

Beyond the Rubber Ruler

Creating standardized instruments
for assessing energy interventions

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Acknowledgments: IEA DSM Task 24 on Behavior Change supported methods review and instrument creation. Southern California Edison supported instrument testing. Report at:
<http://www.etcc-ca.com/reports/dimensions-energy-behavior-psychometric-testing-scales-assessing-behavioral-interventions>

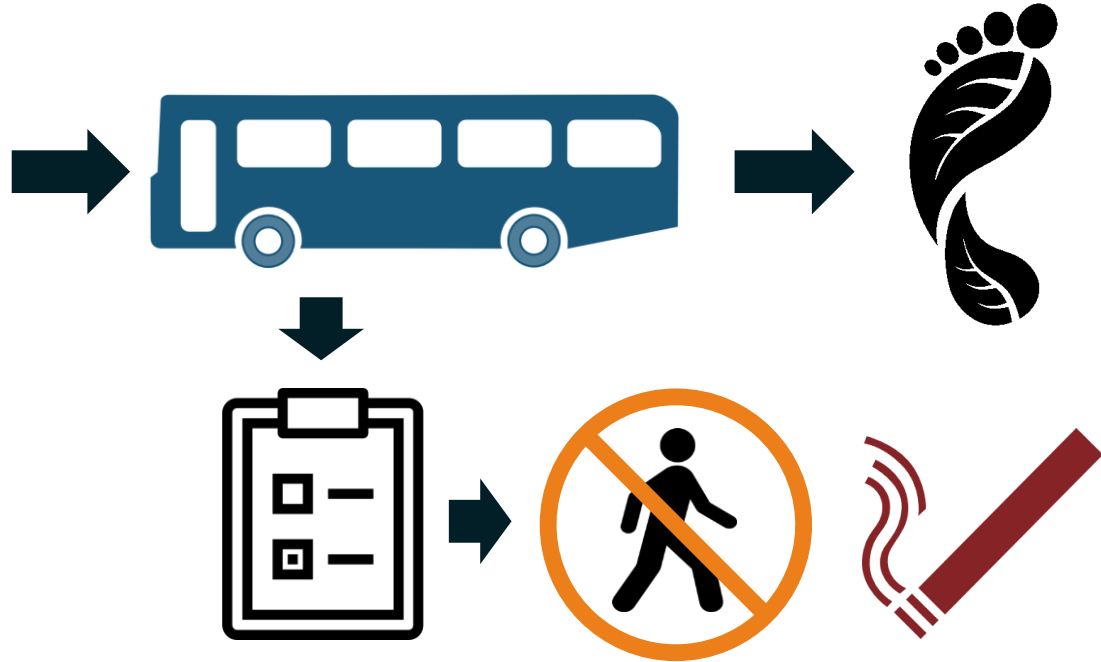
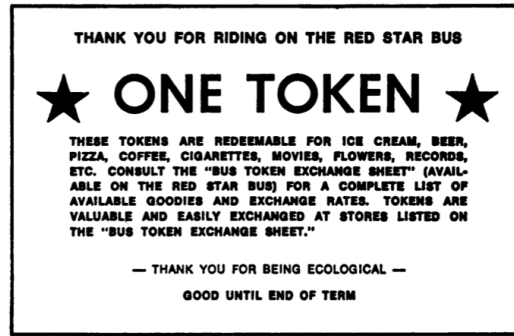
Agenda

- **Welcome and Introductions**
- **Toolkit Background:** Why a unified approach to measurement?
- **Toolkit Development:** What is worth measuring?
- **Toolkit Testing:** How do you create a good measure?
- **Toolkit Implementation:** How will this work in the field?
- **Q&A / Discussion**

Toolkit Background

Why a unified approach to measurement?

The IMPORTANCE of Asking Questions



Everett, Hayward, & Scott (1974). The effects of a token reinforcement procedure on bus ridership. *Journal of Applied Behavioral Analysis*, 7, 1-9.

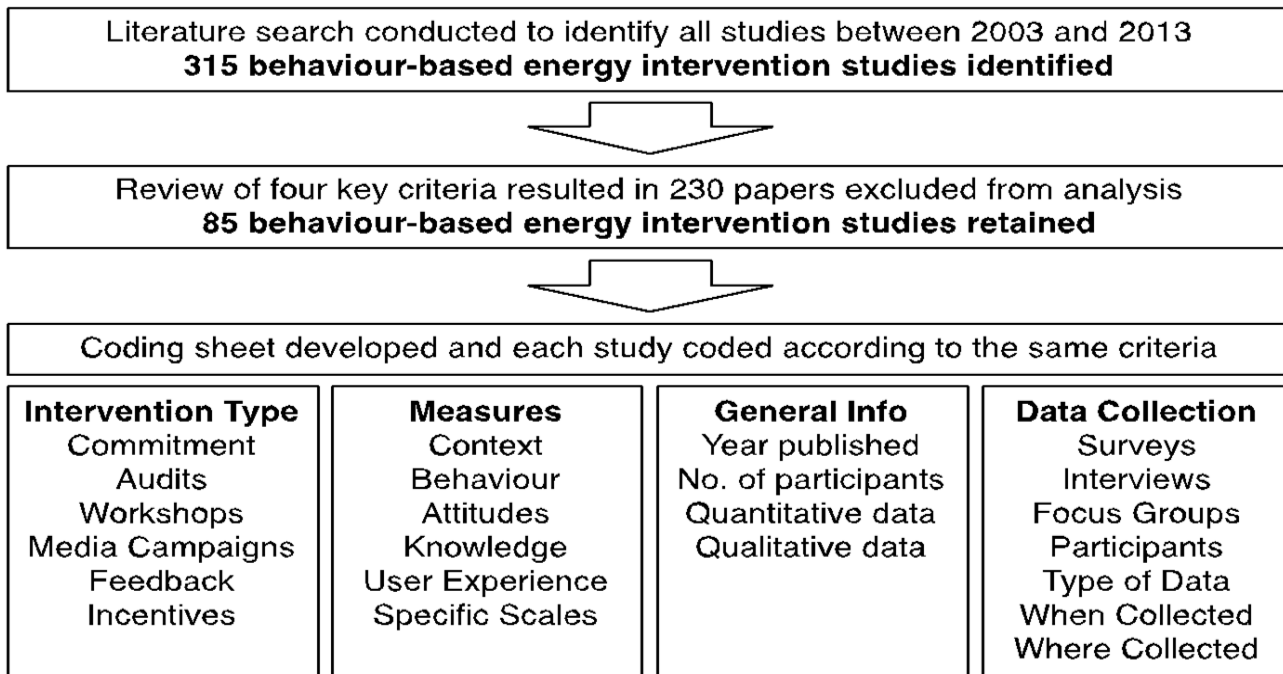
The **IMPORTANCE** of Measurement Consistency

Stanford Binet Intelligence Scale

Genius	Over 140
Very Superior	120 - 139
Superior	110 - 119
Average	90 - 109
Dull	80 - 89
Borderline Deficiency	70 - 79
Moron	50 - 69
Imbecile	20 - 49
Idiot	Below 20

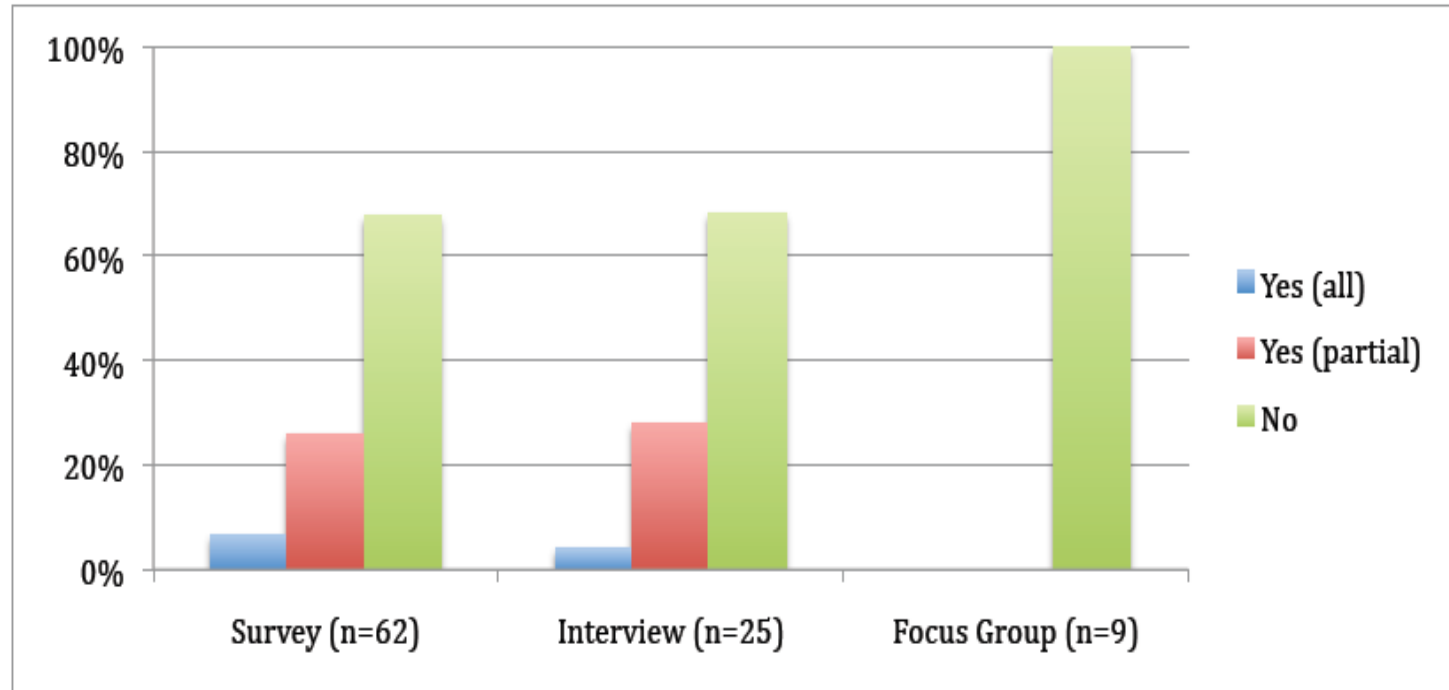


Reviewing Ten Years of Data Collection



Karlin, Ford, Wu, & Nasser. (2015). What Do We Know About What We Know? A Review of Behaviour-Based Energy Efficiency Data Collection. IEA-DSM Task 24 Subtask 3 Report.

Most Reports Are Not Sharing Instruments



Karlin, Ford, Wu, & Nasser. (2015). What Do We Know About What We Know? A Review of Behaviour-Based Energy Efficiency Data Collection. IEA-DSM Task 24 Subtask 3 Report.

The IMPORTANCE of Question Design

How awesome is our blog content?

- Out of this world awesome
- Pretty awesome
- I enjoy it a lot
- I like it
- I don't like it



The IMPORTANCE of Question Design

Rate how much you agree with the following

- Helping people and the environment is important
- My car and my house are energy efficient
- I turn off lights and unplug appliances when not in use



The **IMPORTANCE** of Measurement Validation

Close Ended Question

How much time do you spend studying?

A) 1-8 hours B) 9-18 hours C) > 18 hours

Open Ended Question

Tell me about your study habits...

The **IMPORTANCE** of Measurement Validation

What one issue mattered most to you in deciding how you voted for president?

	Open-ended ¹	Closed-ended ²
The economy	35%	58%
The war in Iraq	5	10
Health care	4	8
Terrorism	6	8
Energy policy	*	6
Other	43	8
Candidate mentions	9	-
Moral values/social issues	7	-
Taxes/dist. of income	7	-
Other issues	5	-
Other political mentions	3	-
Change	3	-
Other	9	-
Don't know	7	2
	100	100

¹ Unprompted first response to open-ended question

² First choice from 5 options read to respondents

The **IMPORTANCE** of Measurement Validation




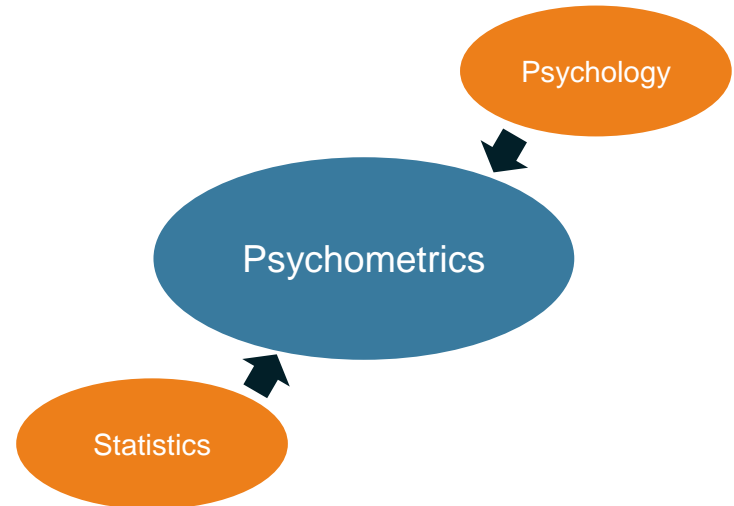
OR



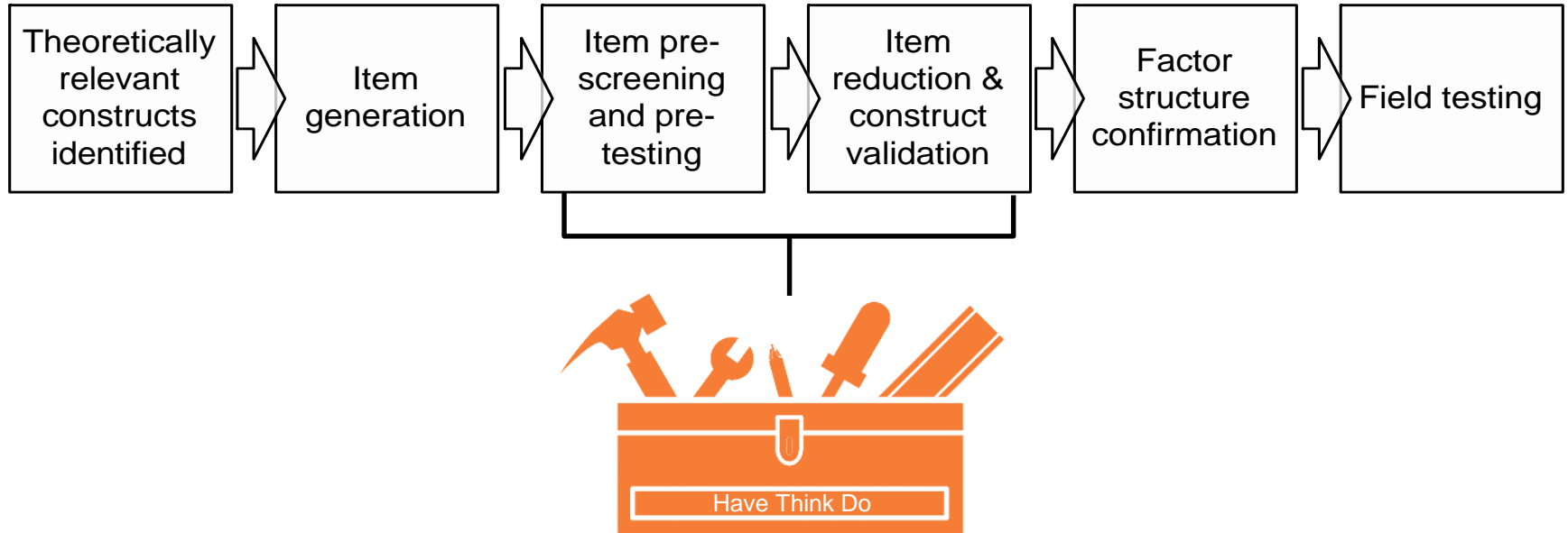
Psychometrics

- Theory and technique of measurement:
Knowledge, abilities, attitudes, traits
- Construction and validation of instruments:
Questionnaires, tests, assessments

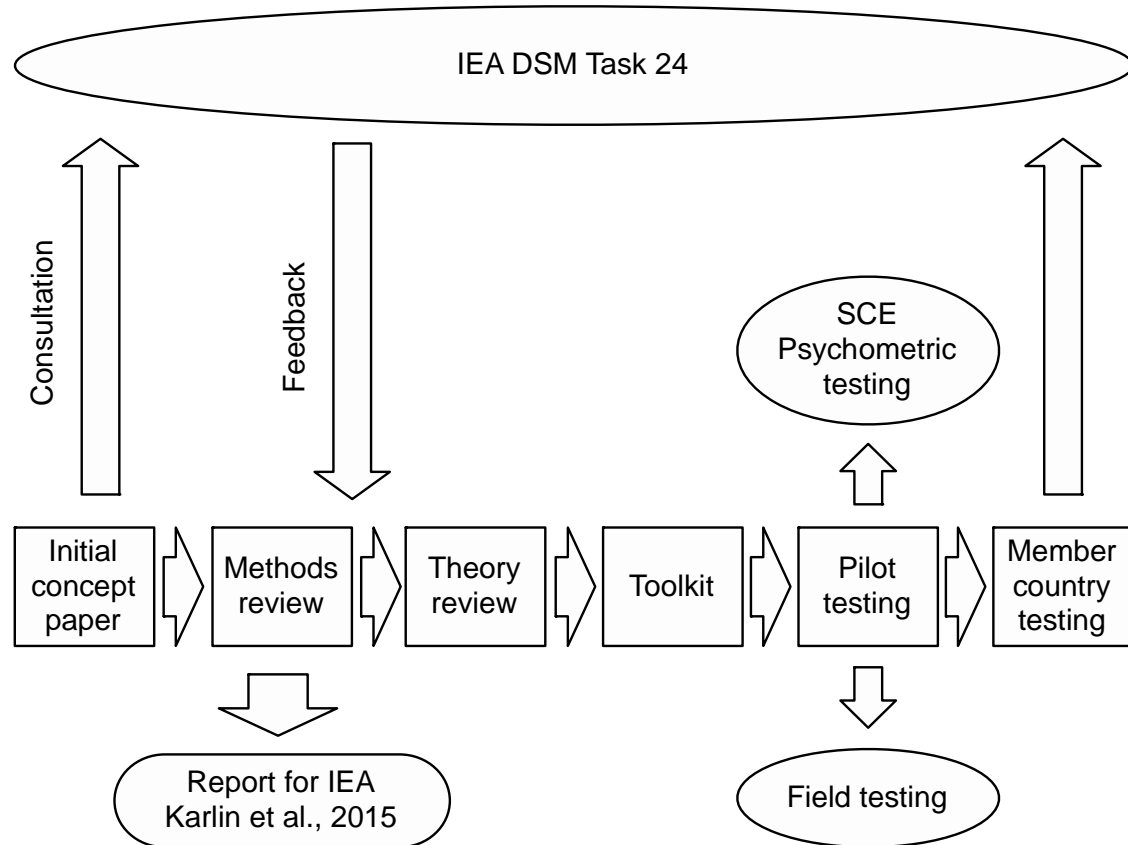
	Right Way	Wrong Way
Right Thing		
Wrong Thing		



The **PROCESS** of Psychometrics



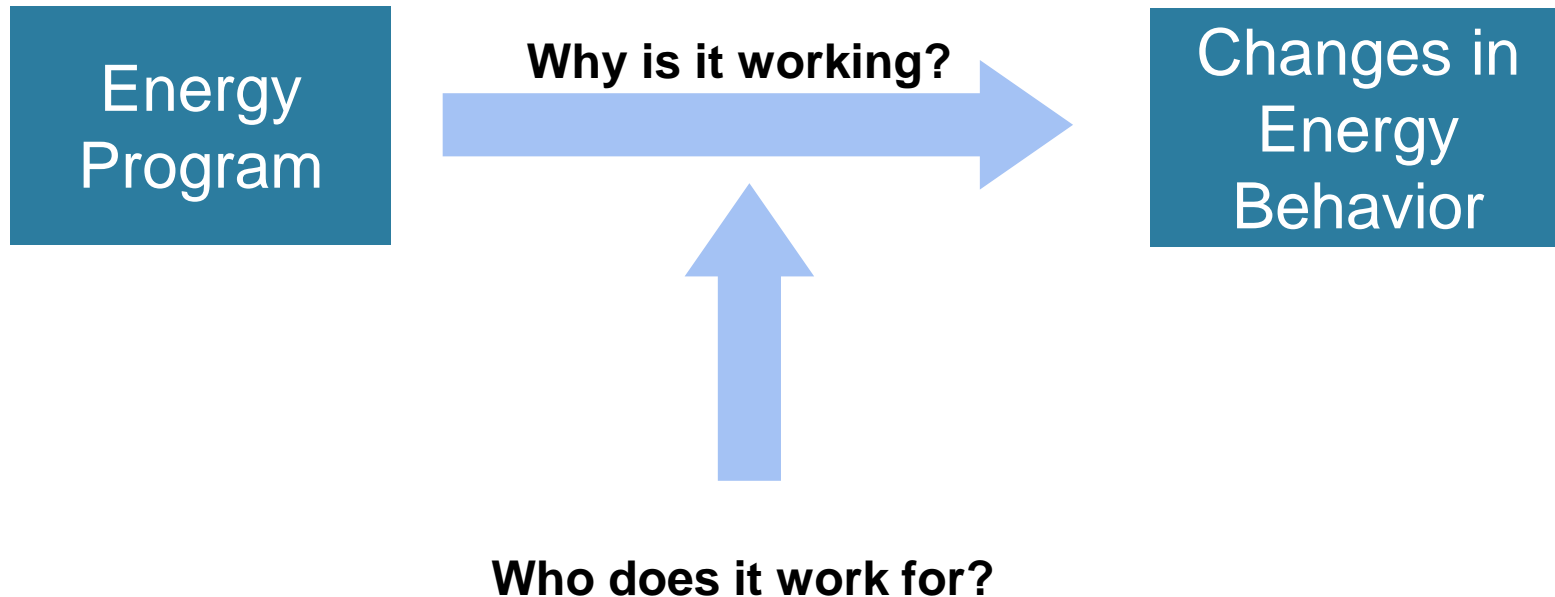
Our Project



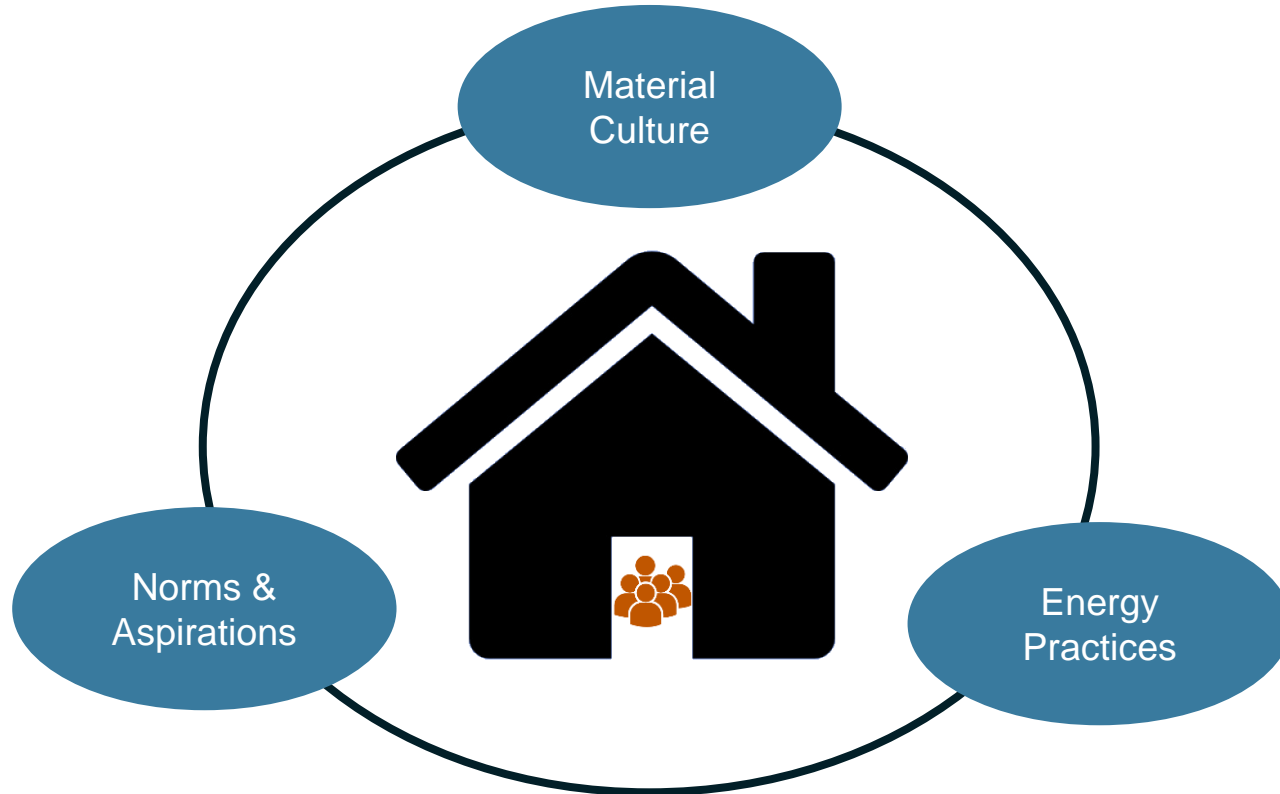
Toolkit Development

What is worth measuring?

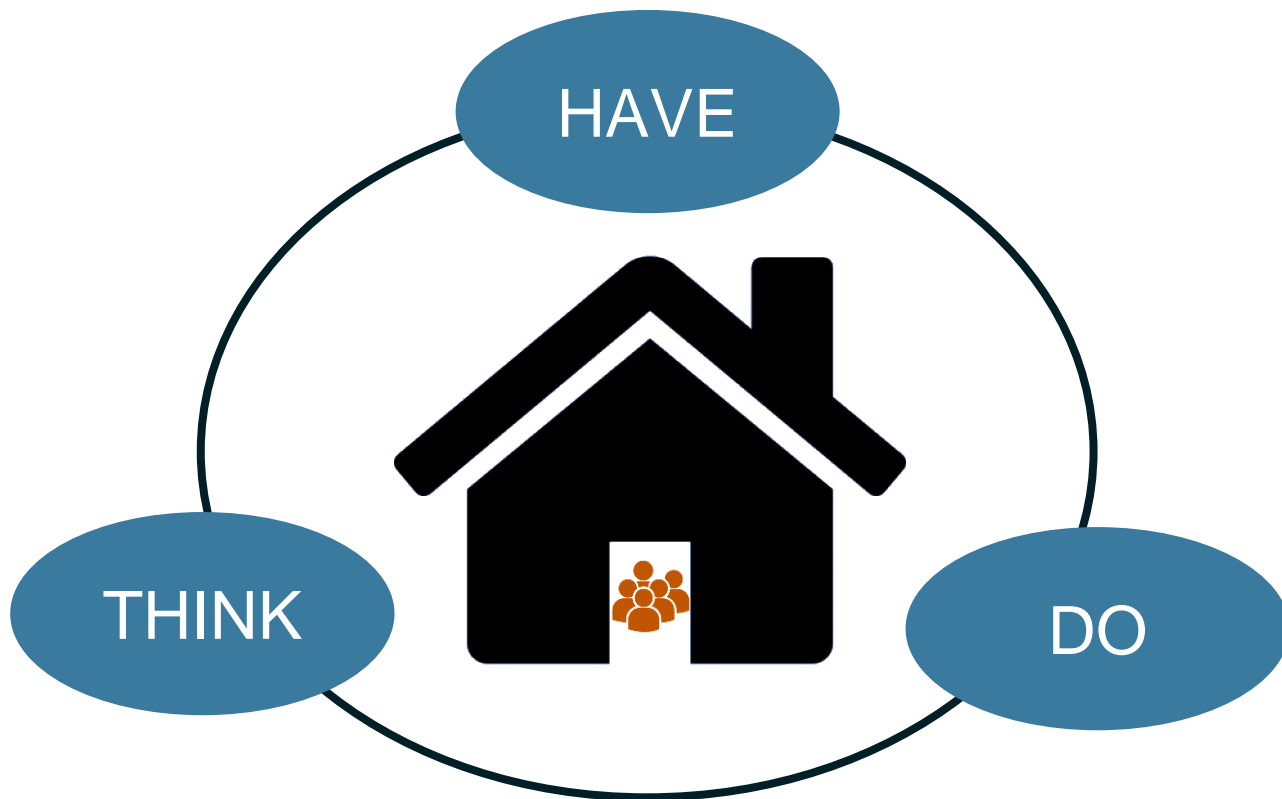
HOW Does it work?



Energy Cultures Framework



Energy Cultures Framework



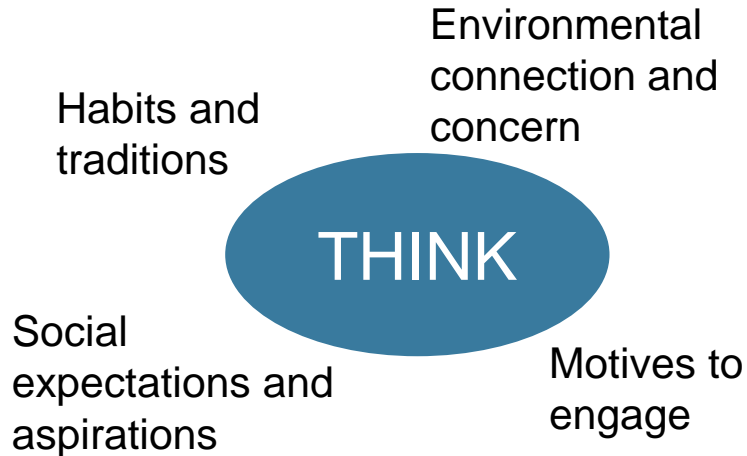
Toolkit Development



Material Culture (Have)

- What time of dwelling do you live in?
- Which of the following appliances do you own? (E.g., space heater, dishwasher, central AC, etc.)

Toolkit Development



Beliefs (Think)

Connection and Concern

Norms (Personal and Social)

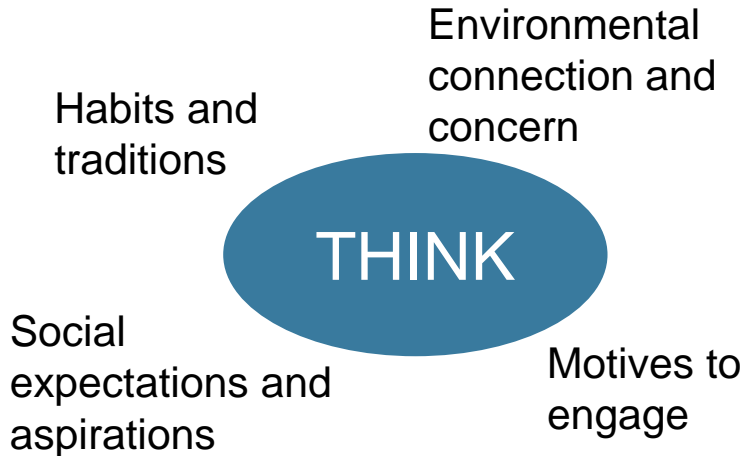
Efficacy (Performance and Response)

Motivation

Behavioral Intention

Toolkit Development

Beliefs (Think)



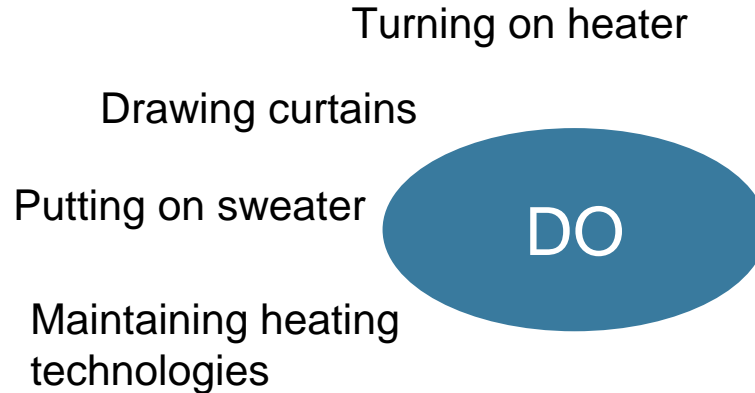
Efficacy (Performance and Response)

- I can invest the time and effort to make changes towards reducing my energy use .
- If enough people use less energy, we can benefit the natural environment .

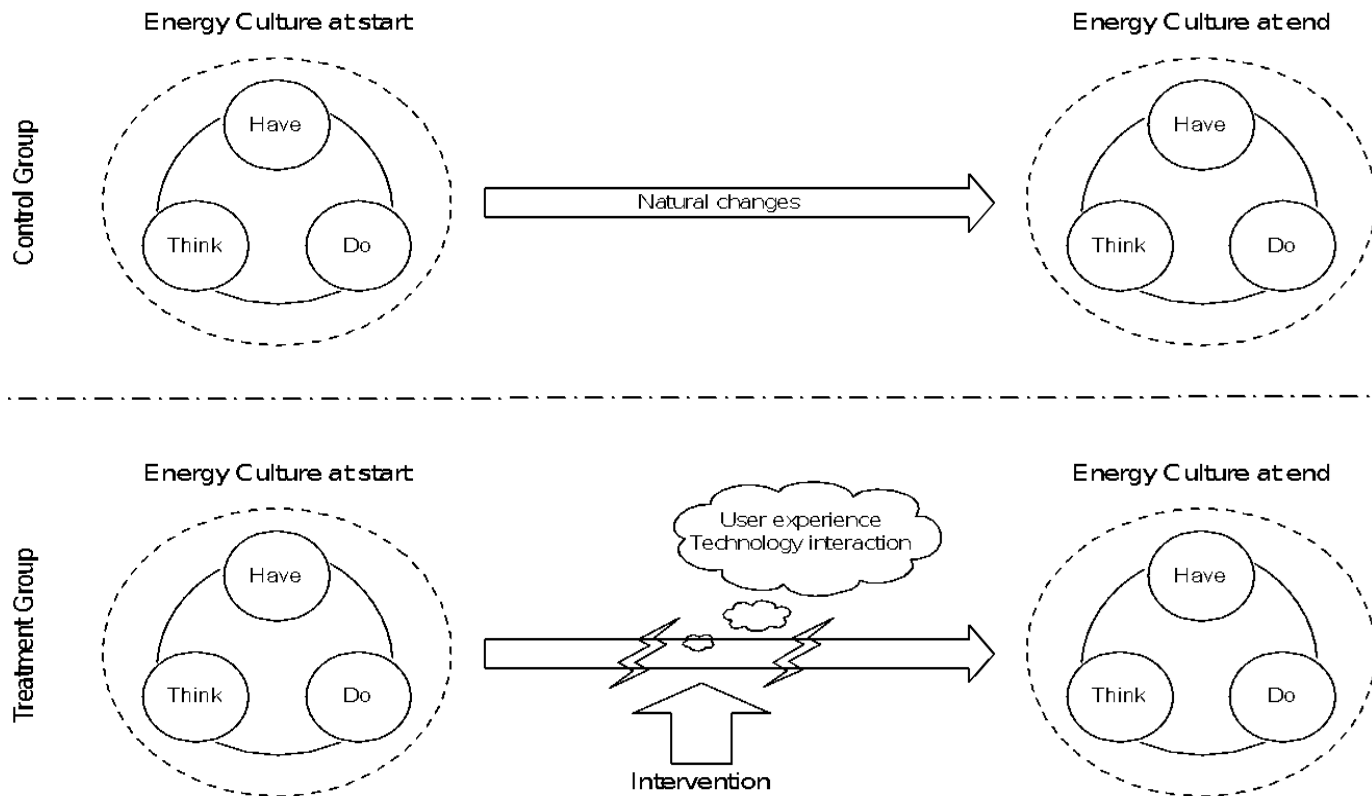
Toolkit Development

One-time and Recurring Behaviors (Do)

- Please indicate whether you have done each of the following since moving into your home: (e.g., installed insulation, replaced incandescent bulbs with CFLs or LEDs, etc.)
- How frequently do you: (e.g., limit time in shower, turn off lights when not needed, etc.)



Toolkit Development



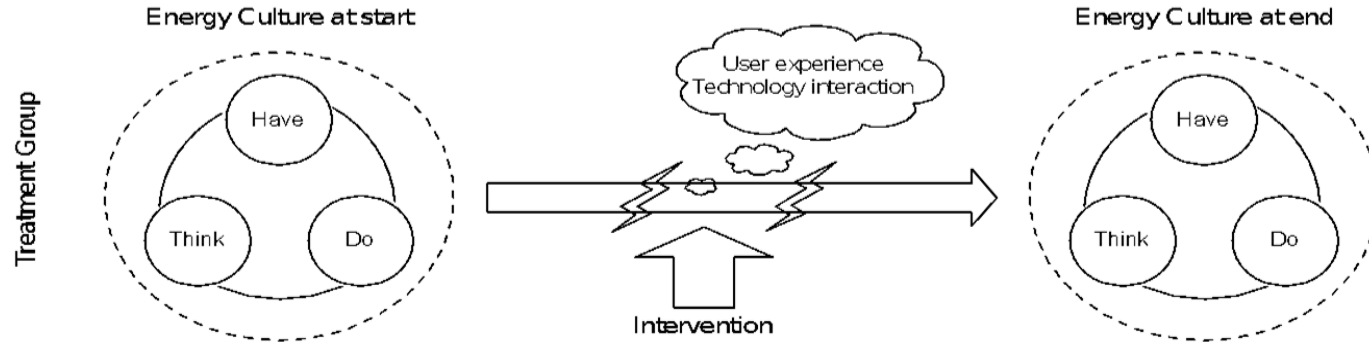
User Experience (UPscale)

Ease of Use

- I feel very confident interpreting the information provided to me.
- A person would need to learn a lot in order to understand this _____.

Engagement

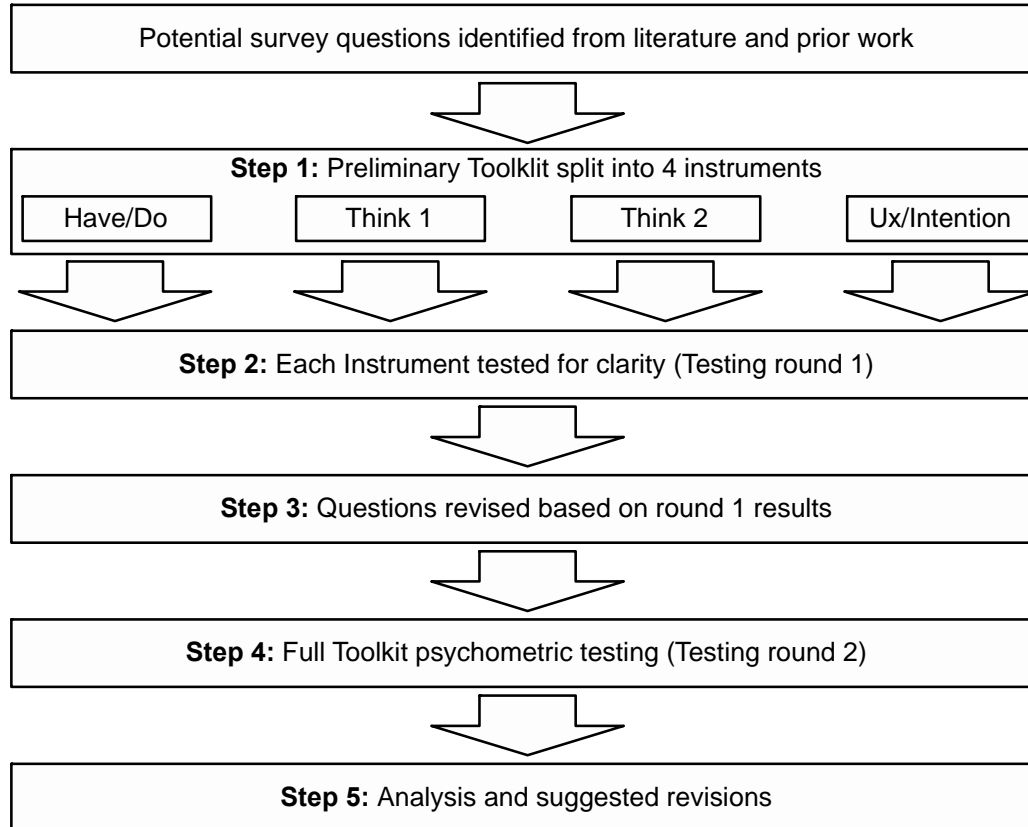
- I do not find this _____ to be useful.
- I think that I would like to use this _____ frequently.



Toolkit Testing

How do you create a good measure?

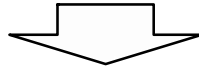
Toolkit Testing - Methods



Toolkit Testing - Methods

- Online survey (Amazon Mechanical Turk)
- Testing Round 2: 520 participants (\$2 compensation)
 - Most lived in houses (67.1%) followed by an apartment (4.2%)
 - About half owned their home (47.9%) or rented their home (47.7%)
 - Average # of people in home was 2.8 (SD = 1.4)
 - More than half ranged from 25-45 years old (59.2%)
 - 50.2% were female and most identified as White (79.4%)

Step 4: Full Toolkit psychometric testing (Testing round 2)



Step 5: Analysis and suggested revisions

Toolkit Testing - Results

Psychometric Properties

1. Factor Analysis/Item Reduction

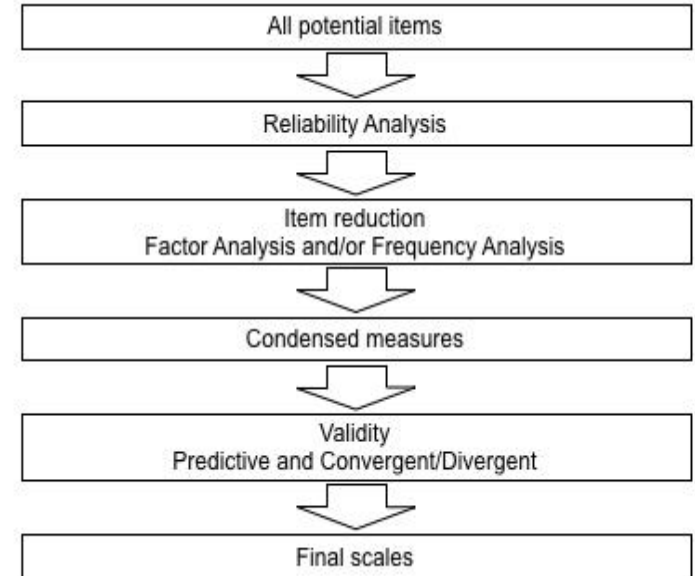
- Are measures of each construct distinct?
- Which items best represent the construct?

2. Reliability

- Do items hang together/interrelate strongly?

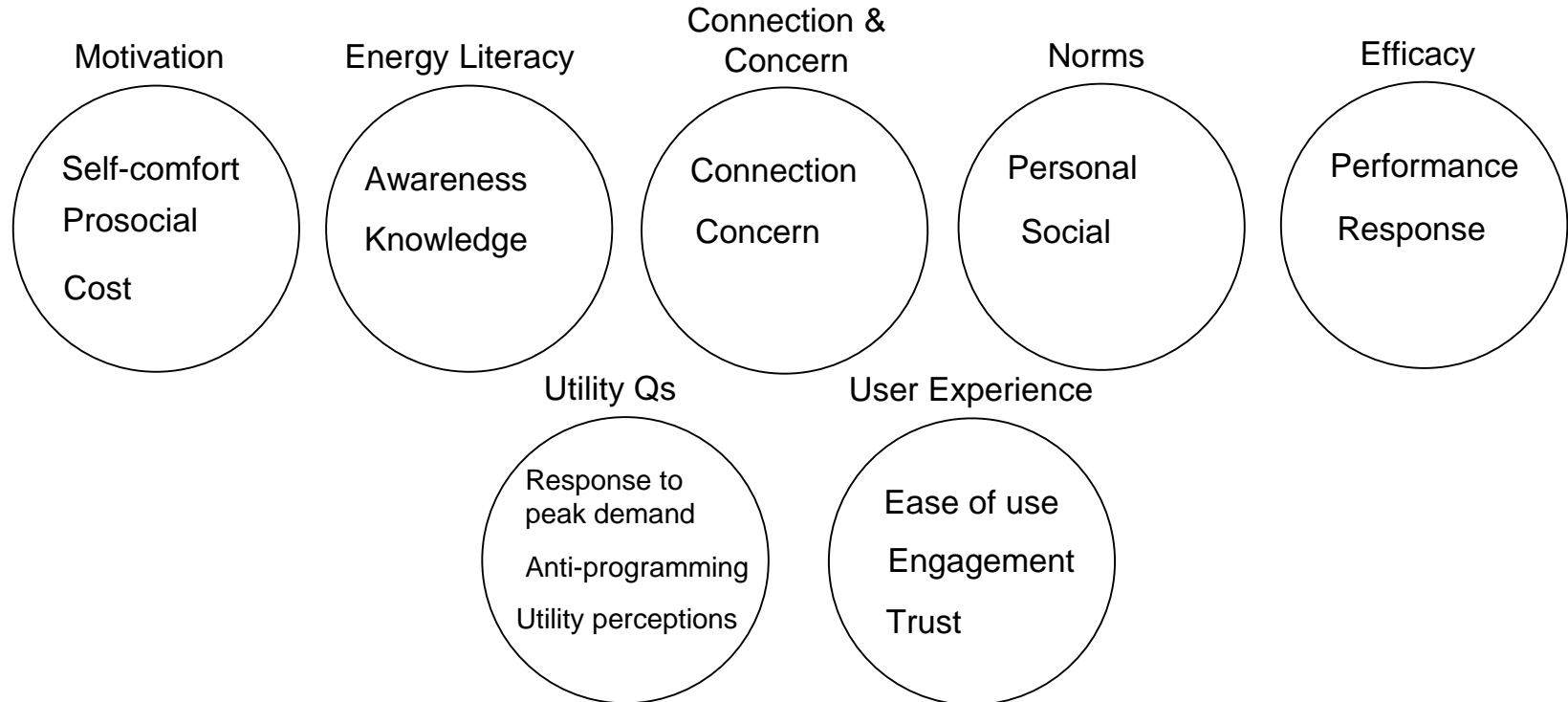
3. Criterion Validity

- Does it measure what its supposed to?
- Does it relate to/predict relevant constructs?



Toolkit Testing - Results

1. Factor Analysis/Item Reduction



Toolkit Testing - Results

1. Factor Analysis

2. Reliability

Alpha > .70 is good

Factor	Items	Alpha
Motivation - cost	1	N/A
Motivation - prosocial	3	0.801
Motivation - self-comfort	3	0.796
Energy Literacy - awareness	2	0.861
Connection	2	0.769
Concern	2	0.843
Personal Norms	3	0.808
Social Norms	2	0.738
Performance Efficacy	2	0.820
Response Efficacy	3	0.828
Utility Questions: Response to peak demand	4	0.655
Utility Questions: Anti-programming	3	0.443
Utility Questions: Utility perceptions	2	0.505
UPscale - Ease of Use	7	0.870
UPscale - Engagement	9	0.900
UPscale - Trust	2	0.924
Satisfaction	2	0.870

Toolkit Testing - Results

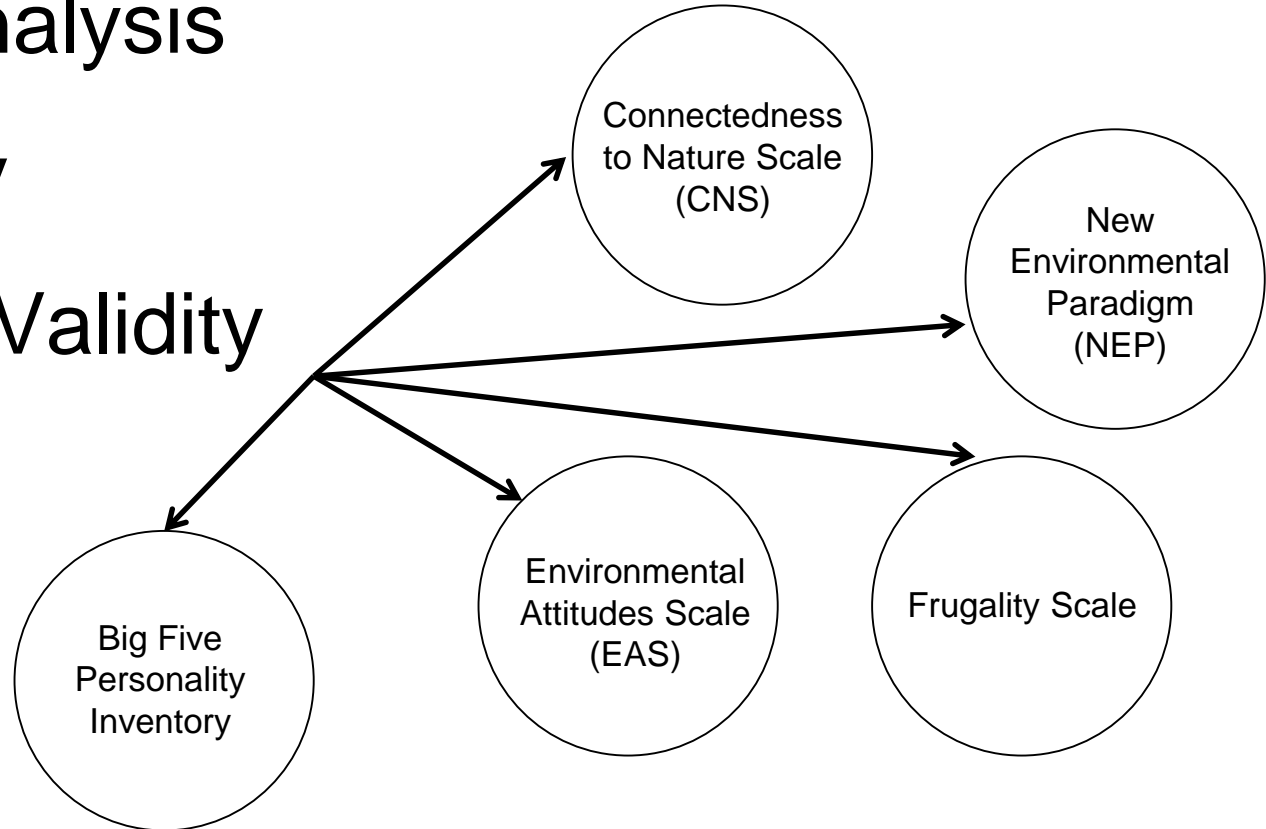
1. Factor Analysis

2. Reliability

3. Criterion Validity

Convergent: Scales should relate to other relevant concepts

Divergent: Scales should NOT relate to certain concepts



Toolkit Testing - Results

(Exemplary Evidence of)

3. Criterion Validity

Convergent: Scales
should relate to other
relevant concepts

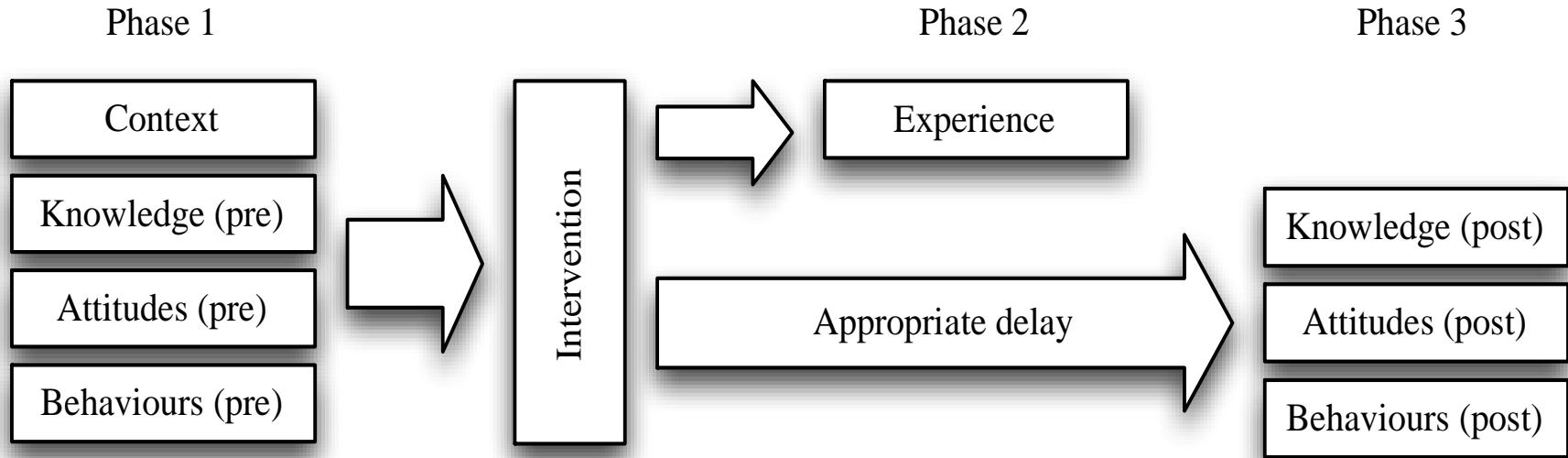
** Significant at the
 $p < .01$ level

Measure	Intrinsic Environmental Attitudes	Extrinsic Environmental Attitudes
Motivation - prosocial	.451**	.388**
Motivation - self comfort	-0.033	-0.06
Motivation - cost	.258**	0.023
Energy Literacy - awareness	.421**	.273**
Connection	.540**	.356**
Concern	.570**	.280**
Personal norms	.701**	.297**
Social norms	0.026	.294**
Performance efficacy	.390**	.150**
Response efficacy	.560**	.237**
UPscale - Ease of use	-.430**	-.234**
UPscale - Engagement	.428**	0.053
UPscale - Trust	.254**	0.053
Satisfaction	.255	.010

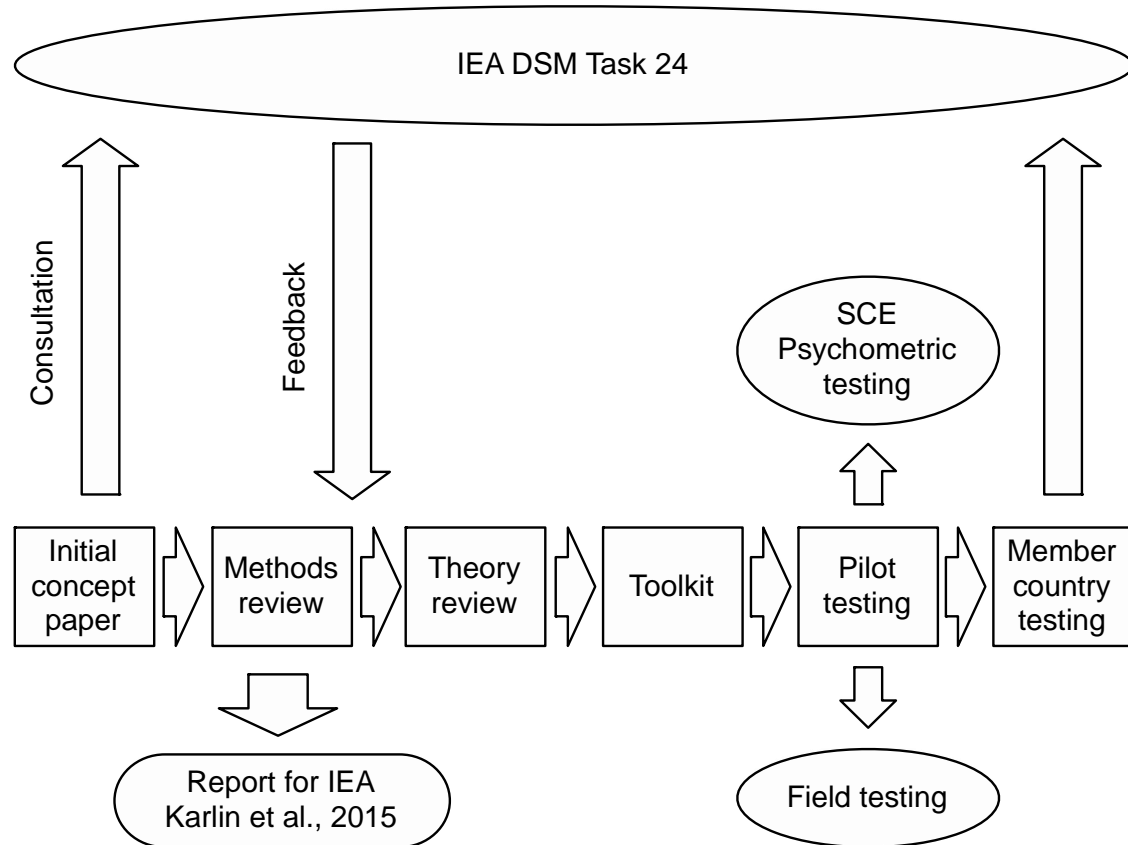
Toolkit Implementation

How will this work in the field?

Toolkit Implementation



Next Steps



Thank you!

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