



S·H·E

Schools for Health in Europe

Scale development – A quick overview

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This activity has received funding
under an operating grant from the
European Union's Health Programme



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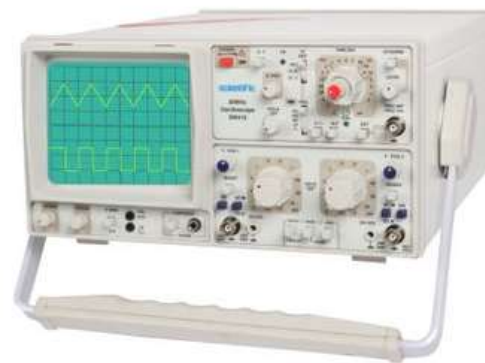
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Measurement

- In sciences, we have several solutions to measure different physical quantity



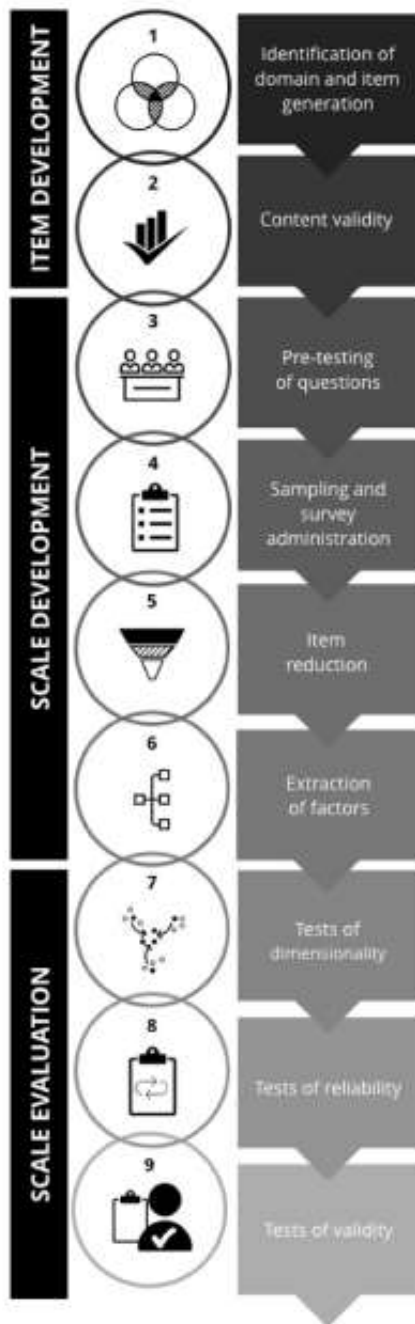
- But it's different for social measures
 - Motivation
 - Well-being
 - Happiness
 - Satisfaction
 - ...

Different steps in scale development

- Constellation of techniques
- What is needed to published ?
- Our goal is to describe the process for scale
- Facilitate the development of new, valid, and reliable scales, and to help improve existing ones

Theoretical framework

- Scales are a manifestation of constructs
- They measure behaviors, attitudes, and hypothetical scenarios we expect to exist as a result of our theoretical understanding of the world, but cannot assess directly



- 3 phases span in 9 steps

- *Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR and Young SL (2018) Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. Front. Public Health 6:149*

- <https://www.ncbi.nlm.nih.gov/pubmed/29942800>

FIGURE 1 | An overview of the three phases and nine steps of scale development and validation.

Phase 1 : Item development

- Step 1 : Identification of domain and item generation

Need to specify the boundaries of the domain and facilitate item generation

Need to identify appropriate questions that fit the identified domain

How ?

- Specify the purpose of the domain
- Confirm that there are no existing instruments
- Describe the domain and provide preliminary conceptual definition
- Specify the dimensions of the domain if they exist a priori
- Define each dimension
- literature review and assessment of existing scales
- exploratory research methodologies
- focus group discussions and interviews

Phase 1 : Item development

- Step 2 : Content validity : assessing if the items adequately measure the domain of interest

Evaluation by experts (5 to 7) : to see if each of the items well constitute the domain for content relevance, representativeness, and technical quality

Evaluation by target population (interviews) : to see if each item well constitute the domain for representativeness of actual experience from target population

University Self-efficacy

What the theory says ?

2 dimensions

- *Be able to manage the time*
- *Be able to create a solid social network*

Phase 2 : Scale development

- Step 3 : Pre-testing Questions: Ensuring the questions and answers are meaningful

How ?

- Administer draft questions to 5–15 interviewees in 2–3 rounds while allowing respondents to verbalize the mental process entailed in providing answers

University Self-efficacy

What the focus group says ?

The same 2 dimensions

- *Be able to manage the time*
- *Be able to create a solid social network*

But...a new one :

- *Be able to don't care about what the other students say/think*

Phase 2 : Scale development

- Step 4 : Survey Administration and Sample Size: Gathering Enough Data from the Right People

Collect data with minimum measurement errors

Ensure the availability of sufficient data for scale development

Ensure the availability of data for scale development and validation

How ?

- Administer potential scale items on a sample that reflects range of target population using paper or device
- Recommended sample size is 10 respondents per survey item and/or 200-300 observations
- Ensure the availability of complete cases for scale Development -> Deleting or imputing missing cases

Phase 2 : Scale development

- Step 5: Item Reduction: Ensuring Your Scale Is Parsimonious
- Determine the correlations between scale items, as well as the correlations between each item and sum score of scale items -> Inter-item and item-total correlations

Phase 2 : Scale development

- Step 6: Extraction of Factors: Exploring the Number of Latent Constructs that Fit Your Observed Data
- Determine the optimal number of factors or domains that fit a set of items -> factor analysis

Example

- I want to measure University Self-efficacy
 - Dimension 1 : *Be able to manage the time* (Items 1,4,5,10,11,12)
ie: I'm able to find enough time to prepare my exams
 - Dimension 2 : *Be able to create a solid social network* (Items 2,13,14,15)
ie: It's easy for me to have new friend
 - Dimension 3 : *Be able to don't care about what the other students say/think* (Items 6,7,8,9,3)
ie : Even if other students say it's not cool to sit in the first row in the class, i prefer to do it

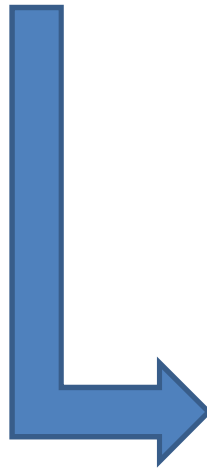
What i expected :

One dimension with :
Items 1,4,5,10,11,12

One dimension with :
Items 2,13,14,15

One dimension with :
6,7,8,9,3

BUT



Saturation/Loading factor
>.40

exemple

| | Dimensions | | | |
|-----------------------------------------------------|------------|--------|--------|--------|
| | 1 | 2 | 3 | 4 |
| Item 1 | 0,671 | 0,114 | 0,066 | -0,072 |
| Item 2 | 0,569 | 0,064 | 0,047 | 0,612 |
| Item 3 | 0,071 | 0,317 | 0,029 | 0,78 |
| Item 4 | 0,748 | 0,139 | -0,065 | 0,202 |
| Item 5 | 0,655 | 0,032 | -0,061 | -0,001 |
| Item 6 | 0,083 | 0,113 | 0,731 | 0,218 |
| Item 7 | -0,024 | -0,019 | 0,796 | -0,048 |
| Item 8 | 0,185 | -0,019 | 0,281 | 0,628 |
| Item 9 | -0,063 | -0,037 | 0,669 | 0,009 |
| Item 10 | 0,621 | 0,078 | 0,136 | 0,206 |
| Item 11 | 0,641 | 0,12 | -0,026 | 0,151 |
| Item 12 | 0,533 | 0,248 | 0,143 | -0,087 |
| Item 13 | 0,151 | 0,745 | -0,031 | 0,071 |
| Item 14 | 0,185 | 0,822 | -0,084 | 0,127 |
| Item 15 | 0,122 | 0,824 | -0,112 | 0,205 |
| Extraction Method: Principal Component Analysis. | | | | |
| Rotation Method: Oblimin with Kaiser Normalization. | | | | |

What i expected :

One dimension with :
Items 1,4,5,10,11,12

One dimension with :
Items 2,13,14,15

One dimension with :
6,7,8,9,3

After removing 2,3 and 8

| | Component | | |
|---------|-----------|--------|--------|
| | 1 | 2 | 3 |
| Item 1 | 0,67 | -0,082 | 0,072 |
| Item 4 | 0,752 | -0,174 | -0,061 |
| Item 5 | 0,655 | -0,019 | -0,058 |
| Item 6 | 0,091 | -0,162 | 0,742 |
| Item 7 | -0,028 | 0,023 | 0,808 |
| Item 9 | -0,065 | 0,012 | 0,675 |
| Item 10 | 0,622 | -0,133 | -0,121 |
| Item 11 | 0,647 | -0,152 | -0,032 |
| Item 12 | 0,529 | -0,198 | -0,123 |
| Item 13 | 0,16 | -0,724 | -0,034 |
| Item 14 | 0,198 | -0,815 | -0,097 |
| Item 15 | 0,139 | -0,829 | -0,132 |
| | | | |

Phase 3 : Scale evaluation

- Step 7: Tests of Dimensionality: Testing if Latent Constructs Are as Hypothesized
- Validate whether the previous hypothetical structure fits the items -> model fit indices (Chi-square test, RMSEA, TLI, CFI, SRMR...)

Phase 3 : Scale evaluation

- Step 8: Tests of Reliability: Establishing if Responses Are Consistent When Repeated
- Assess the internal consistency of the scale. i.e., the degree to which the set of items in the scale covary, relative to their sum score -> Cronbach's alpha
- Assess the degree to which the participant's performance is repeatable; i.e., how consistent their scores are across time -> Test-retest reliability

Phase 3 : Scale evaluation

- Step 9: Tests of Validity: Ensuring You Measure the Latent Dimension You Intended
- determine if scores predict future outcomes
- -> linear regression or just corelations