SURVEY DESIGN AND ADMINISTRATION

FACULTY ACADEMY ON TEACHING FIRST-YEAR STUDENTS

ADRIANA SIGNORINI

CENTER FOR ENGAGED TEACHING AND LEARNING

MOTIVATION AND CONTEXT

Surveys are critical to our work:

- UC-wide surveys (UCUES, NSSE)
- UC Merced surveys (New Student Survey)
- School-based course evaluations

- Classroom surveys ◄ We are here!

  Mid-course feedback

  Classroom needs assessment surveys

- Action-research in our classrooms resulting in SoTL

Ongoing professionalization toward data-driven decision-making

OUTCOMES

At the end of this presentation, you will be able to:

1. Identify key components in the survey design process
2. Discuss key issues in survey administration
3. Extract meaning from the data
4. Make decisions on how to report data depending on the goals of the survey

AGENDA

1. Quick background knowledge probe
2. Interactive presentation on key issues in survey development
3. Short presentation on data analysis and interpretation, and reporting
4. Summary and Q&A

BACKGROUND QUESTION 1

How frequently do you use surveys to collect data or information from your class?

a) Never
b) Rarely
c) Sometimes
d) Often

BACKGROUND QUESTION 2

Since January 1, 2017, approximately how many surveys have you developed?

a) None
b) 1 or 2
c) 3 - 5
d) more than 6

BACKGROUND QUESTION 3

Typically, a sampling error of ±3% is considered acceptable.

If you want to survey your 100 students, how large a sample do you need to get a sampling error of approximately ±3%?

a) 30
b) 80
c) 90
d) 100
e) Don't know

BACKGROUND QUESTION 4

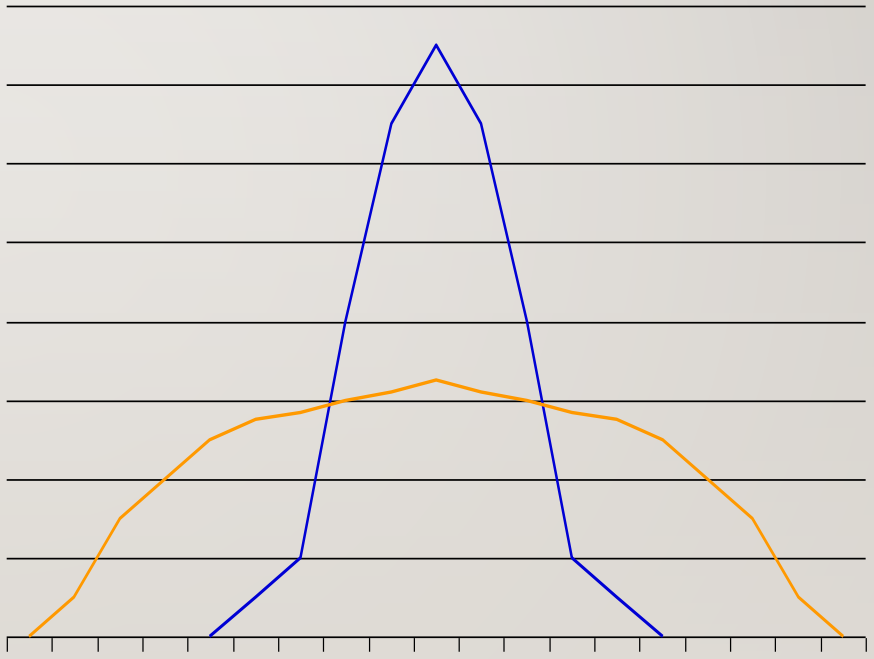
Which of the following distributions has the smallest standard deviation?

a) Line 1

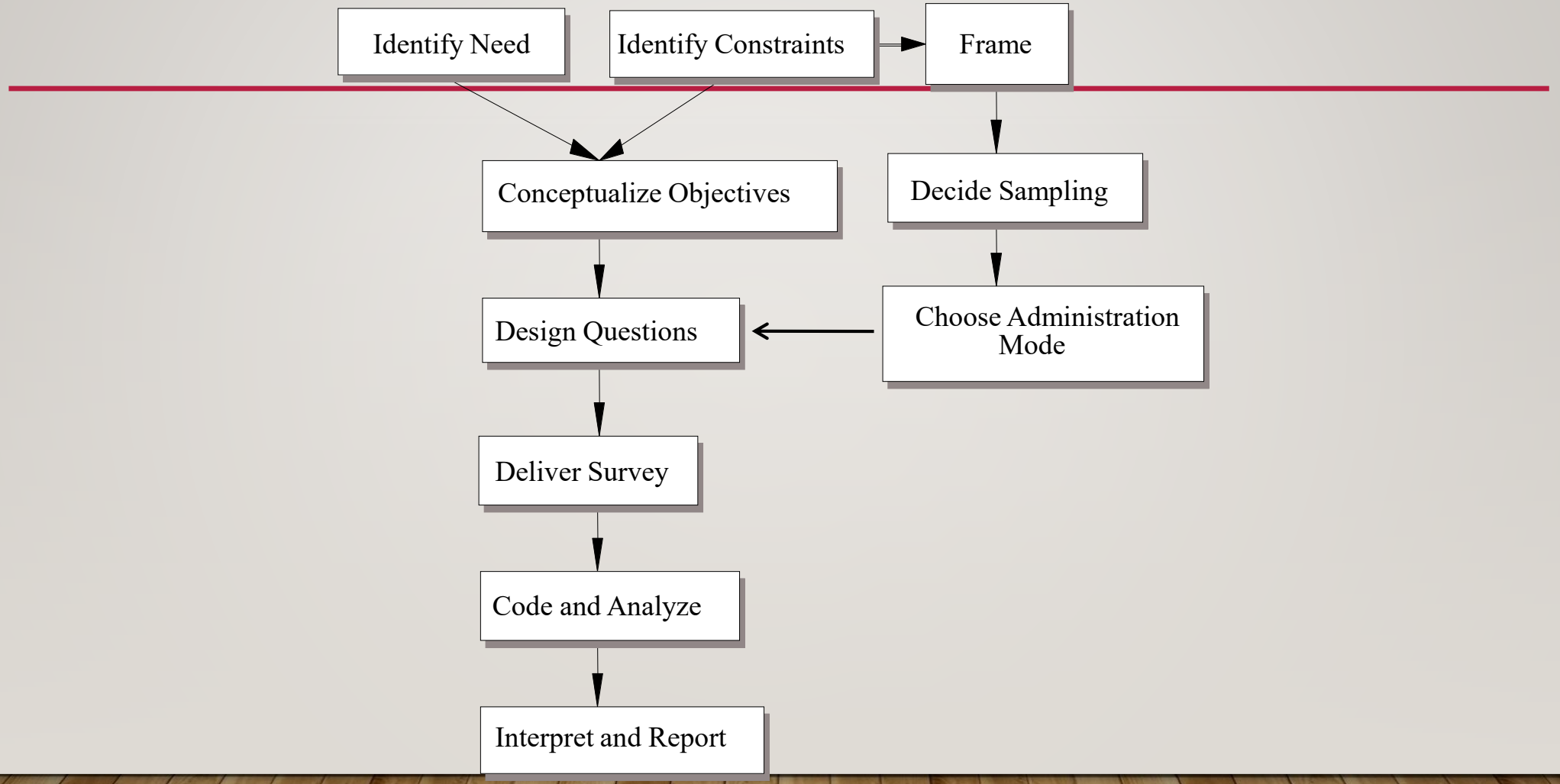
b) Line 2

c) They have the same standard deviation

a) I don't have a clue



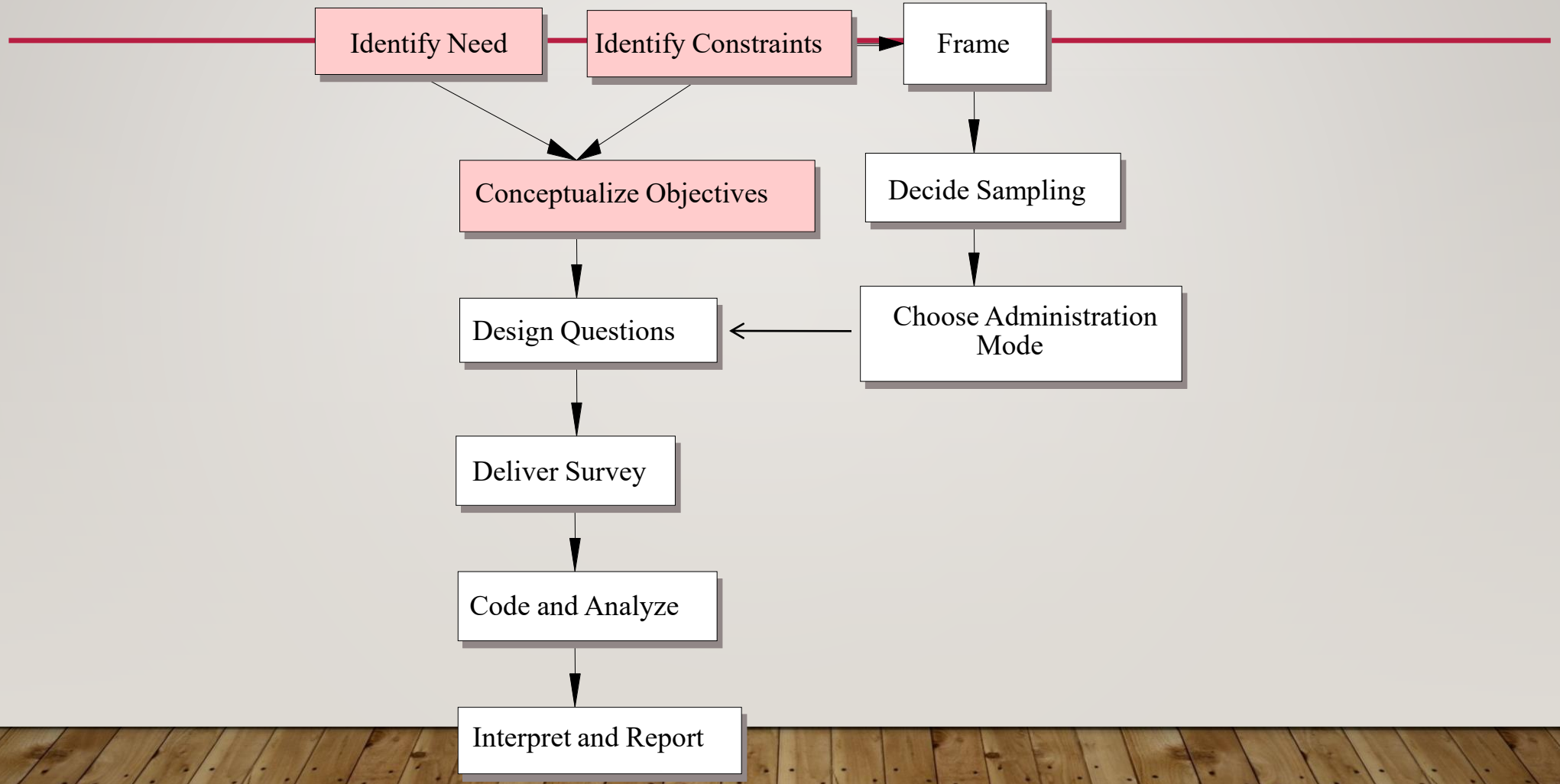
CONCEPTUAL FRAMEWORK



AN ERROR-BASED PERSPECTIVE ON SURVEYS

- We are trying to measure something
- The measurements will not be perfect
  - Surveys accrue errors at every step of the process
- Our goal is to minimize errors/maximize quality
  - Validity
  - Reliability

PROJECT DESIGN ERROR



1. IDENTIFY THE NEED

Is a survey necessary?

- Ask yourself:
  - *Can I get the data I need from another source?*
  - *Can I get the data I need using another method?*

1. IDENTIFY THE NEED

Is a survey appropriate?

- *CANNOT USE SURVEYS TO PROVE CAUSALITY*!

2. CONCEPTUALIZE OBJECTIVES

- Writing questions is not the starting point
- Identify your objective(s).
  - What information do you want your survey to collect?
  - Examples:
    - How well the class has achieved the SOL based on the deliberate practice implemented compared to other classes?
    - One/ two/ three years from now/ after graduation, what do students from your class think about the deliberate practice?
    - How successful was this semester's the deliberate practice implementation?

2. CONCEPTUALIZE OBJECTIVES

THE CONCEPTUAL DRILL DOWN

Conceptual objective: How successful was this semester's deliberate practice implementation?

How would a successful deliberate practice manifest itself in the students:

Knowledge / Factual Information
Thoughts
- –Beliefs and attitudes
- –Expectations
- –Evaluations

Feelings
- –Positive affect (satisfaction, comfort, happiness, etc.)
- –Negative affect (anxiety, disappointment, anger, etc)

Behaviors
- –Explicit behaviors
- –Intentions

3. IDENTIFY CONSTRAINTS

- Time
- Money
- Human Capital (not only survey expertise, but also tech or administrative support)

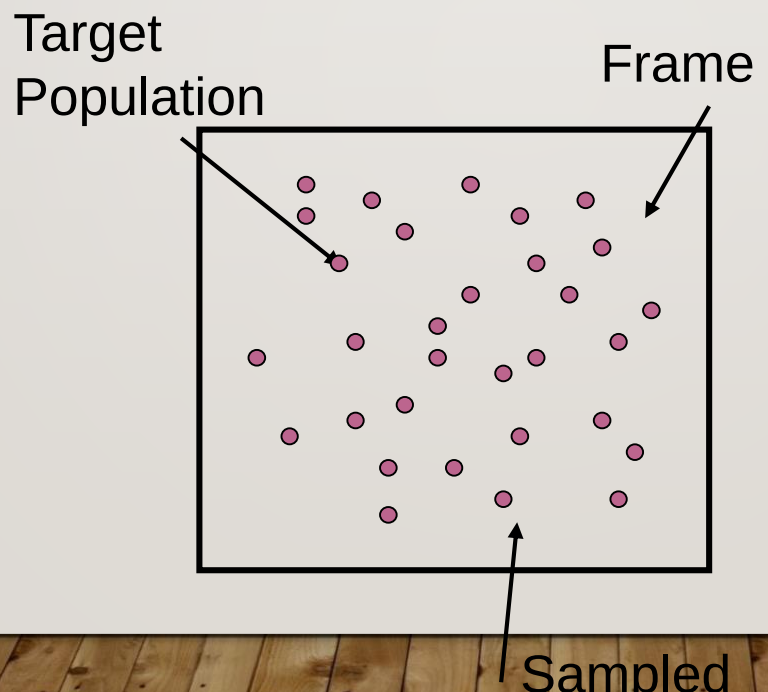
4. A STATISTICAL CONSTRAINT: THE *FRAME*

- **Target Population:** complete collection of observations we want to study
- **Frame:** the list of courses from which we actually sample
- **Sampled Population:** the list of population units that might have been chosen in a sample

(Lohr 1999)

EXAMPLE

- Survey of the deliberate practice implementation



DECIDE THE SAMPLING PLAN

- Goal: take a sample *representative* of the entire population
  - So we can *generalize* our results to the population
- How do we ensure that? *Randomization*
  - Laws of probability guarantee representativeness *on the average*
- Bad news: true random samples are close to impossible in real life
  - Need other kinds of samples
  - Need to articulate the pros and cons of those

CONSIDERATIONS FOR SAMPLE SIZE

- How large is your population?
- What level of confidence do you need to have? *90%, 95%, 99%*
- What level of sampling error is acceptable? *±3%, ±5%, ±10%*
- *What is the distribution (standard deviation) of responses?*

We don't know this in advance so we hedge against the worst case scenario

In general, can use online sample size calculators

- www.raosoft.com/samplesize.html

Raosoft®

Sample size calculator

What margin of error can you accept? 5% is a common choice	%	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	%	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000		How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	%	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size.
Your recommended sample size is	**0**	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

I HAVE A SAMPLE SIZE, NOW WHAT?

- To determine how many respondents to solicit, estimate your response rate.
  - Prior experience, normative data, intuition.
- Example: Sample size of 80

	Response Rate			
	100%	75%	50%	25%
Number of solicitations	80	60	40	20

6. MODE OF ADMINISTRATION

Options

- In person
- Online
- Telephone
- Mail
- Mixed-mode

6. MODE OF ADMINISTRATION

- Paper-and-pencil (in person, mail):
  - Familiar format for most people
  - Can complete anywhere, anytime
  - Can add comments or qualify responses

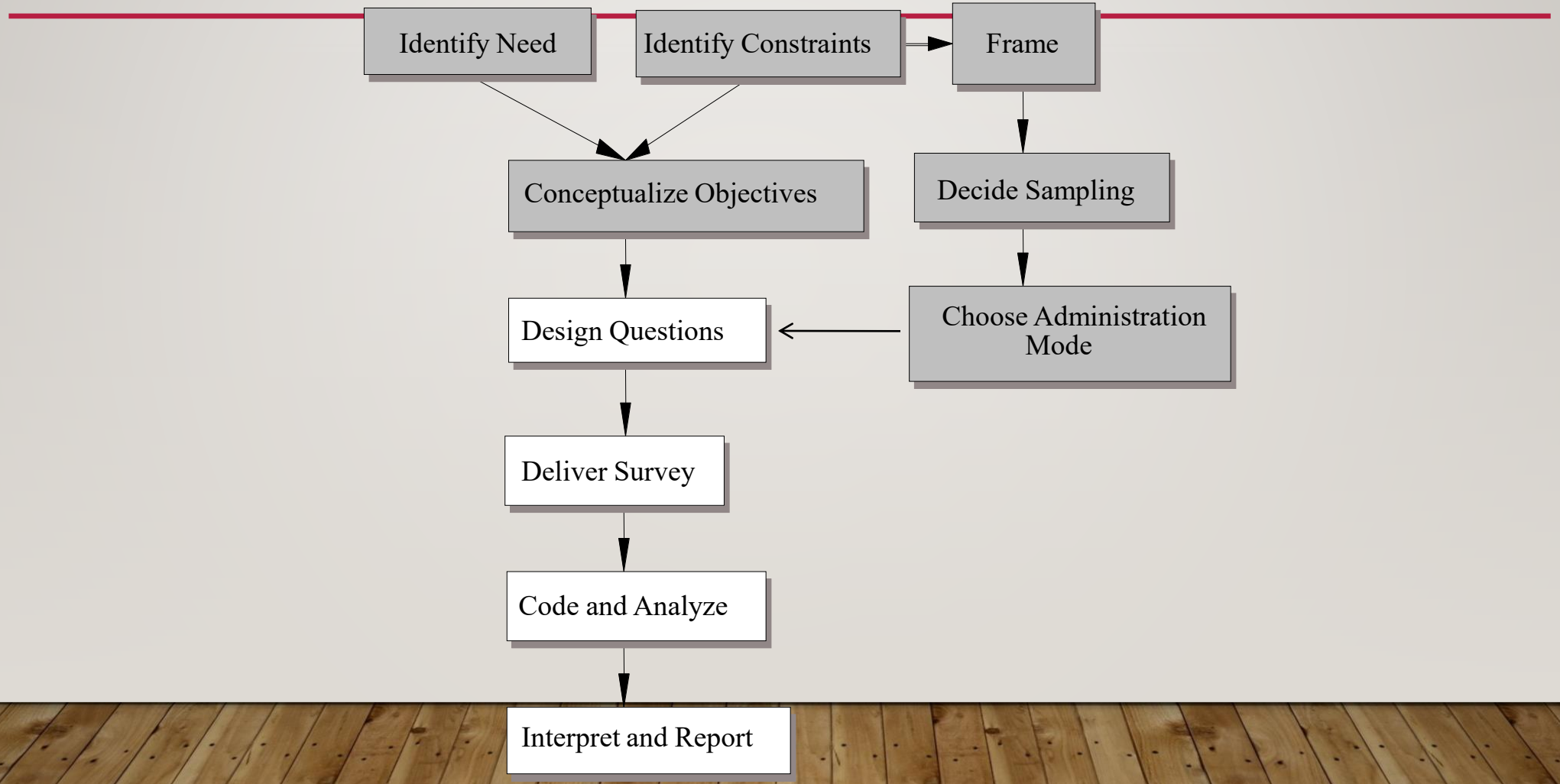
- Online:
  - Low cost distribution
  - Can program branches and skips
  - Data stored in database
  - Can automate reminders and thank yous
  - Can easily track number of respondents and responses

6. MODE OF ADMINISTRATION

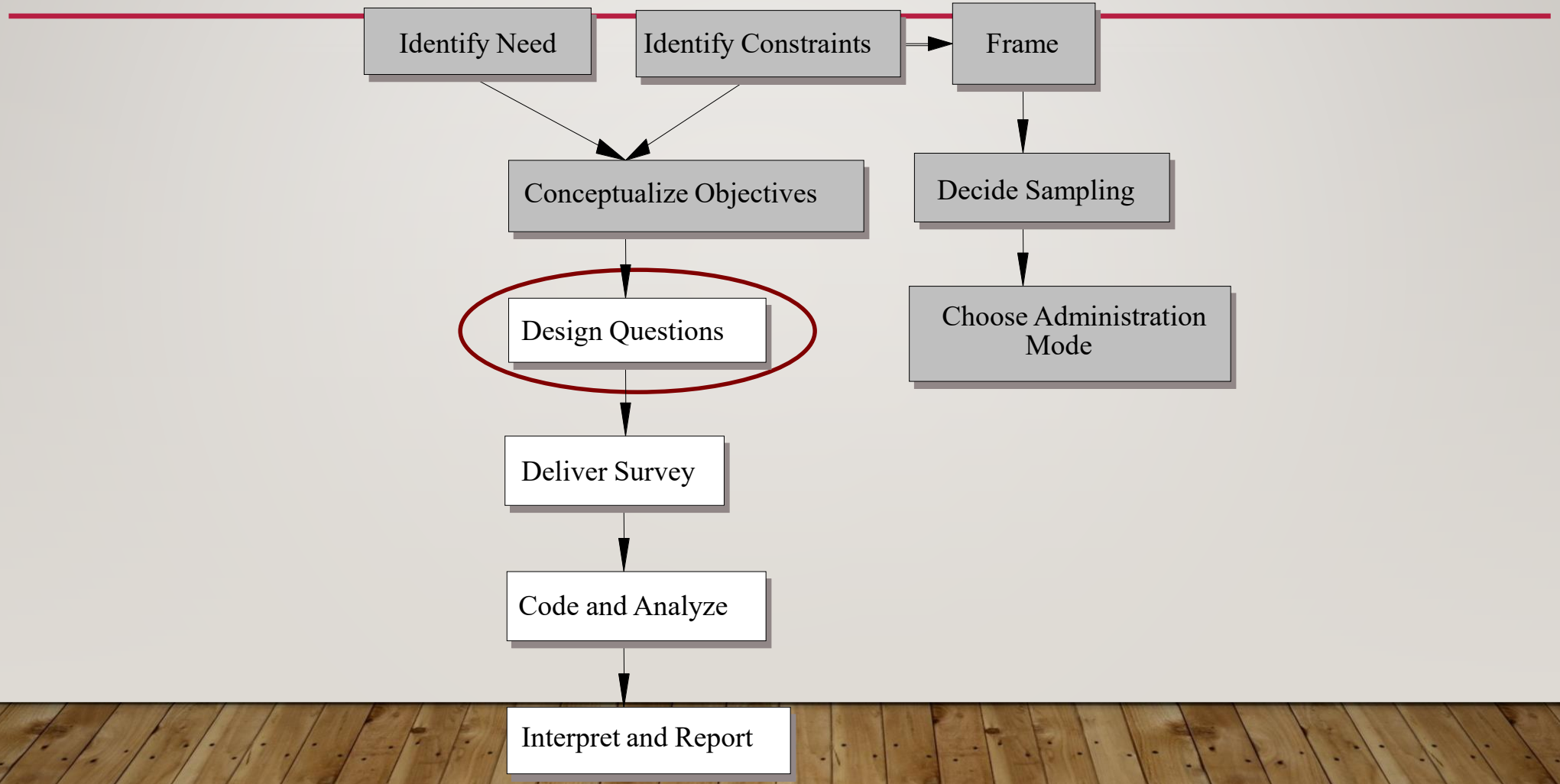
Considerations:

- Population characteristics
- Sample size
- Topic (e.g., sensitive topics)
- Resources
  - Time
  - Money
  - People

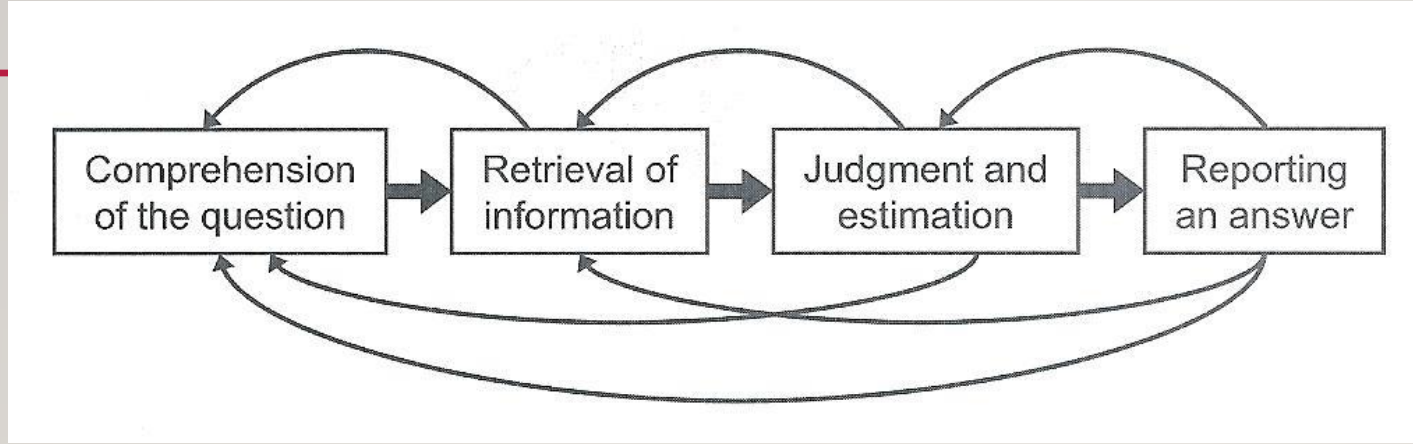
RECAP


Identify Need
Identify Constraints
Frame
Conceptualize Objectives
Decide Sampling
Design Questions
Choose Administration Mode
Deliver Survey
Code and Analyze
Interpret and Report

NOW WE CAN THINK ABOUT QUESTIONS



7. DESIGN QUESTIONS



- *Does respondent understand what you mean?*
- *Can respondent recall information from memory?*
- *How does respondent combine, edit, fill in, information needed to answer question?*
- *What does respondent elect to respond?*

Groves et al. (2004)

7. DESIGN QUESTIONS

How the question is posed can have a big impact on how it is answered.

Example: *How many hours a day do you typically study?*

Version A	Version B
< .5 hrs	< 2.5 hrs
.5 – 1 hrs	2.5 – 3 hrs
1 – 1.5 hrs	3 – 3.5 hrs
1.5 – 2 hrs	3.5 – 4 hrs
2 – 2.5 hrs	4 – 4.5 hrs
> 2.5 hrs	> 4.5 hrs

Version A	Version B
< .5 hrs	< 2.5 hrs
.5 – 1 hrs	2.5 – 3 hrs
1 – 1.5 hrs	3 – 3.5 hrs
1.5 – 2 hrs	3.5 – 4 hrs
2 – 2.5 hrs	4 – 4.5 hrs
> 2.5 hrs	> 4.5 hrs
% that report > 2.5 hrs of studying	23%	69%

How would you answer the question "What percentage of students study 2.5 hours or more a day?

(Rockwood, Sanser & Dillman, 1997)

7. DESIGN QUESTIONS

- General guidelines to follow:
  - Be brief
  - Be simple and clear
  - Be specific
  - Be objective

7. DESIGN QUESTIONS

BE BRIEF:

"Brevity's goal is to create the shortest way to ask a question without losing its intent. It's not always about reducing the length of the question" Iarossi, 2006

- A general rule of thumb:

If a question is longer than 25 words, see if you can reduce the number of words.

Issue: Cognitive Demand

7. DESIGN QUESTIONS

BE SIMPLE and CLEAR

- Use simple language
- Avoid jargon
- Avoid negatives
- Avoid absolutes (e.g., always, never)
- Avoid double-barreled questions
- Put choices last

7 DESIGN QUESTIONS

- Be simple and clear: simple language

USE…	INSTEAD OF…
tired	exhausted
honest	candid
most important	top priority
free time	leisure
work	employment
brave	courageous
correct	rectify

7. DESIGN QUESTIONS

- EXAMPLE: Be simple and clear: Negatives

Do you favor or oppose not allowing classes to be cancelled during spring break?

Revision:

Do you think classes should be cancelled during spring break?

7. DESIGN QUESTIONS

- EXAMPLE: Be simple and clear : Double-Barreled

To what extent has the dean demonstrated strong leadership and innovation?

Revision:

To what extent has the dean demonstrated strong leadership ?

To what extent has the dean demonstrated innovation?

7. DESIGN QUESTIONS

- BE SPECIFIC

- Avoid asking questions that have more than one meaning or multiple interpretations.

7. DESIGN QUESTIONS

- EXAMPLES: Be specific

- How would you rate your participation during this class?

Revision: Compared to other students in this class, how would you rate the quality of your participation in class discussion?

- How many times have you visited a tutor this year?

Revision: How many times have you visited a tutor at the STEM Center since fall this year?

7. DESIGN QUESTIONS

- BE OBJECTIVE

Avoid questions that lead the respondents to answer in a particular way.

7. DESIGN QUESTIONS

- EXAMPLE: Be objective

- This semester, we installed state-of-the-art classroom response systems in the all large lecture halls. How much do you like the system?

Revision: Please indicate how satisfied or dissatisfied you are with the classroom response systems in the large lecture halls?

7. DESIGN QUESTIONS

Known problems

- Asking about rates, proportions percentages
- Recall from the past
- Hypotheticals

7. QUESTION DESIGN

- Common issues in writing questions.

7. DESIGN QUESTIONS

- Open-ended (free response)
  - Often times more demanding to answer (may have higher skip rate)
  - Richer, contextualized information
  - Demanding to code and analyze
  - Good for exploratory issues
- Closed-ended (categorical or ordinal)
  - Less demanding to answer, code and analyze
  - May force answers
  - Good when response options are well-known and limited

7. DESIGN QUESTIONS

- Open-ended
  - Size of text box or number of blank lines cue the length of the response
  - Be sure to indicate the desired form or units of your answer.
    - Examples:
      - What resources do you currently use?

        _____tutoring _____which one?
      - How long ago did you attend office hours?

        _____(days; if less than 1 day indicate 0)

7. DESIGN QUESTIONS

- Close-ended
  - Categorical
    - Mutually exclusive and exhaustive categories
    - When you go out to eat, which type of food do you most prefer?
      - Indian
      - Italian
      - Mexican
      - Chinese
      - Ethiopian
      - Other:_____

7. DESIGN QUESTIONS

- Close-ended
  - Ordinal
    - Make sure that the response options match the dimension of interest in the question
    - To what extent has the deliberate practice improved your research skills?
      - Never
      - Rarely
      - Sometimes
      - Often

      Revision:
      - Not at all
      - A little
      - Some
      - A great deal

7. DESIGN QUESTIONS

RESPONSE OPTIONS*

Common Issues

- How many options?
- Neutral points?
- Labels?
- Check all that apply?

7. DESIGN QUESTIONS

HOW MANY OPTIONS?

It depends!

Issues:

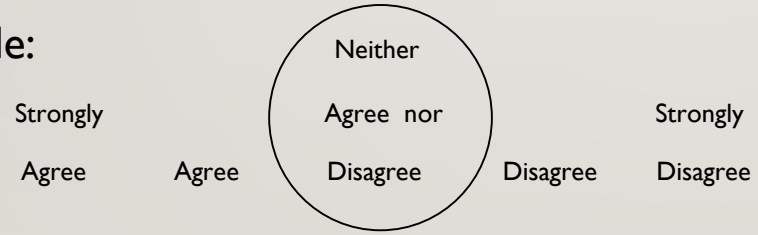
- Should have at least 3 options for non dichotomous scales (more than 9 and discrimination becomes difficult)
- Should be easily understood by respondents
- Should map to their experiences or perceptions
- Should discriminate among respondents' perceptions

7. DESIGN QUESTIONS

- NEUTRAL POINT

Issues:

- Does it make sense in the context of the question?
  - Most relevant in bipolar scales (e.g., satisfaction or agreement vs. value)
- Philosophical position
- Caveat: including a neutral point may reduce the proportion of positive responses.
- Example:

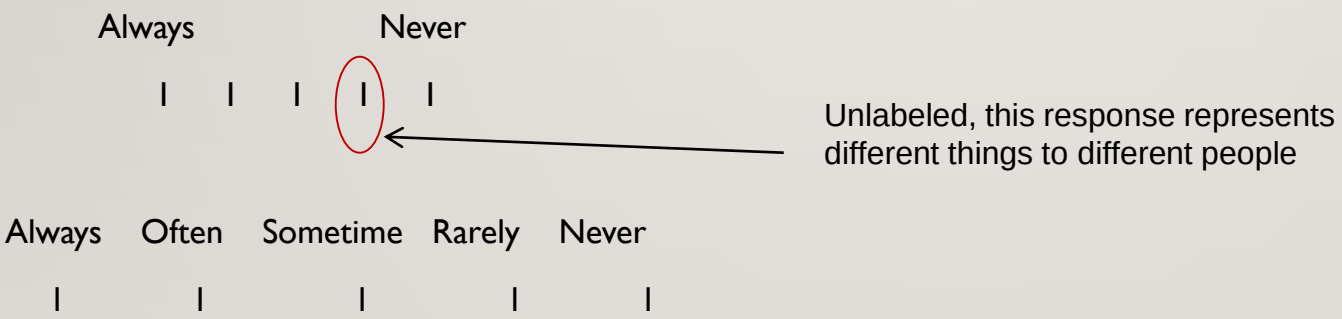


7. DESIGN QUESTIONS

- LABELS

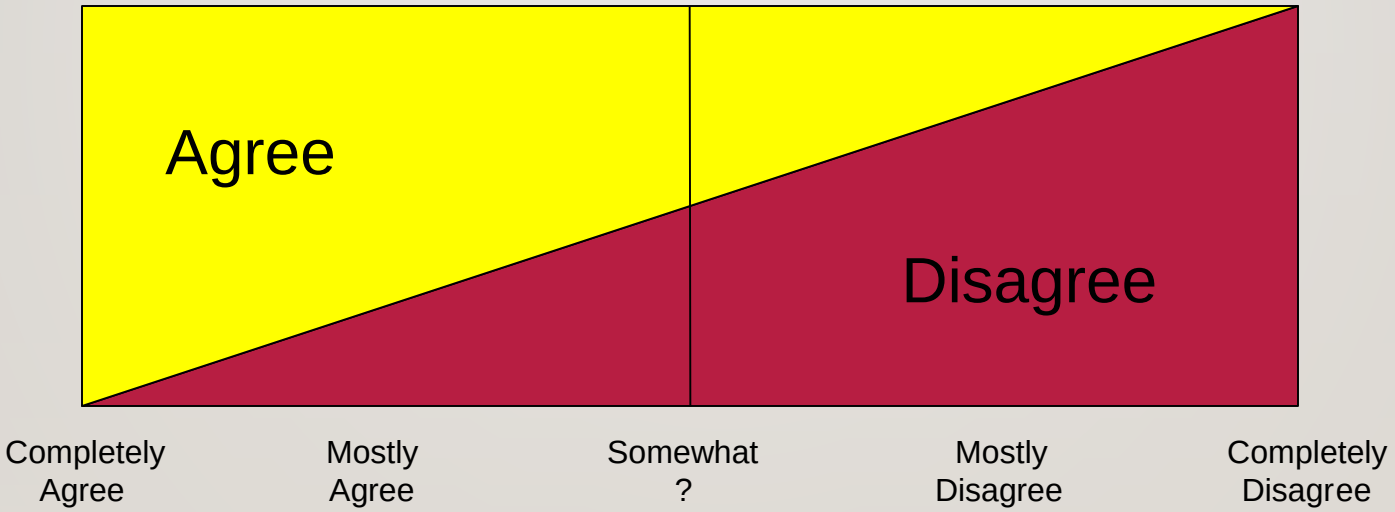
Providing anchors reduce error.

Example: Frequency



7. DESIGN QUESTIONS

Beware of “Somewhat”



7. DESIGN QUESTIONS

- CHECK ALL THAT APPLY

- Which of the following describe you (check all that apply)
  - ☒ Smart
  - ☒ Attractive
  - Rich
  - ☐ Fit
  - ☒ Kind
  - Funny
  - ☒ Articulate

- A more reliable alternative:
  - Indicate if the following characteristics describe you or not.

	Yes	No
Smart	☐	☐
Attractive	☐	☐
...		

7. DESIGN QUESTIONS

- RANKING

Issues:

- Demanding to answer
- Limit to 5 or fewer items
- Can accomplish similar goals using a scaled question.

PRETEST

- Test your questions!

- Cognitive Interviews
  - Verbal Protocols

WHAT DO YOU THINK?

Should the University use funds from student tuition to partially pay for a new swimming pool that includes lanes for swimming laps and that is not enclosed for the winter?

Yes ☐

No ☐

1. Good, needs no work
2. OK, needs a little work
3. Yikes, needs a lot of work

WHAT DO YOU THINK?

Which of the following best characterizes your attitude toward advising?

I find advising pleasant and rewarding

I have neither very positive nor very negative feelings toward advising

I find advising unpleasant

1. Good, needs no work
2. OK, needs a little work
3. Yikes, needs a lot of work

WHAT DO YOU THINK?

What brand of computer do you own?

- ☐ IBM PC
- ☐ Apple

1. Good, needs no work
2. OK, needs a little work
3. Yikes, needs a lot of work

ACTIVITY DEBRIEF

- What were the challenges in creating your survey?
- How did you decide between different alternatives?

SUMMARY SO FAR

- The process so far lets us conceptualize a good survey and design good questions relative to the identified needs.
- Now it's time to actually administer the survey and do something with the data we collect!

RESEARCH COMPLIANCE AND ETHICS

Remember to get IRB clearance if the survey is done for research purposes (i.e., for publication)!

8. DELIVER SURVEY

- Key Issues
  - Solicitation
  - Incentives

8. DELIVER SURVEY

SOLICITATION

- Personalization
- Short and to-the-point
  - How/why the respondent was selected
  - Purpose of survey
  - Simple instructions
  - Point of contact for problems
- Reminders and thank yous
- Preminders

8. SURVEY DELIVERY

- All these considerations try to maximize the response rate

- Face to face
- Telephone
- Mail-in
- Online
  - Online with an email invitation and a preminder postcard approximates mail (Kaplowitz et al 2004)

8. SURVEY DELIVERY

- Ideal response rate: as close to 100% as possible
- Realistically with online surveys: you'd be lucky to get 50%
  - Need 33% at least

9. ANALYZE AND CODE DATA

- Analyze Questions
  - **Exploratory Data Analysis**
    - Numerical Summaries
    - Graphic Displays
    - Coding Open-Ended Questions
  - **Hypothesis Testing**
  - **Modeling**

9. ANALYZE AND CODE DATA

- Numerical Summaries
  - Measures of central tendency
    - **Mode** – category with the highest frequency

What is the mode in this distribution?

1. Male
2. 60
3. 100
4. Can't tell

Category	Frequency
Male	60
Female	40
Total	100

9. ANALYZE AND CODE DATA

- *Measures of central tendency*
  - **Numbers and Percentages**
    - Yes/No (Dichotomous) Questions
    - Categorical Questions (e,g., Race, Major)

What should we report from these data?

1. Raw Numbers
2. Percentages
3. Both
4. I don't know

9. ANALYZE AND CODE DATA

A recommendable resource?

- See "A Journalist's Guide to Statistics" at http://www.robertniles.com/stats/

- ***Measures of central tendency***
  - **Median** – number which leaves half the responses below itself and half above
    - Ordinal or numerical responses
  - **Mean** – average of all the responses

9. ANALYZE AND CODE DATA

Which of these two measures do you think is more sensitive to outliers?

1. The Mean
2. The Median
3. They are equally sensitive
4. I can't tell

9. ANALYZE AND CODE DATA

Which of these two measures do you think is more sensitive to outliers?

1. The Mean
2. The Median
3. They are equally sensitive
4. I can't tell

Example: Age

44, 39, 48, 46, 44

9. ANALYZE AND CODE DATA

Which of these two measures do you think is more sensitive to outliers?

1. The Mean
2. The Median
3. They are equally sensitive
4. I can't tell

Example: Age

Order data:

39, 44, 44, 46, 48

Mean = 44.2
Median = 44

9. ANALYZE AND CODE DATA

Which of these two measures do you think is more sensitive to outliers?

1. The Mean
2. The Median
3. They are equally sensitive
4. I can't tell

Example: Age

Order data:

39, 44, 44, 46, 72

Mean = 49
Median = 44

9. ANALYZE AND CODE DATA

- ***Numerical Summaries***
  - *Measures of Variability*
    - **Standard Deviation** – (quadratic) average of deviations from the mean
      - Measure of how far from the mean each observation lies, *on average*
      - Measure of *agreement* (small SD $\Rightarrow$ agreement)

9. ANALYZE AND CODE DATA

What happens to the standard deviation in the presence of outliers?

1. It increases
2. It decreases
3. It stays the same
4. I can't tell

9. ANALYZE AND CODE DATA

What happens to the standard deviation in the presence of outliers?

1. It increases
2. It decreases
3. It stays the same
4. I can't tell

Example: Age

39, 44, 44, 46, 48

Mean = 44.2
Median = 44
St. Dev. = 3.3

9. ANALYZE AND CODE DATA

What happens to the standard deviation in the presence of outliers?

1. It increases
2. It decreases
3. It stays the same
4. I can't tell

Example: Age

39, 44, 44, 46, 72

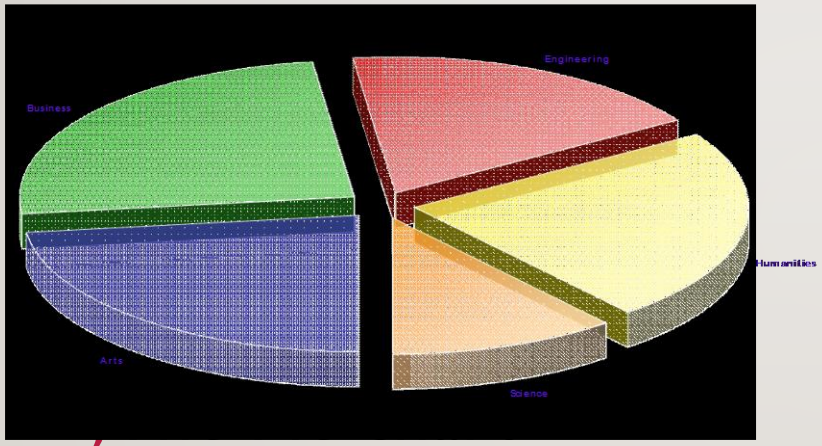
Mean = 49
Median = 44
St. Dev. = 13.1

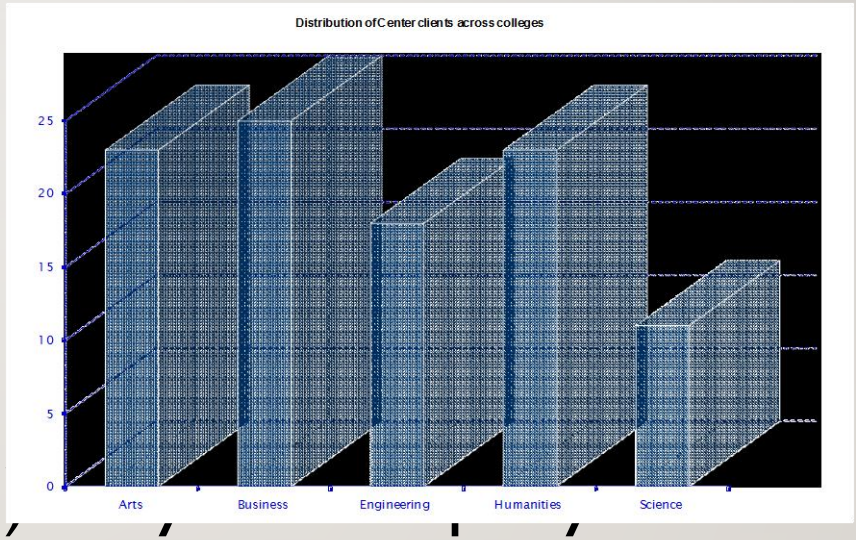
9. ANALYZE AND CODE DATA

Exploratory Data Analysis

- ***Graphic Displays***
  - **Pie chart** – used to represent categorical distributions
  - **Barplot** – used to represent categrical distributions
  - **Histogram** – used to represent the entire distribution of numerical variables
  - **Mean plot** – used to compare the means of two or more groups of variables

Which of these two displays works better?





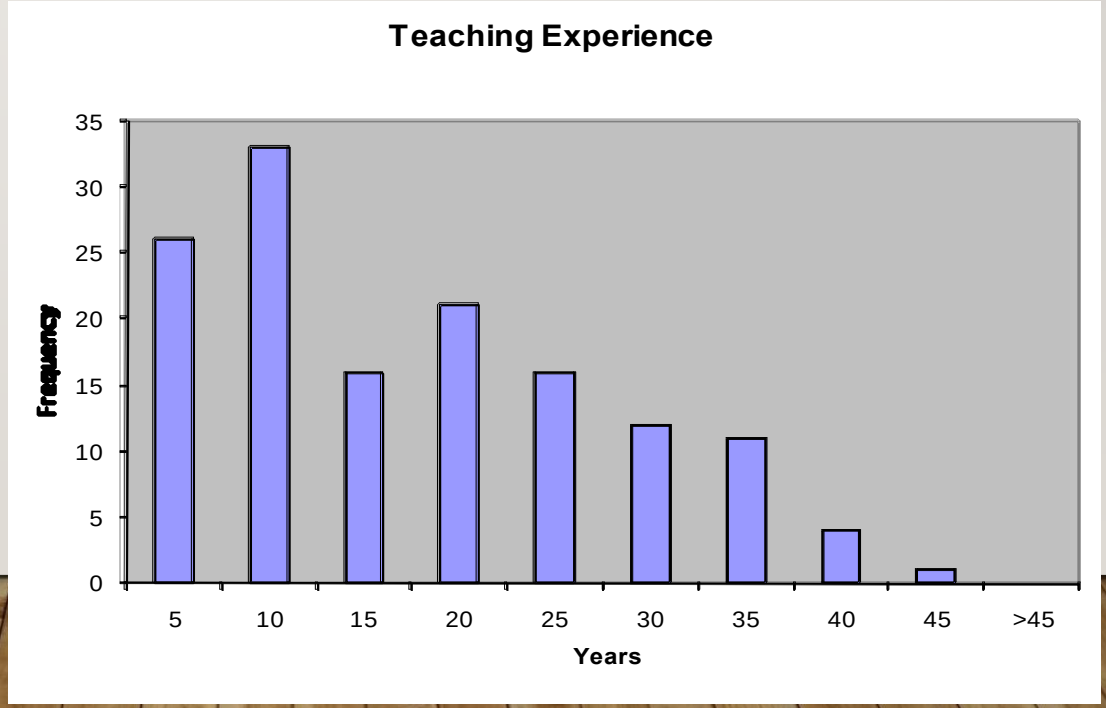
2) The Histogram

3)

4) I can't tell

9. ANALYZE AND CODE DATA

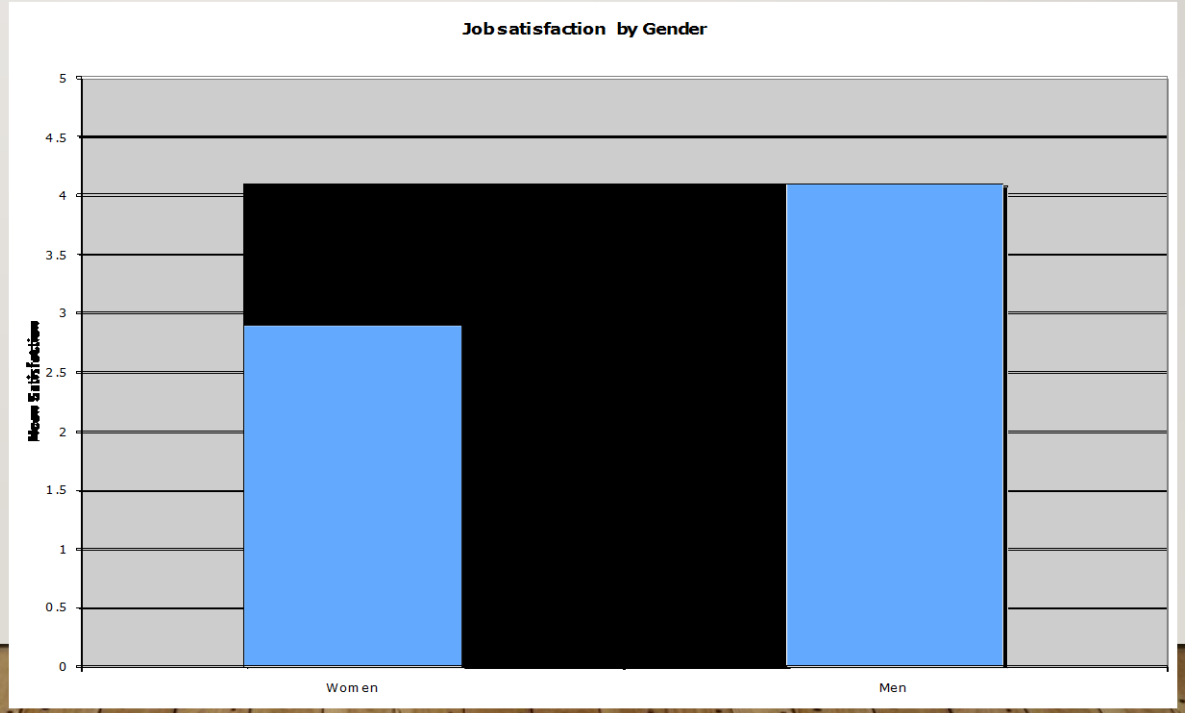
- **Histogram** – similar to barplot but the bars are ordered
  - Represents the shape of the distribution
    - Mode(s)
    - Center
    - Symmetry
    - Outliers



9. ANALYZE AND CODE DATA

Which of the two groups has a significantly higher mean?

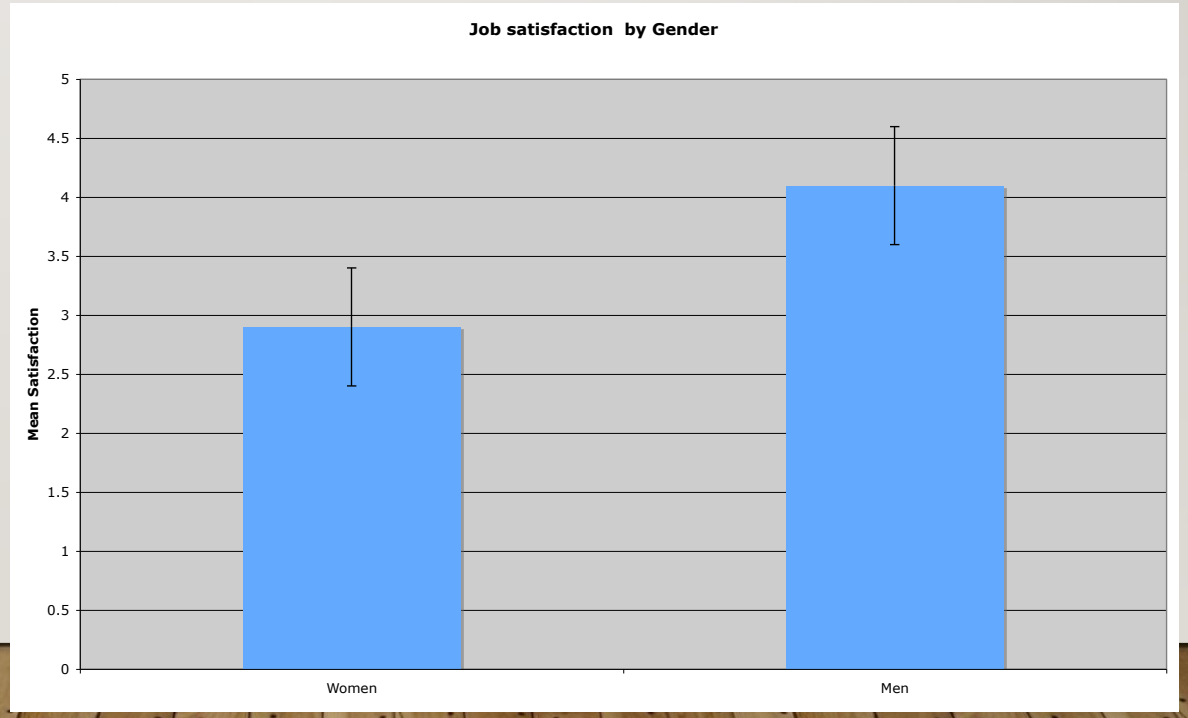
1. Women
2. Men
3. The means are the same
4. I can't tell



9. ANALYZE AND CODE DATA

Which of the two groups has a significantly higher mean?

1. Women
2. Men
3. The means are the same
4. I can't tell



9. ANALYZE AND CODE DATA

- **Open-Ended Comments**
  - Cluster them into categories
    - A Priori groupings
    - Ex-post groupings
  - Report frequencies/percentages for each category
  - Can include sample comments for each category

10. INTERPRET AND REPORT

- ***Statistical Caveats***

- ***General Caveats***

10. INTERPRET AND REPORT

Statistical Caveats

1. Do not assume Significance!!
2. Do not assume Causality!!
   - *Association does not imply Causation*
   - *Temporal Progression does not imply Causation*
   - In general, need experiments (not surveys) to infer causation

10. INTERPRET AND REPORT

3. Be wary of *Lurking Variables!!*
   - *Simpson's Paradox*

	Humanities College	Engineering College
Left after 1st Year	63	16
Stayed after 1st Year	2037	784
Total	2100	800
(% Attrition)	3%	2%

10. INTERPRET AND REPORT

- Lurking variable: Gender

	Men		*Women*	
	Humanities College	Engineering College	Humanities College	Engineering College
Left after 1st Year	6	8	57	8
Stayed after 1st Year	594	592	1443	192
Total	600	600	1500	200
(% Attrition)	1%	1.3%	3.8%	4%

Adapted from Moore and McCabe 1999

10. INTERPRET AND REPORT

Lurking Variables and Simpson's paradox moral:

- Plan carefully to include important lurking variables
- Bring them into the analysis

10. INTERPRET AND REPORT

- Lurking variable: Gender

	Men		*Women*	
	Humanities College	Engineering College	Humanities College	Engineering College
Left after 1st Year	6	8	57	8
Stayed after 1st Year	594	592	1443	192
Total	600	600	1500	200
(% Attrition)	1%	1.3%	3.8%	4%

Adapted from Moore and McCabe 1999

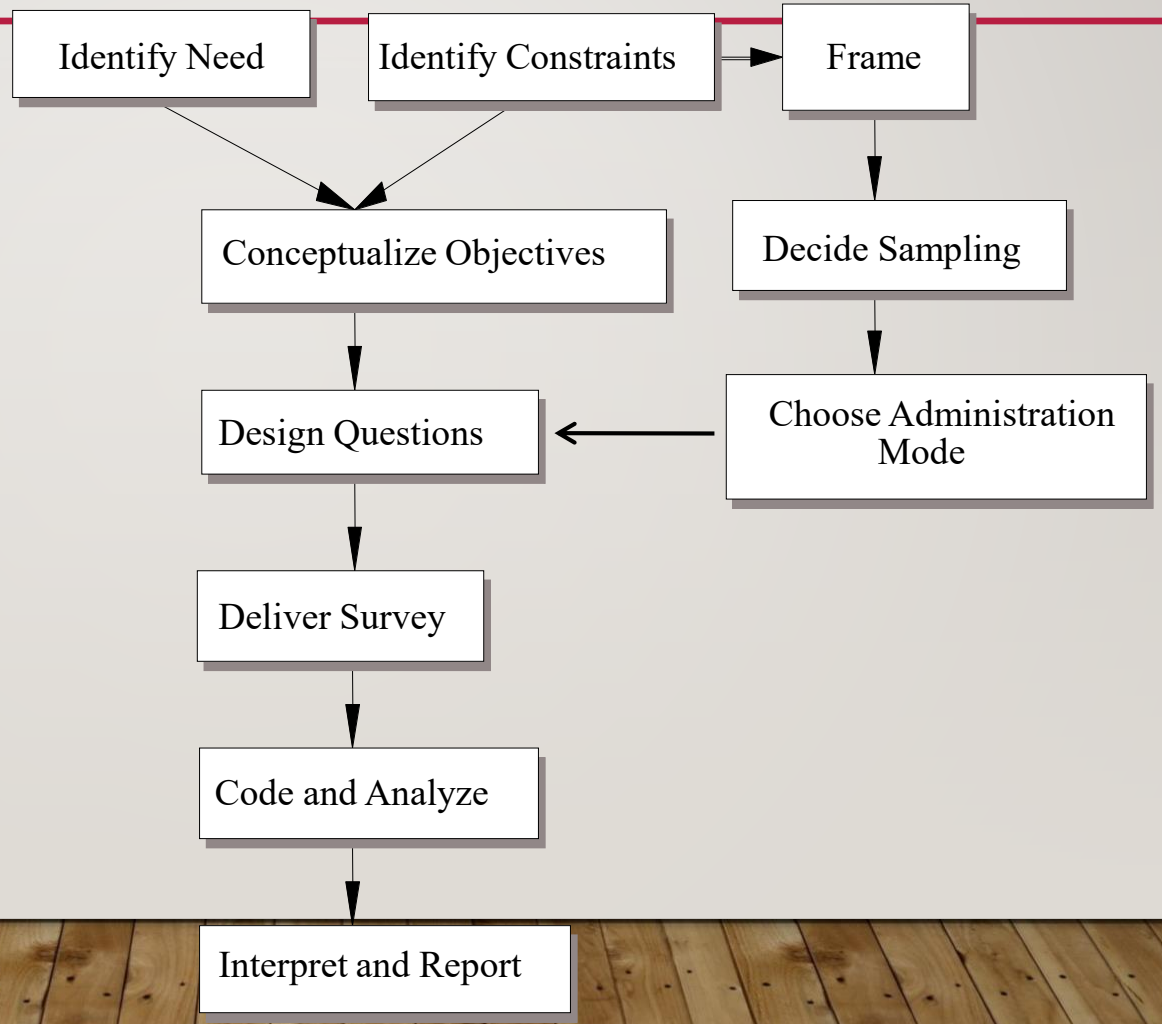
10. INTERPRET AND REPORT

General Caveats

- Don't ask if you don't want to know!
- Don't ask if you can't do anything about it!
  - Work with all your constituencies
- Plan the follow-up
  - Tie it back to the original purpose

SUMMARY

Following a thoughtful survey design process helps to eliminate error and provides high-quality, useful data.



REFERENCES

- Dillman, D.A. (2000). *Mail and Internet Surveys: The Tailored Design Method* (2nd ed.) New York: Wiley & Sons.
- Groves, R., et al. (2004) *Survey Methodology*. Wiley & Sons.
- Iarossi, G. (2006) *The Power of Survey Design: A User's Guide for Managing Surveys, Interpreting Results and Influencing Respondents*. Washington D.C.: The World Bank.
- Lohr, S. (1999) *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press.
- Moore, D., and McCabe, G. (1999) *Introduction to the practice of statistics* (3rd ed.). New York: Freeman.
- Excel Survey Analysis Guide, from the University of Wisconsin-Extension Program https://learningstore.uwex.edu/assets/pdfs/G3658-14.pdf
- CETL's Students Assessing Teaching and Learning at http://cetl.ucmerced.edu/satal