Online Ethics Center
FOR ENGINEERING AND SCIENCE

TEST Lesson Plan - Safety Matters: Product Design, Safety, and Standards

Description

Lesson 1 from the Kids In Danger Teach Early Safety Testing (TEST) program aims to Introduce students to the concepts and importance of design safety, ethics, and standards, using children's products as an example.

Abstract

This lesson plan and an accompanying PowerPoint presentation are also available directly from Kids in Danger.

Goal

- Introduce students to the concepts and importance of design safety, ethics, and standards, using children's products as an example.

Objectives

1. Students should know where to find information on product safety and standards.
2. Students should be able to consider design hazards in sample products and the likely way a product will be used by consumers that might contribute to hazards.

3. Each student will be able to identify the standard setting agencies that apply to children's products.
4. Students will know where to look for standards that might apply to products they design in the future.

Concepts

Safety
Ethics
Standards

Issues Addressed

Importance of Testing
Responsibility to Public
Safety from the beginning
Role of Standards

Materials

CPSC Injury and Recall Numbers (http://www.cpsc.gov/en/Research--Statistics/Injury-Statistics)

Recalled products (These are available for loan from KID or are pictured on the CD PowerPoint.)

- travel lite crib
- baby carrier
- baby swing

Body

Safety Matters: Overview

Problem of unsafe children’s products
Factors to consider while designing children’s products
Design for Safety Resources
Goal: Integrate safety into product design

Opening Questions:

What is our responsibility as engineers to consumers?
What are the keys to ensuring that a product is safe?
Is absolute safety possible?
What are standards?
What part do standards play in design?
What kinds of testing should be done on a product prior to its release?
How big a problem is product safety-how many people are injured by unsafe products?

Kids in Danger -- An Overview

A nonprofit organization dedicated to protecting children by improving children’s product safety.

- Founded in 1998 by Linda Ginzel and Boaz Keysar following the death of their son, Danny Keysar.
- Our Mission is to promote, advocate, and educate.
- This lesson plan was developed by KID for the Teach Early Safety Testing Program (TEST). TEST seeks to educate engineering students about safety issues so that when they become professional engineers they will be experienced with designing for safety and safety testing, thus reducing the number of potential product recalls and resultant injuries.

Children’s Product Facts

Introductory Information: "Unintentional injuries are the leading cause of death for Americans between the ages of 1 and 35 and are the fifth leading cause of death in the nation. Children under five are the age group most likely to require emergency room treatment and the elderly are the age group most likely to die because of product-related injuries. In 2008, over 35 million people in the U.S. sought medical attention for injuries related to consumer products. Over the past five years, the CPSC handled an average of 473 product recalls annually, involving 116 million recalled items from around the world."
-From the CPSC's *Strategic Plan*, 2011-2016.

Children’s Products Design Flaws, Case Study: Playskool Travel-Lite Crib

Use recalled product(s) to show the unforeseen dangers associated with them. Discuss annual CPSC data-the number of dangerous products recalled and the number of injuries caused by those products. Reinforce reality of dangers by referring to the story of Danny Keysar.

- What are some of the areas of potential hazards you see on this portable crib?
- What types of testing would you suggest to reveal if those areas are safe?
- Can you suggest basic testing that should be required for a crib of this type to assure safety?

The Consumer Product Safety Improvement Act (CPSIA)

History of Voluntary Standards

- Let’s look at a brief history of consumer product standards to see how we reached our current state of affairs.

- In 1972, Congress enacted the Consumer Product Safety Act, which created the Consumer Product Safety Commission (CPSC). The CPSC was given the authority to create mandatory safety standards for consumer products.
- Unhappy with the authority granted to the CPSC, Congress added several amendments to the CPSA in 1981, one of which removed the authority to create mandatory standards.
- It was instead decided that the CPSC would work in conjunction with manufacturers on individual products in order to create voluntary standards.
- Today, the CPSC is led by Elliot Kaye. Its budget is currently $117 million and it has a staff of 548, about half of its staff in 1981. It uses these resources to regulate the $47.7 billion dollar baby product market, as well as 15,000 other types of consumer products.
- CPSC is developing new standards for juvenile products, but the process will take several years. In 2008, the Consumer Product Safety Improvement Act (CPSIA) was signed. The CPSIA imposes new testing and documentation requirements, and increases fines and specifies jail time for some violations.

Existing Mandatory Standards

- Mandatory government standards have been established for non-portable cribs, bunk beds, pacifiers and small parts in toys (These standards can be found at the Code of Federal Regulations main page - www.gpoaccess.gov/cfr/index.html).

The appeal of mandatory standards

- A remedy to this solution might be to introduce rigorous testing and mandatory standards for all consumer products.
- Such a solution would obviously please consumer groups and concerned parents, but it would also lift a burden off the backs of manufacturers.
- Although manufacturers would probably have to spend a longer time developing their products, the result would ultimately be safer products, fewer injuries and fewer lawsuits and recalls.
- Engineers would also feel less burdened, as they would not be solely responsible for raising concerns about product safety.
- Strict mandatory standards would include relevant test methods to accurately and thoroughly test products for flaws, address how a product is actually used, and use existing data to determine past and current risks in different types of

products.
- Problem: children's products that do not fit neatly into a product category can enter the market without any testing, according to current standards. A recent example of this is the Nap Nanny, which after causing 5 infant deaths has been recalled.

Questions at the Design Stage

What questions should engineers ask when initially designing or redesigning a product?

What considerations are most important? What are insignificant?

- Market Factors, Human Error, Foreseeable Misuse, Design Ethnography…

How the product is intended to be used and how it will be used in reality are often different concepts?

Designing a Safe Product

Standards

What are product standards?

- Product standards exist to assure conformity and safety.
- The standards can either be voluntary or mandatory, and can involve both performance requirements and test methods. Some voluntary standards, such as those used on electronics by Underwriters Laboratories, are in essence mandatory since building codes require outlets and other materials to have the UL label and most stores won't sell electronics without the UL label.
- Standards represent the minimum safety requirements.
- Most countries have governmental agencies that set product standards.
- The European, Australian, Canadian, etc are all governmental bodies. In the US, the CPSC and NHTSA set some standards; others are set by voluntary agencies.

Despite product standards, children in the U.S. are in danger.

- Unintentional injuries are the leading cause of death among children.
- An average of 111 children under age five die annually in incidents associated with nursery products.
- An estimated 77,900 children under age 5 were treated in hospital emergency rooms in 2012 for injuries associated with nursery products.
- Children's products are recalled on average almost twice a week. A recall occurs when the government and manufacturer are aware of a design or manufacturing flaw that makes the product dangerous for regular use.

Why do so many product injuries happen?

- The problem is, everyone has different needs. Parents of infants want products that are as safe as possible, but also want their baby products to be affordable, portable and visually pleasing.
- The idea behind mandatory safety standards is that they force companies to focus on safety as much as other factors like the weight of their products.
- The US is only beginning to develop strong mandatory standards for juvenile products. A law passed in 2008 requires third party testing for children's products as well as new mandatory standards for durable infant and toddler products such as cribs, high chairs and strollers. The voluntary ASTM standard for toys, F963, was made mandatory through that 2008 law.

Example: Designing a Safe Crib

In the last 20 years 1,100 children have died from crib related injuries. Over 14,500 children are rushed to emergency rooms with injuries and an average of 41 children die each year in unsafe cribs.

Key Considerations for design safety:

- Slats are spaced no more than 2-3/8 inches.
- Mattress fits snugly and is securely attached.
- Corner posts are no higher than 1/16 of an inch (1-1/2 mm) above the top of the end panel.
- Drop-side latches cannot be released by a baby and securely hold side in

raised position.
- All screws, bolts and other hardware are present and tight.

Review the Safe Nursery Page and the Safe Nursery Booklet from the Consumer Product Safety Commission.

Performance and Test Methods

- Standards attempt to set performance measurements – not design specifications when possible to allow the most freedom in designs.
- Testing, however, must be very specific and address specific problems. If you are developing a new stroller that uses a latch to keep the baby in place, the product designers should immediately ask what problems could potentially arise.
- For example, a potential problem could be the strap breaking or releasing unexpectedly. Tests would then be developed to see if latch malfunction is possible on the stroller, and if so, the product must be redesigned.
- This type of mandatory testing would weed out many problems in infant products (and consumer products in general) before they were released.

Design Safety and Recalls

Recalling Products

- The CPSC can also try recalling dangerous products.
- The CPSC works with companies to issue voluntary recalls. The benefits of voluntary recalls are that they avoid expensive and protracted legal battles.
- A downside to voluntary recalls, however, is that the company whose product is being recalled has to approve every step of the process. This means that everything from a press release to an informational poster can be watered down in tone by a company that wishes to downplay the hazard.
- In many cases, recalls fail to reach over 80% of a given product's consumers (a notable exception here is automobiles, where the rate is significantly higher). KID was founded in 1998 by the parents of sixteen-month-old Danny Keysar who died when a portable crib collapsed around his neck in his Chicago

childcare home. Although the portable crib had been recalled five years earlier, word of its danger had not reached Danny's parents, caregiver, or a state inspector who visited the home just eight days before Danny's death.
- By working in the framework of voluntary recalls, the CPSC ultimately prevents the news of recalls from reaching a significant amount of the population.

Resources

Resources for Standards Creation

There are many resources available on how to create good and thorough standards for children's products:

- Anthropometric Data
- Developmental information from pediatricians
- Injury data from similar products
- Research by testing labs or others into use patterns

People are always surprised to find out that many of the everyday products our children and we use do not face mandatory tests or regulations.

Standards Agencies

How it works in the U.S.:

In the US, one of these bodies sets most standards.

- ASTM International has the standards that cover the portable crib we have here, but also the steel in skyscrapers, alloys and metals, and many other products and building materials.
- UL sets most electrical standards and is incorporated into other standards and building codes internationally.

Conclusion

- Many assume that if something is for sale at a “reputable” store, the U.S. government has made sure it is safe.
- This could not be farther from the truth. The reality is that most consumer products face a patchwork of mandatory and voluntary standards that allow dangerous products to be released on the market.
- As politicians and pundits argue constantly over whether government regulation is evil or not, children like Danny Keysar are dying every year in ways that could be prevented.

Discussion Topics

1. The first item in the National Society of Professional Engineers (NSPE) Code of Ethics is to "hold paramount the safety, health, and welfare of the public."
2. Although personal experience is certainly indispensable for successful product engineering, it is unreasonable to assume that a designer will foresee every possible interaction with a product, especially by children.
3. Design flaws occur quite frequently in our high technology world but they certainly should not, especially if the design decisions are made by competent, professional engineers.
4. Absolute product safety is unattainable but there is a need for systematic analysis to ensure *reasonable* product safety.
5. Engineers need to employ comprehensive, scientific hazard analysis techniques.
6. There is no standard methodology for determining the safety of a product, but there *are* many techniques that integrate different factors, like consumer behavior and potential structural hazards, to reach an objective estimate of risk. Systematic hazard analysis methodologies can effectively prevent design flaws and product failure.
7. Industry standards come from multiple sources, including the ASTM, ANSI, and the CPSC, and may be voluntary or mandatory. They should be used as a guide in the design process.
8. Safety and standards should be considered from the outset, not included as an afterthought.
9. Engineers need to be able to reconcile engineering standards and realistic constraints such as economic, environmental, sustainability, manufacturability, and political constraints.

10. As an engineer, would you rather work under mandatory or voluntary safety standards? Does your duty toward society play any role in answering this question?
11. Businesses worry that mandatory standards would impose too big a burden on their engineers. Is this a legitimate concern? If so, is there any way around this?

Rights

Resource Type

Instructor Materials

Topics

Product Liability
Safety
Public Health and Safety

Discipline(s)

Engineering