All items in a Likert scale are supposed to measure the same aspect of a concept
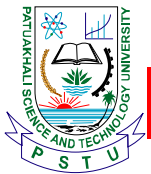
Is this the case in our previous example?
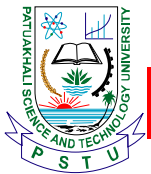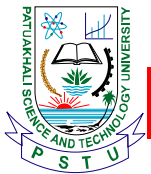
Building a Likert scale (Kumar, Chapter 10)

- Step 1: Construct (or assemble) statements (items)
- Step 2: Administer them to a small group of people (pilot study)
- Step 3: Recode the answers if necessary (either the positive or the negative statements)
- Step 4: Compute sum score
- Step 5: Item analysis (assess correlations between total sum score and each item)
- Step 6: Decide which items to keep
- Step 7: Now construct final questionnaire

Thank YOU

Questions??