What do Elementary School Children know about Architecture?

36-303: Sampling, Surveys, and Society
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Introduction

K-12 Architectural Education

- Architecture ***is*** being taught to K-12 students
  - Architecture Centers
  - Museums
  - Historical Organizations
  - Universities
  - K-12 Magnet Schools

- National Organization: A+DEN (Architecture and Design Educator Network)

Introduction

Why is testing Architectural Knowledge Important?

- Given that architecture is being taught, effective teaching requires knowledge of:
  - What students already know
  - What we want them to know
  - If they learned what we want them to know

Introduction

Status of Published Research

- Architectural education research
  - Method: qualitative, typically case study
  - Population: typically college students
- Connections to Other Disciplines
  - Geography research (spatial reasoning and mapping)
  - Education (NAEP)
  - Arts

Introduction

Our Research and Contribution

- What do students already know
  (based on what we want them to know)?
  - What does an architect do?
  - Visual literacy (“reading” drawings)
  - Mapping skills
  - Measurement skills

- Knowing this helps architectural educators plan programming that is educationally appropriate

Where we are

Target Population & Sampling Frame

- Target Population
  - 3rd, 4th, and 5th graders
  - Two Pittsburgh Public School Academies
    - Carmalt Academy
    - Lincoln Academy
- Sampling Frame
  - Rosters of enrolled 3rd, 4th, and 5th grade students at both schools

Where we are

Expected "Sample" Size

- Student body
  - Lincoln (K-8) = 455 students
  - Carmalt (K-8) = 621 students
- Assuming equal number of students per grade level
  - Lincoln = 51 students / grade
  - Carmalt = 69 students / grade
- 3 grade levels at each school
  - Lincoln = 153 students in 3rd – 5th grades
  - Carmalt = 207 students in 3rd – 5th grades
  - Total population = 360 students
- Attendance rates – reduction of sample size
  - Lincoln = 90% attendance rate required for admission
  - Carmalt = 94% reported attendance rate
- Other unavailability – further reduction of sample size
  - Assume worst case is 1 student per class
  - Estimated class size 18 students
- Final Estimation of Expected Respondents for Census

  ((153 x .90) + (207 x .94)) x (17/18) = 314 students

Where we are

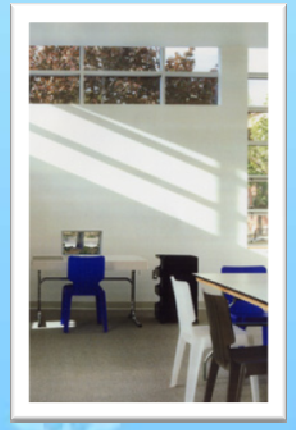
Sample Size Calculations

- 314 Students
- Margin of Error = 2
  - Accurate within +/- 2 questions
- Standard Deviation = 8
  - Pilot Survey SD = 2
    - Increased due to more questions on test (14 to 35)
    - Increased due to biased sample
- Simple Random Sample Calculations
  - $n_o = 2^2 * SD^2 / ME^2 = 2^2 * 8^2 / 2^2 = 64$ students
  - $n = (N*n_o)/(N + n_o) = 314*64/(314+64) = 57$ students

Where we are

Method

- **Mode of data collection**
  - Administered in person
  - Paper and Pencil
- **How to carry out study**
  - Three days per school (on day per grade)
  - Classrooms
- **Variables to measure and how**
  - What does an Architect do?
  - Visual literacy
  - Mapping skills
  - Measurement skills



Where we are

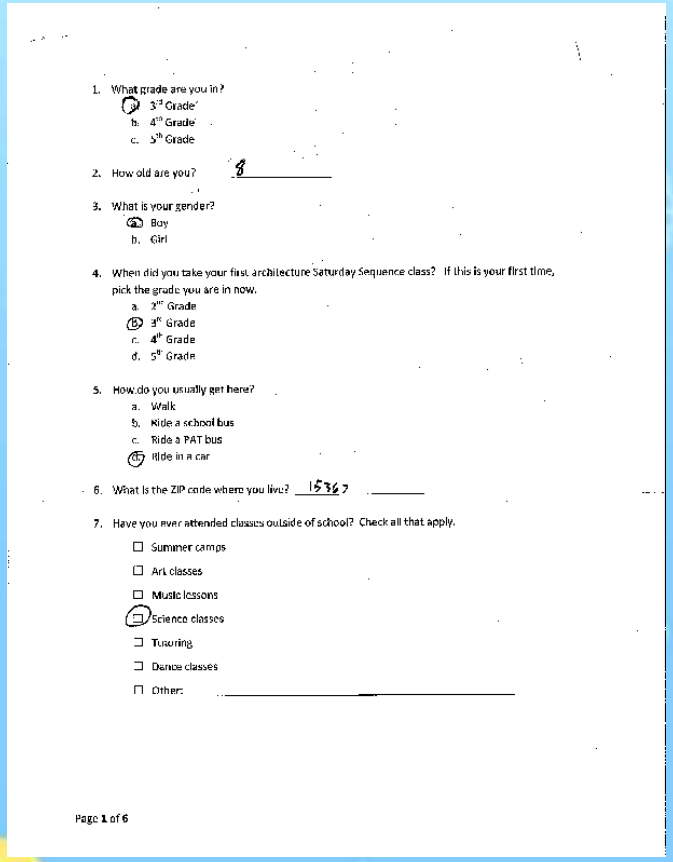
Bias and Non-response

- **Coverage error**
  - Federal and State regulations of school enrollment and attendance rates
  - Recent changes in enrollment
- **Ineligible units (children)**
- **Non-response errors**
  - Child in time-out
  - English as a Second Language (ESL)
  - Blank answers
- **Processing errors**
  - Coding error
  - Data entry errors
  - Out of the ordinary responses

Where we are

Pilot Questions

- Demographic Questions



1. What grade are you in?
   a. 3rd Grade
   b. 4th Grade
   c. 5th Grade

2. How old are you? 8

3. What is your gender?
   a. Boy
   b. Girl

4. When did you take your first architecture Saturday Sequence class? If this is your first time, pick the grade you are in now.
   a. 2nd Grade
   b. 3rd Grade
   c. 4th Grade
   d. 5th Grade

5. How do you usually get here?
   a. Walk
   b. Ride a school bus
   c. Ride a PAT bus
   d. Ride in a car

6. What is the ZIP code where you live? 15367

7. Have you ever attended classes outside of school? Check all that apply.
   - ☐ Summer camps
   - ☐ Art classes
   - ☐ Music lessons
   - ☑ Science classes
   - ☐ Tutoring
   - ☐ Dance classes
   - ☐ Other: _____

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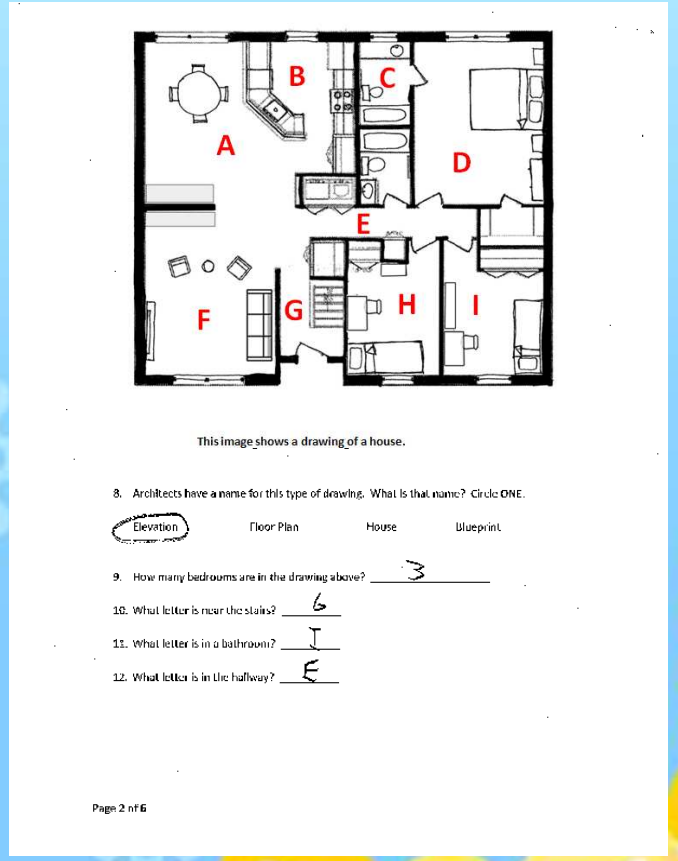
- Visual Literacy: Floor Plans



This image shows a drawing of a house.

8. Architects have a name for this type of drawing. What is that name? Circle ONE.
   (Elevation) Floor Plan House Blueprint

9. How many bedrooms are in the drawing above? 3

10. What letter is near the stairs? G

11. What letter is in a bathroom? I

12. What letter is in the hallway? E

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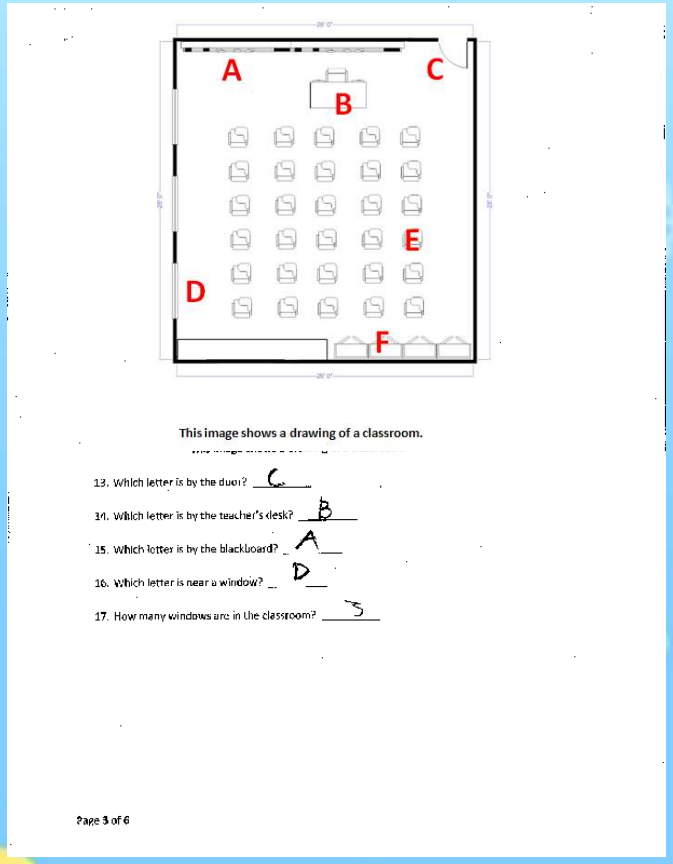
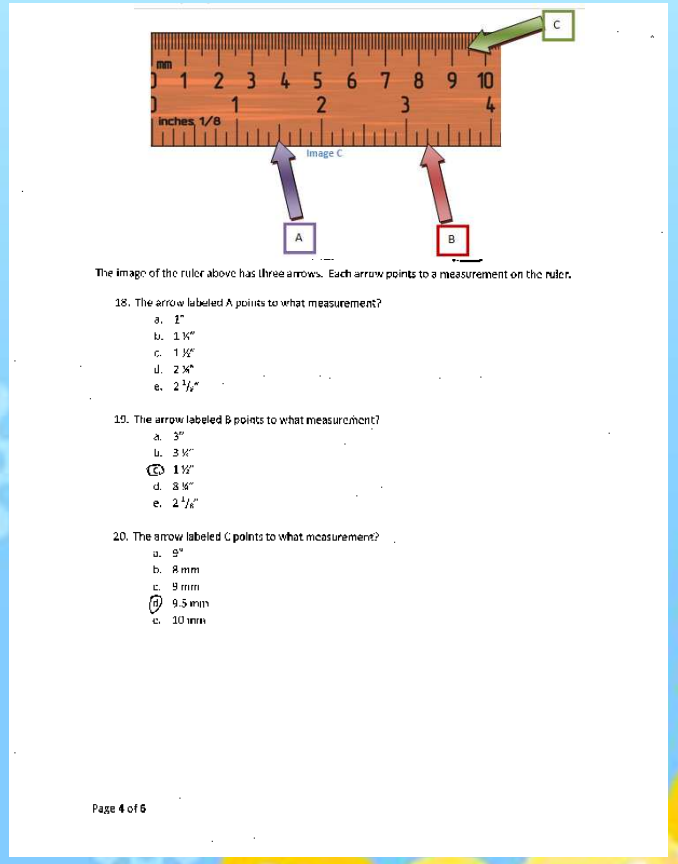
Where we are

Pilot Questions

- Visual Literacy Floor Plans



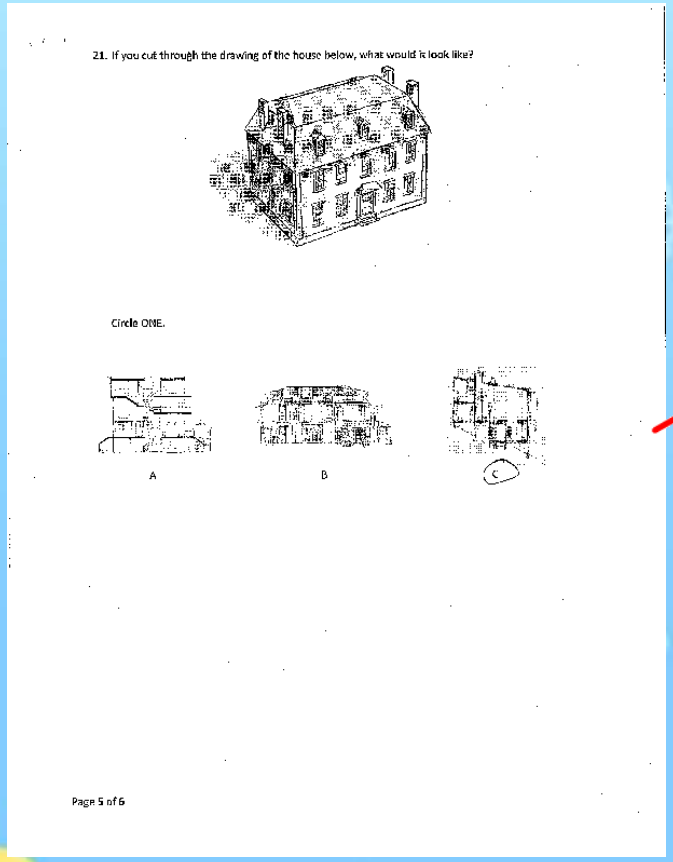
- Measurement skills



Where we are

Pilot Questions

- Visual Literacy: Sections


21. If you cut through the drawing of the house below, what would it look like?

Circle ONE.

A B C

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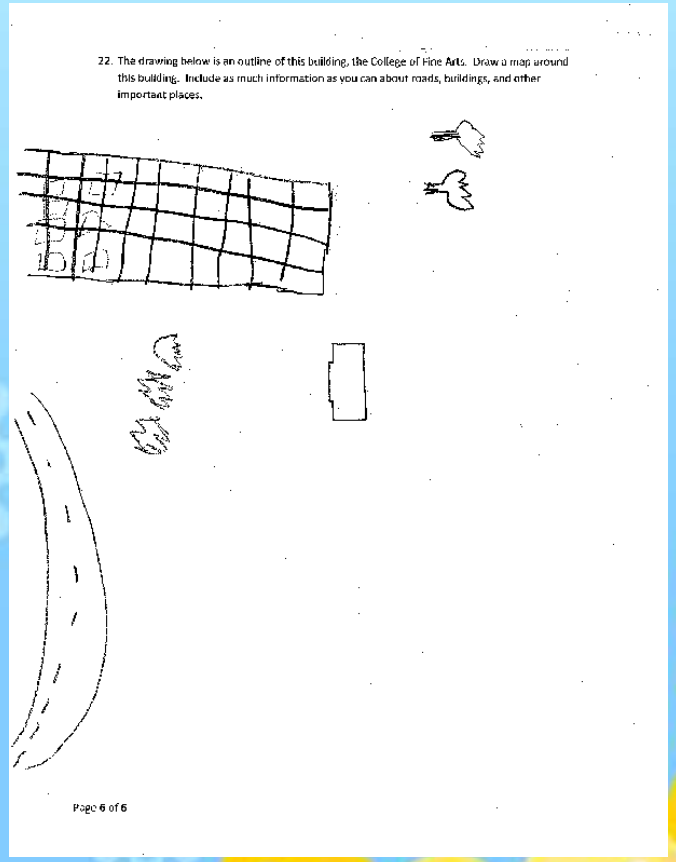
- Visual Literacy: Creation


22. The drawing below is an outline of this building, the College of Fine Arts. Draw a map around this building. Include as much information as you can about roads, buildings, and other important places.

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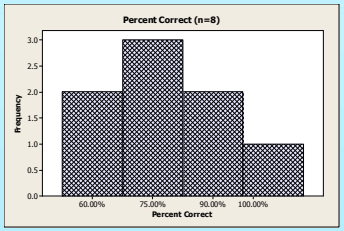
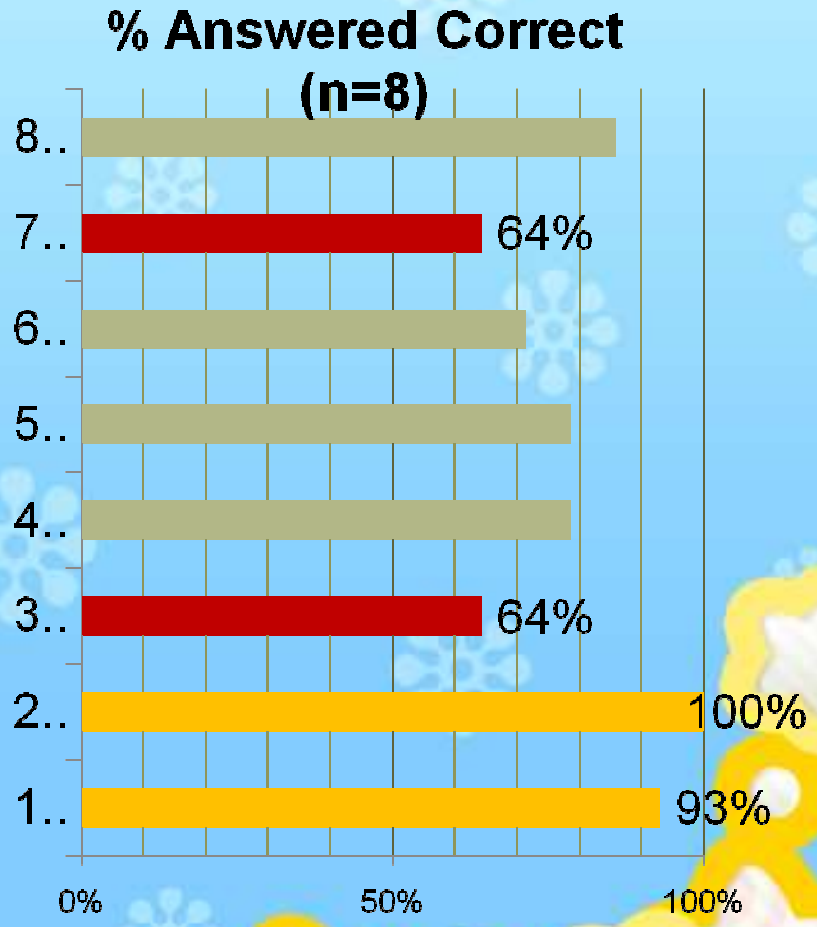
Where we are

Results from Pilot Questionnaire

can't read this



Quest. #	Question text	1	2	3	7
1	Grade	3	5	5	3
2	Age	8	10	11	8
3	Gender (G/B)	G	B	B	B
4	1st Arch class	3	5	4	3
	#years since 1st Arch class	0	0	1	0
5	Mode of transp.	Walk	Car	Car	Car
6	*Zip code*	*Squirrel Hill*	*15012, Belle Vernon*	*15012, Belle Vernon*	*15367*
7 Total	Attended classes outside of school	2 (Arch)	2	1	1
		93%	**100%**	**64%**	**64%**



Mean: 79% Median: 79% Min: 64% Max: 100%

Where we are

Results from Pilot Questionnaire

Question #	Question text	% Answered correct
8	Type of drawing	50%
9	# Bedrooms	100%
10	Identify stair	100%
11	Identify bathroom	75%
12	Identify hallway	100%
13	Identify door	100%
14	Identify teacher's desk	100%
15	Identify blackboard	100%
16	Identify window	50%
17	# Windows	50%
18	Measure 1.5"	75%
19	Measure 3.25"	75%
20	Measure 9.5 mm	88%
21	Identify correct section	63%

- Biased sample population
- Ceiling effect
- What don't they know?

Where we are

Lessons Learned

- Questionnaire took about 10 – 15 minutes to complete
- Questionnaire did not address what an architect does – so more questions were added:
  - Does an architect drive a bulldozer?
  - Does an architect work in a hospital?
  - Does an architect design buildings?
- One drawing question relied on memory, not just ability, so an ability question was added to assess students ability to create a floor plan
  - “In the space below, draw a map of your classroom from a “birds-eye” view. Include the walls, door, windows, furniture, and anything else you think should be included.

Next steps

Schedule

- Survey two schools – next two weeks
- Data Entry as we go

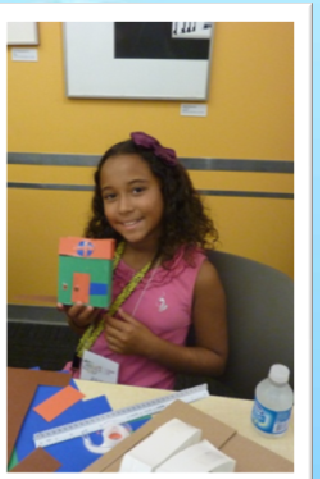
Next steps

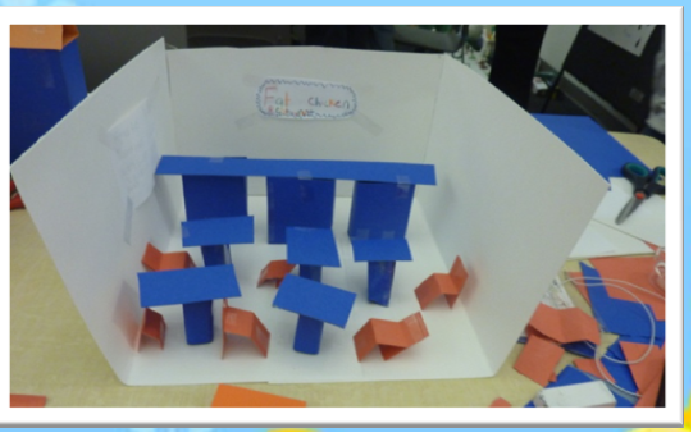
Analysis

great - looking forward to these analyses!

- Descriptive Statistics
- Chi Square Tests
- ANOVA
- Alpha level
  - $\alpha = 0.05$?
  - $\alpha = 0.10$?
- Post Sample Analysis
  - Randomly select 57 surveys
  - Compare results with "census" results
- Share findings

I suggest reporting co-efficients and p-values rather than hypothesis tests at fixed alpha levels.





Thank you

Questions?