

K. Bailey

Understanding By Design

**Toothbrush Design (5th) – 2 day mini-project**

### Topic

**Toothbrush Design—Investigating toothbrushes?**

**Health Observances:** National Children Dental Health Week

World Oral Health Week

**STEM/ Healthcare Career:** Dentist, Engineer, Material Scientist

### Activities

Opportunities to learn:

- Recalling and illustrating key ideas
- Comparing, noting similarities and differences
- Designing and conducting a test
- Reasoning and Evidence
- Group discourse
- Planning investigation procedures (how to determine effective brushing)
- Recording and compare findings
- Creating designs with specific purpose
- Attend to procedure
- Use appropriate tools strategically

### Assessments

- Use of a scoring rubric to evaluate student work: Create a design doing a commercial (or video) format or create an advertisement (drawing) poster; Student work scored on design (features meet purpose); Toothbrush information of features and function are provided; Communicates selling points of toothbrush

## Understanding By Design

### Stage 1 – Desired Results

#### Established Goals(s):

Health Ed Standard I – Students will comprehend concepts related to health promotion and disease prevention to enhance health

H. Ed. Standard 3 – students will demonstrate the ability to access valid information and products to enhance health

- Science and Engineering Practices: Asking questions and defining problems, developing and using models, planning and carrying out investigations
- Structure and Function
- Engineering, Tech & the Application of Science: design(ETS1), links among engineering,

**Understanding(s):**

*Students will understand that....*

- Regular effective brushing protects the body from dental caries (i.e. tooth decay and cavities) and periodontal disease.
- Engineers must consider the economic issues as well as the functionality involved with selling the products they create. A simple toothbrush may be purchased for much less rather than a more complex toothbrush

**Essential Questions(s):**

- With more than 3,000 toothbrush patents, **is one type better than others for cleaning teeth?**
- Is it possible to clean the teeth regardless of which brush is used?
- Toothbrush design...does it matter?
- Does the fluoride in toothpaste help keep teeth healthy

***Students will Know....***

- Toothbrush design features have a purpose to clean teeth effectively
- The ADA gives the Seal of Acceptance to all brushes evaluated that meet their requirements
- A toothbrush design can impact increase sells or cost the least to produce
- A perfect design does not exist specific features of a

***Students will be able to....***

- Determine effective cleaning of various brushes using a fair test
- Identify model features of an effective toothbrush
- Identify good brushing techniques
- Evaluate a design (toothbrush analysis); Communicate toothbrush that is needed; the importance of good brushing techniques

**Stage 2 – Assessment Evidence**

**Performance Task(s):**

- **Design feature should have a purpose (functionality)**
- **Creative designs with a specific purpose (infer purpose for visual exploration)**
- **Sufficient brushing using the fair test; time allotted, brushing all surfaces, in between the teeth and along the gumline**
- **Create a design doing a commercial (or video) format or create an advertisement (drawing) poster**

**Other Evidence:**

- Students determine engineers consider prioritizing cost and benefits
- Results may show little or no difference between expensive and inexpensive toothbrushes (ADA Seal of Acceptance brush show similar results)
- With sufficient brushing, students should be able to fully clean the model teeth with both of their brushes

- Toothbrush is just one factor, and brushing time, technique and frequency are equally important

### Stage 3 – Learning Plan

#### Learning Activities: (multiple modes of learning) (CCSS.ELA-Literacy alignment items)

Opportunities to learn:

- o Historical Background: Primitive toothbrushes of Ancient Egyptians of twigs; 15th century Chinese use aromatic boar bristles; Europeans salt-soaked rags, William Addis (1780) makes cow hair ox bone toothbrush; Nylon toothbrushes introduced in the United States (1938); 1945, After World War II, brushing became more popular with most Americans
- o Students explore various manual toothbrush designs; connect with **Systems** texts
- o Exploring variables features of your own toothbrush
- o Purpose of toothpaste, evolution of toothpaste cream, toothpaste tube
- o Investigating toothpastes range of features
- o Engage: sketching of toothbrushes, sharing ideas, comparing

Day 2

- o Explore: Students test to discover if any of the differences result in a more effective toothbrush; \*See notes below for exploration set up
  - o Plan a fair test to determine effective cleaning of various brushes; Using marshmallow cream on the teeth to simulate plaque and food particles; brush strokes, visually compare cream remaining on each comb, compare the amount of cream remaining under the gum line
  - o Next, students will determine how to get the model teeth as clean possible regardless of which brush is used
  - o Students should try out different brushing techniques; note used techniques; reapplying the marshmallow cream is needed
- o Students explain by sharing findings and noting similarities and differences

#### Differentiation/ Accountability:

- o Post charts
- o 3-4 student groups
- o Examples and evidence to support answers
- o Draw conclusions about what might happen next from ideas
- o Combine knowledge from multiple resources to form ideas

**Materials**

**Resources**

- marshmallow cream
- assortment of toothbrushes (new, donated or dollar store)
- plastic combs
- tape (masking, duct, electrical)
- scissors
- newspaper
- measuring tools

\*Place a plastic comb inside of a plastic cup; Tape around the base of the comb's teeth to represent the gumline and smear marshmallow cream on the comb teeth to mimic food particles and plaque

**OR**

\*Plastic colored eggs in egg holders (or egg carton holder) taped along egg and holder edge to hold egg in place. Top of tape acts as the gumline

- American Dental Association 2007, A Look At Toothbrushes
- ADA. 2010. ADA Seal of Acceptance program products
- Colgate World of Care 2006
- *Every Day Engineering*, NSTA Press, 2012
- *Science Scope*
- PBWorks.com

- **Create a design doing a commercial (or video) format or create an advertisement (drawing) poster**