STEM HOUSE:

ENERGY APPLICATION

EDSGN 100
Section 008
10/16/13

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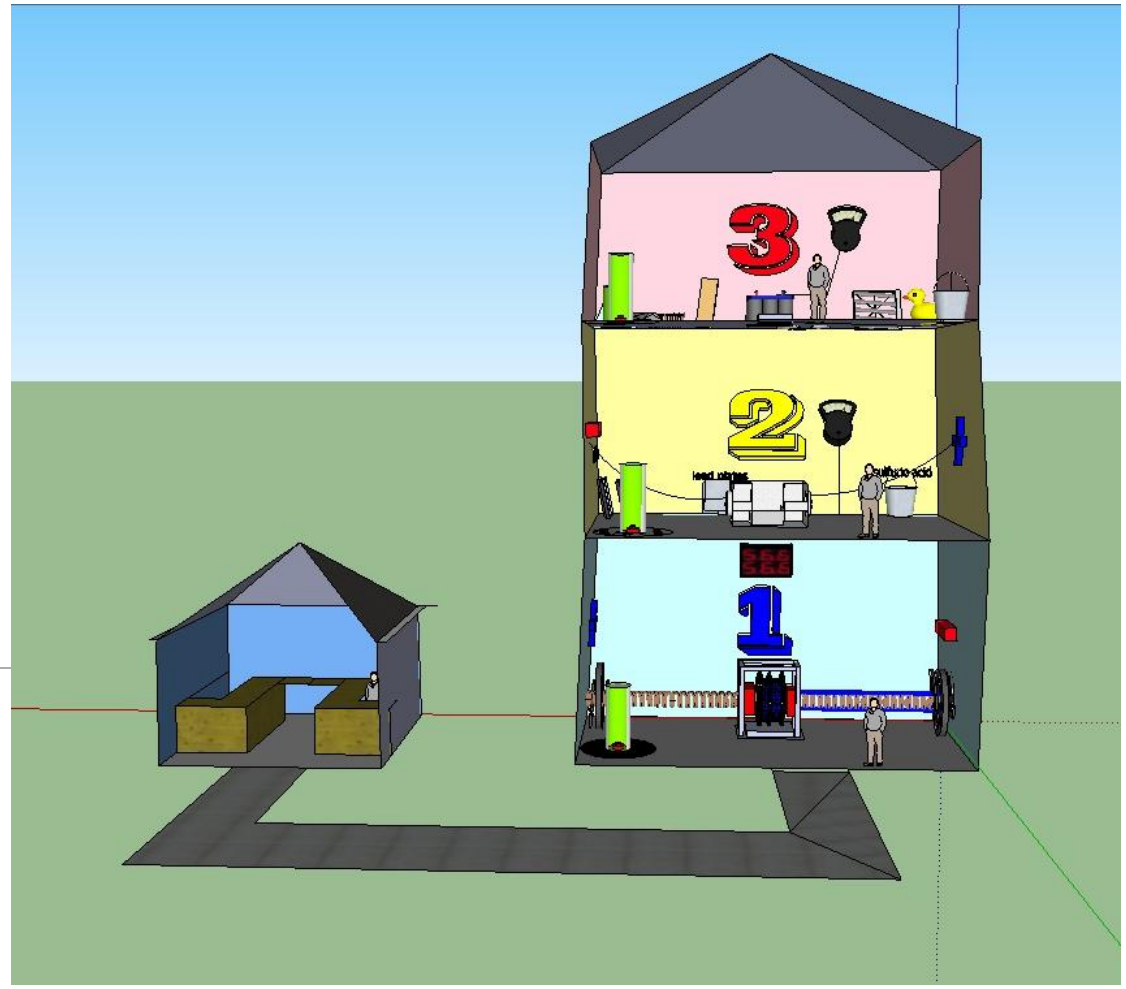

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Why are we here today?

STEM Education

- U.S STEM education lagging comparatively
- Students having trouble integrating concepts and “seeing the big picture”
- Strong math & science background drives future success
- **Opportunity: to design and implement an energy application virtual experience that will enhance STEM learning and higher order thinking skills in grades 6-8**

U.S. adults lag in reading, math skills

Adults in Japan and Finland scored highest in an international test measuring life skills such as reading, math and problem solving, while those in the United States scored below average.

READING SKILLS		MATH SKILLS		PROBLEM SOLVING	
1. Japan	296	1. Japan	288	1. Japan	294
2. Finland	288	2. Finland	282	2. Finland	289
3. Netherlands	284	3. Flanders-Belgium	280	3. Australia	289
4. Australia	280	4. Netherlands	280	4. Sweden	288
5. Sweden	279	5. Sweden	279	5. Norway	286
Average	**273**	**Average**	**269**	**Average**	**283**
16. U.S.	**270**	**21. U.S.**	**253**	**17. U.S.**	**277**

The opportunity at hand…

- Reference leading presentation for customer needs
- Educational Objectives:
  - Energy Application Subsystem
    - 3.2B4 Electrical and Magnetic Energy

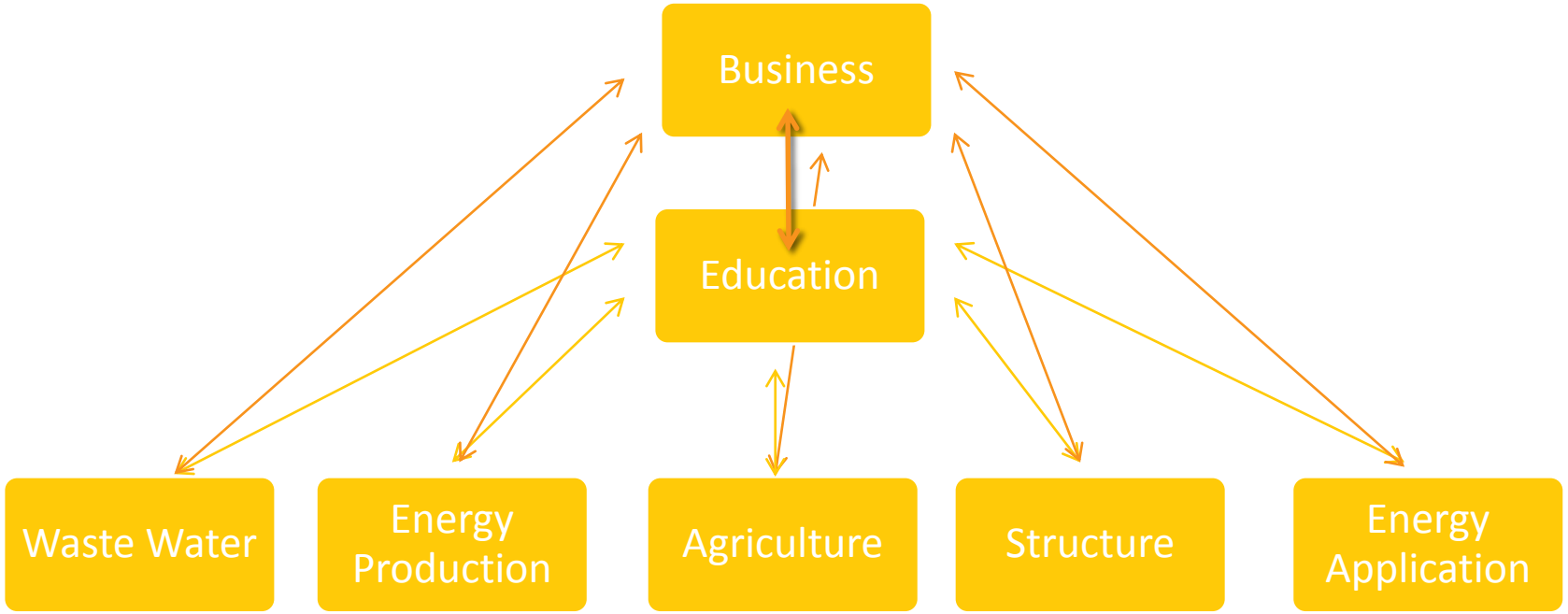
6TH GRADE	7TH GRADE	8TH GRADE
3.2.6.B4. Describe how electric current produces magnetic forces and how moving magnets produce electric current. Derive Ohm's Law through investigation of voltage, current, and resistance.	**3.2.7.B4.** Explain how electrical current is produced by the flow of electrons. Explain and demonstrate how electric current produces magnetic forces and how moving magnets produce electric current.	**3.2.8.B4.** Compare and contrast atomic properties of conductors and insulators.

Who does this project affect?

- Stakeholders
  - School Boards
  - Administration
  - Students
  - Parents
  - Manufacturing
  - Teachers

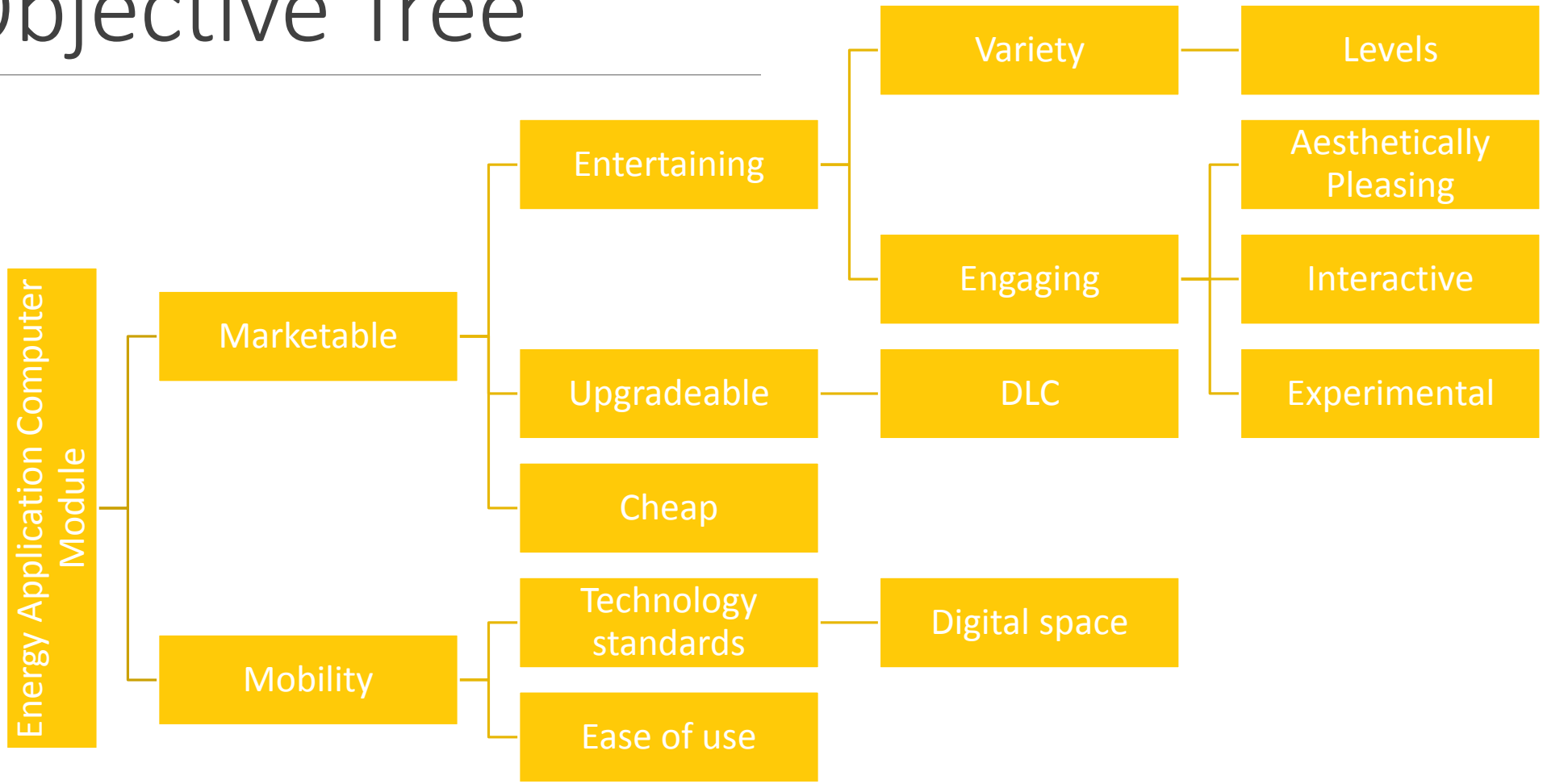
Project Guidelines

- Safety
  - Limited use of computer program to an hour and a half a day
  - Surveys after trial of computer application to assess strain of prolonged game play
- Engaging
  - Must keep the student's attention for the suggested time of use
  - Survey implemented to assess how "fun" and "entertaining" program is via student interaction
- Data Usage
  - Program must fit in 460 bytes
- Sustainable
  - Must be upgradeable with downloadable content available every 6 months
  - Potential partnership with Khan Academy
- Ease of Use
  - Beta-test with selected groups of students 6 months prior to release of product



Process Interaction: Systems Diagram

Objective Tree

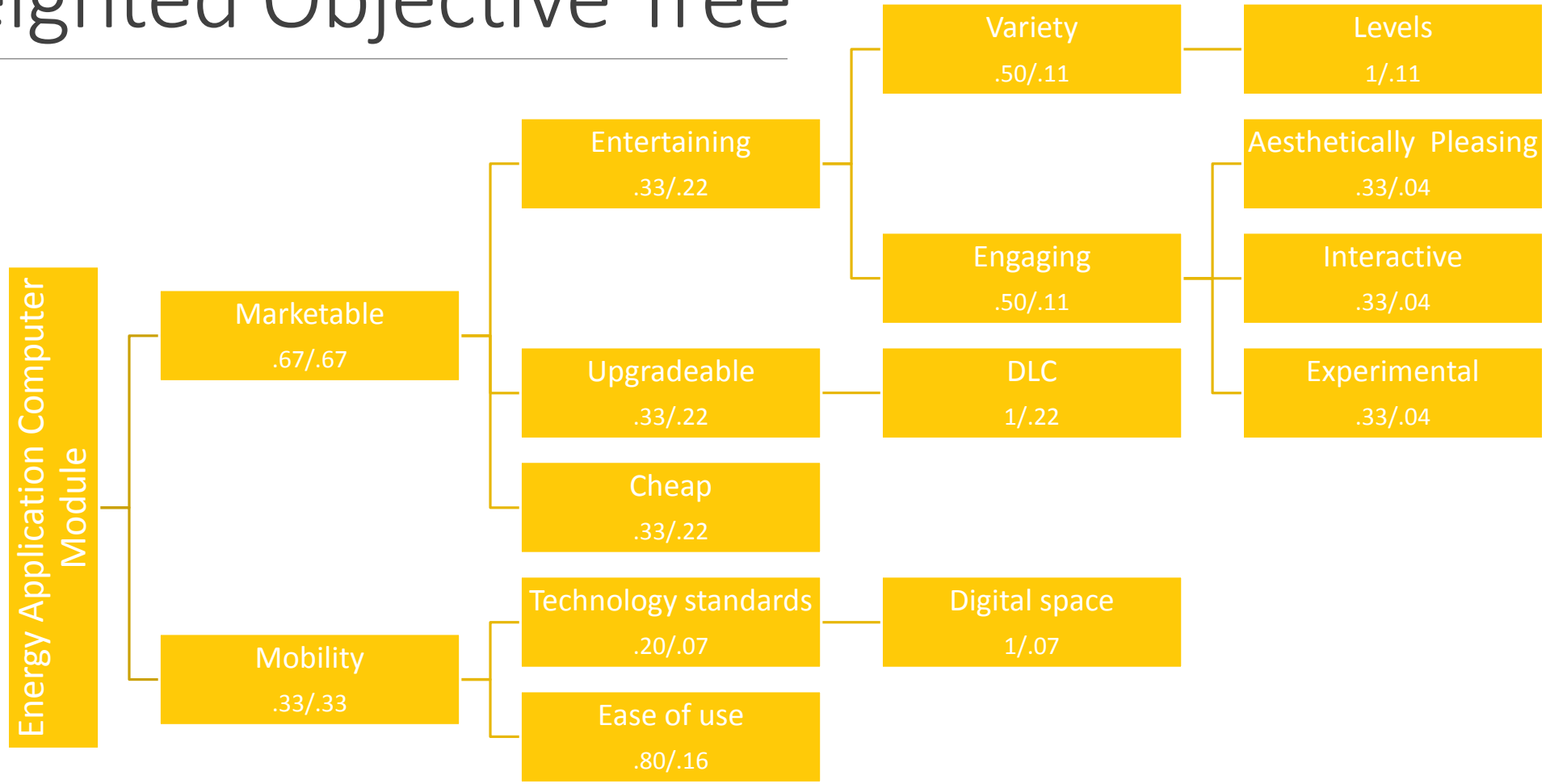


Calculating Weight using AHP

Table 1. Weight Matrix

	Mobility	Educational	Upgradeable	Entertaining	Row Totals	Row Totals/totals
Ease of Use	1	1/7	1/6	1/4	1.56	.05
Educational	7	1	3	2	13.00	.43
Upgradeable	6	1/3	1	½	7.83	.26
Entertaining	4	½	2	1	7.50	.25
				Total	29.89	

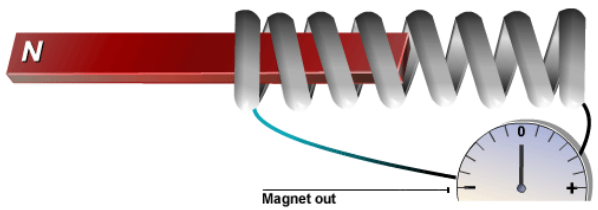
Weighted Objective Tree



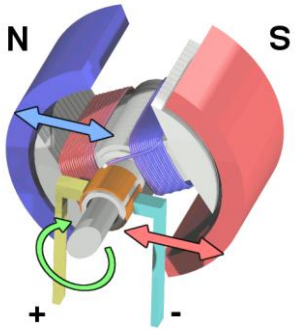
Brainstorm Ideas

Level 1:

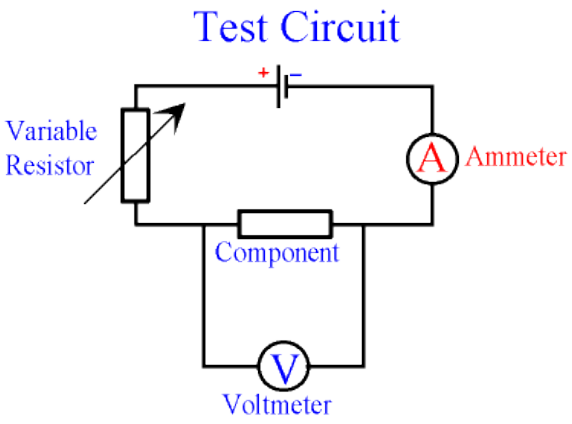
Option 1



Option 2



Option 3

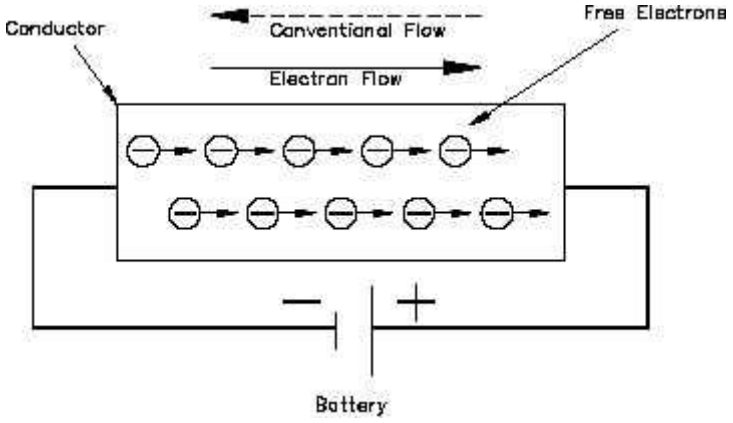


Brainstorm Ideas

Level 2:

Option 1

Option 2



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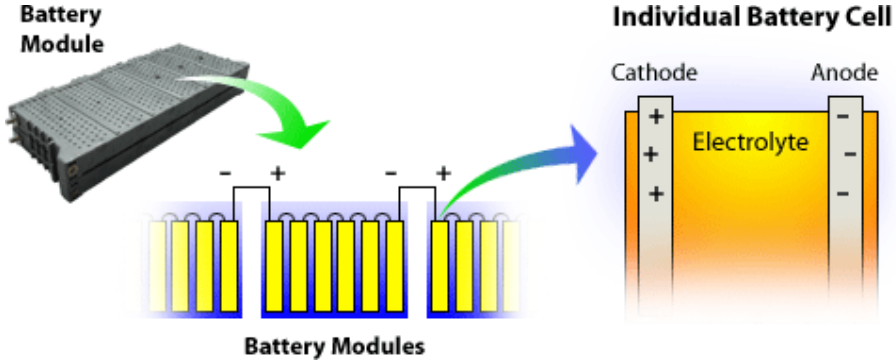
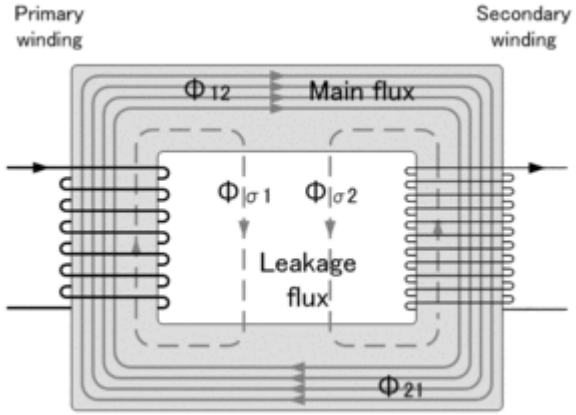


Brainstorm Ideas

Level 3:

Option 1



Option 2

Conductors
vs.
Insulators

Option 3

Evaluate Ideas

Table 2. Concept Screening (Level 1)

Selection Criteria	A	B	C	D	E	F	Reference
Ease of Use	+	+	+	-	-	0	0
Educational	0	0	0	+	+	-	0
Entertaining	+	+	-	+	-	+	0
Upgradeable	-	0	-	0	-	-	0
Pluses	2	2	1	2	1	1	
Sames	1	2	0	1	0	1	
Minuses	1	0	2	1	3	2	
Net	1	2	-1	1	-2	-1	
Rank	2	1	3	2	4	3	
Continue	yes	yes	no	yes	no	no	

Evaluate Ideas

Table 3. Concept Scoring (Level 1)

		Get a coiled wire, and move magnet over charged wire		Simple magnet motor		Manipulative parts (change variables V=IR	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of Use	5%	4	.008	3	.15	4	.008
Educational	43%	3	1.29	4	1.72	4	1.72
Entertaining	26%	3	.78	5	1.3	3	.78
Upgradeable	25%	1	.25	1	.25	2	.5
Total Score		2.328		3.42		3.008	
Rank		3		1		2	
Continue?		no		develop		no	

Analysis

- 6th Grade
  - Magnet Motor
- 7th Grade
  - Battery
- 8th Grade
  - Study of Conductors and Insulators

Prototype Construction

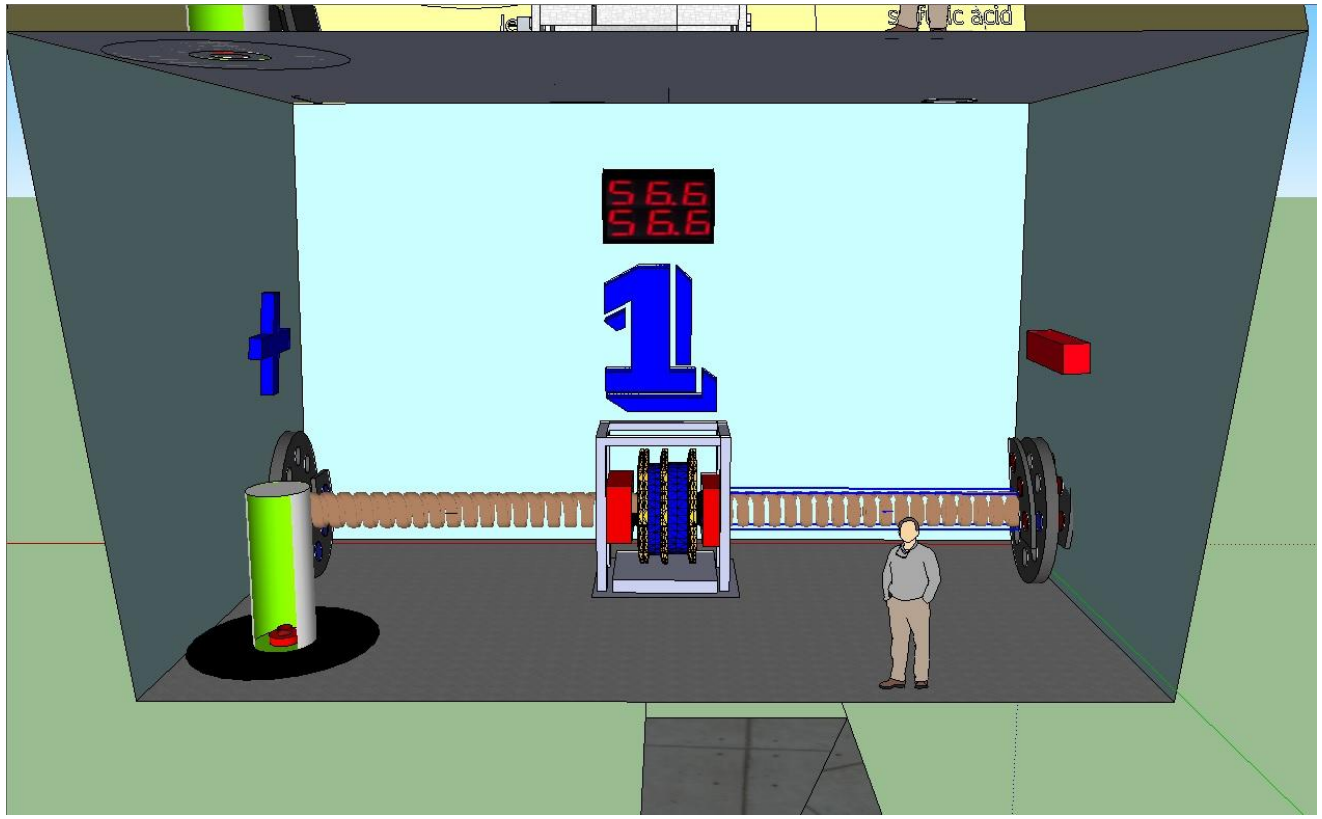


Fig. 1 Level 1

Prototype Construction

Fig. 2 Level 2

Prototype Construction

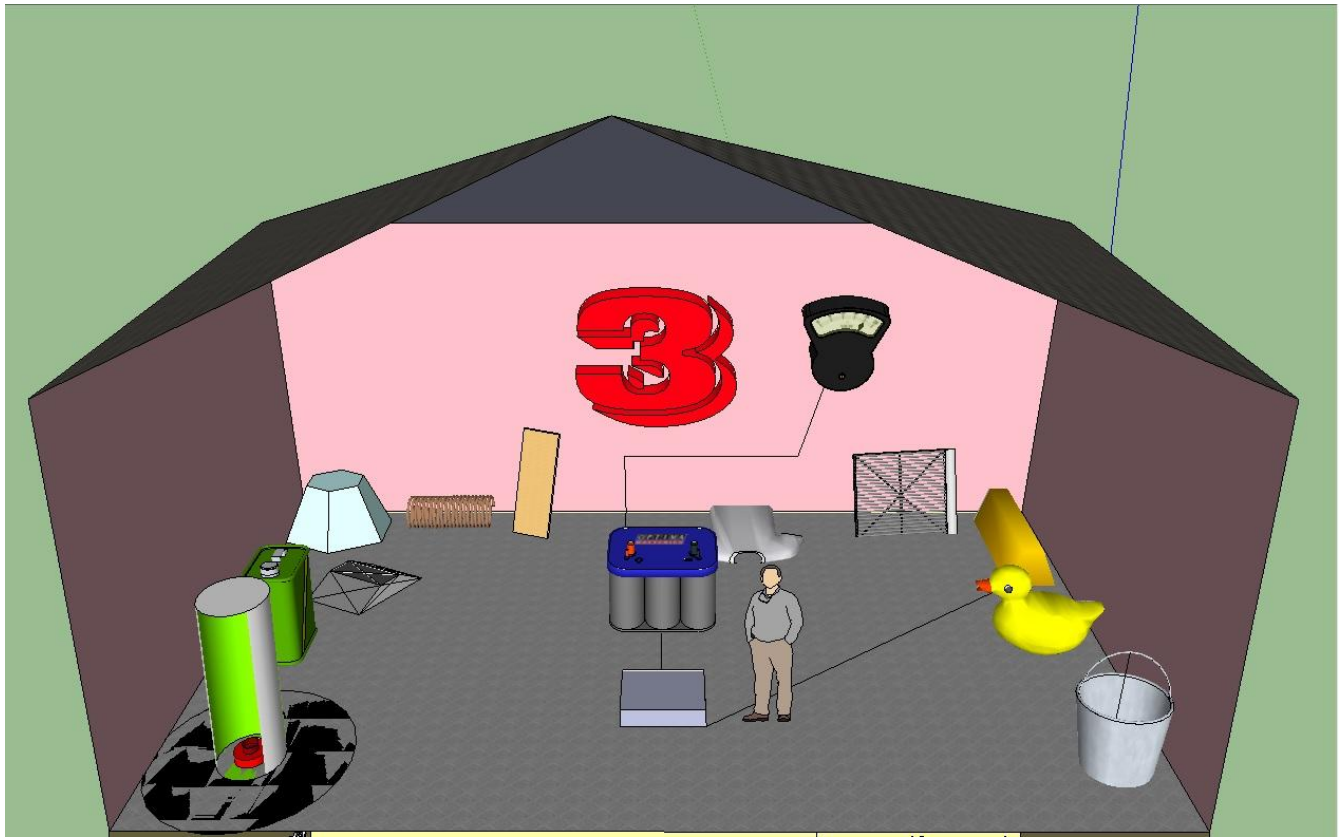


Fig. 3 Level 3

Prototype Construction

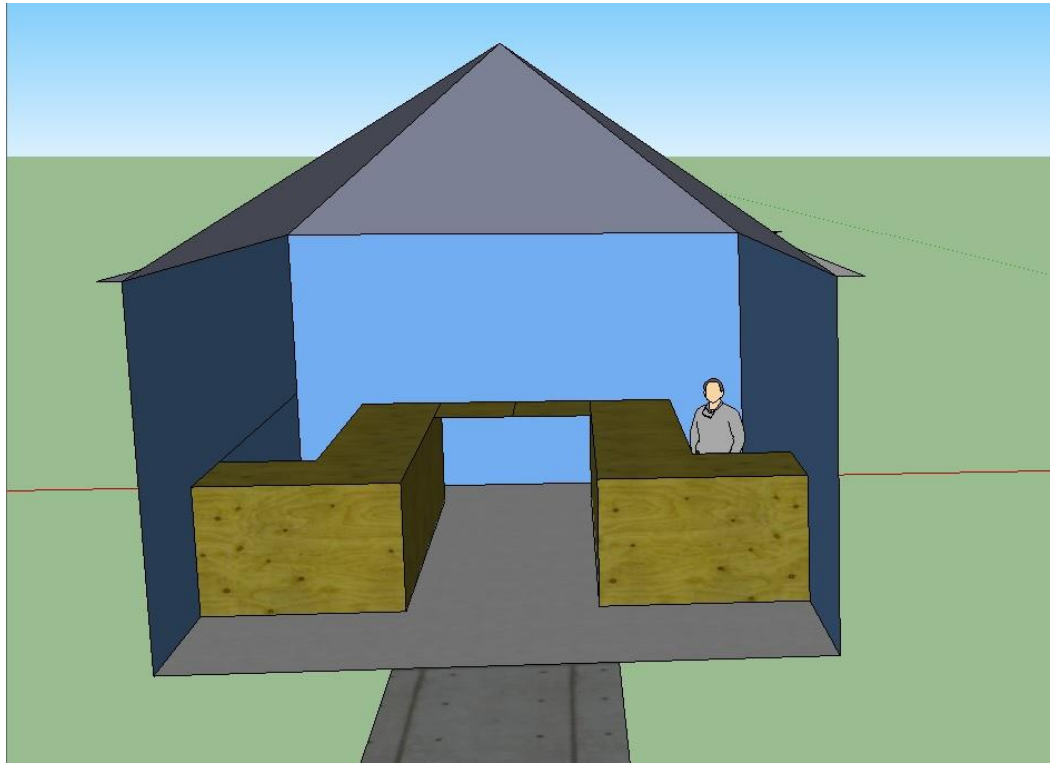


Fig. 4 Materials Shed

Prototype Construction

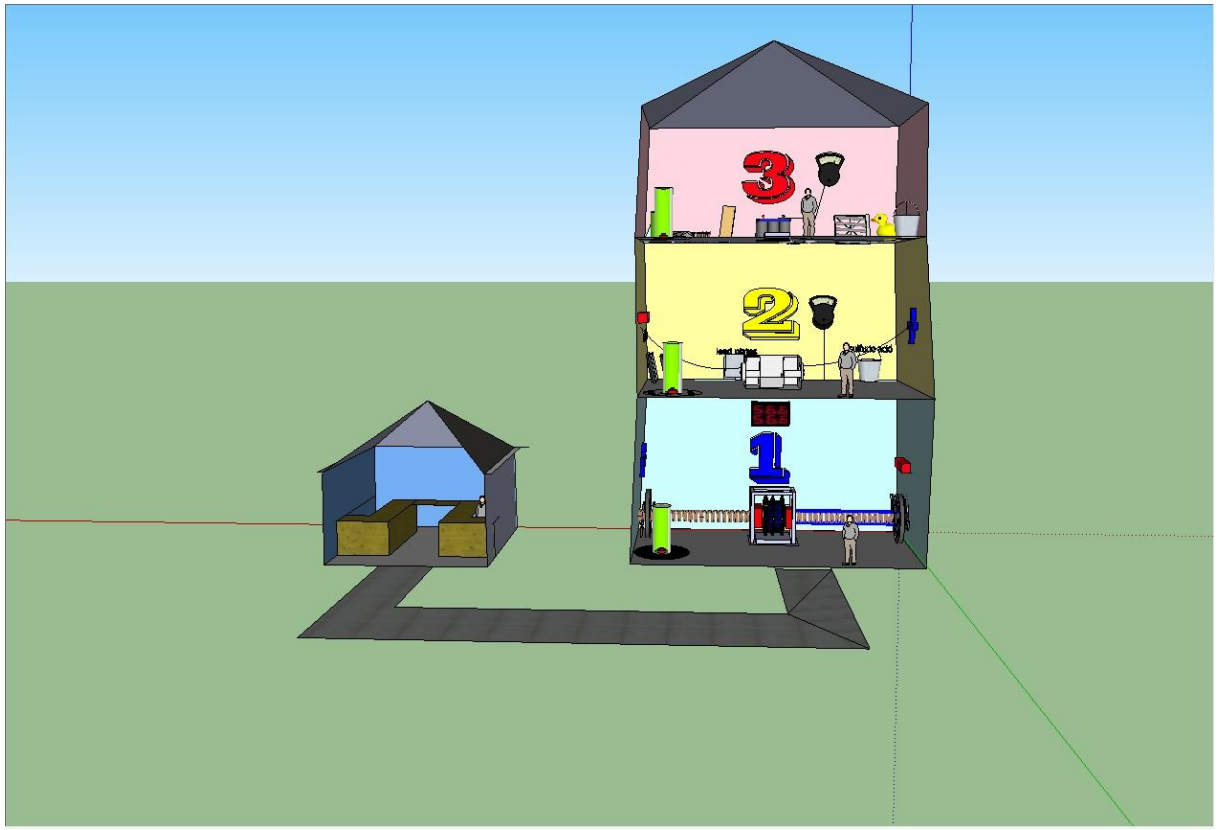


Fig. 5 Overall Program

Design Solution

- Fulfilling Educational State Standards:
  - 3.2.6.B4.
  - 3.2.7.B4.
  - 3.2.8.B4
- Engaging students in an exciting and challenging environment
- Promoting higher-order thinking
- Educational alternative that gives students a wider variety of experience in given fields

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