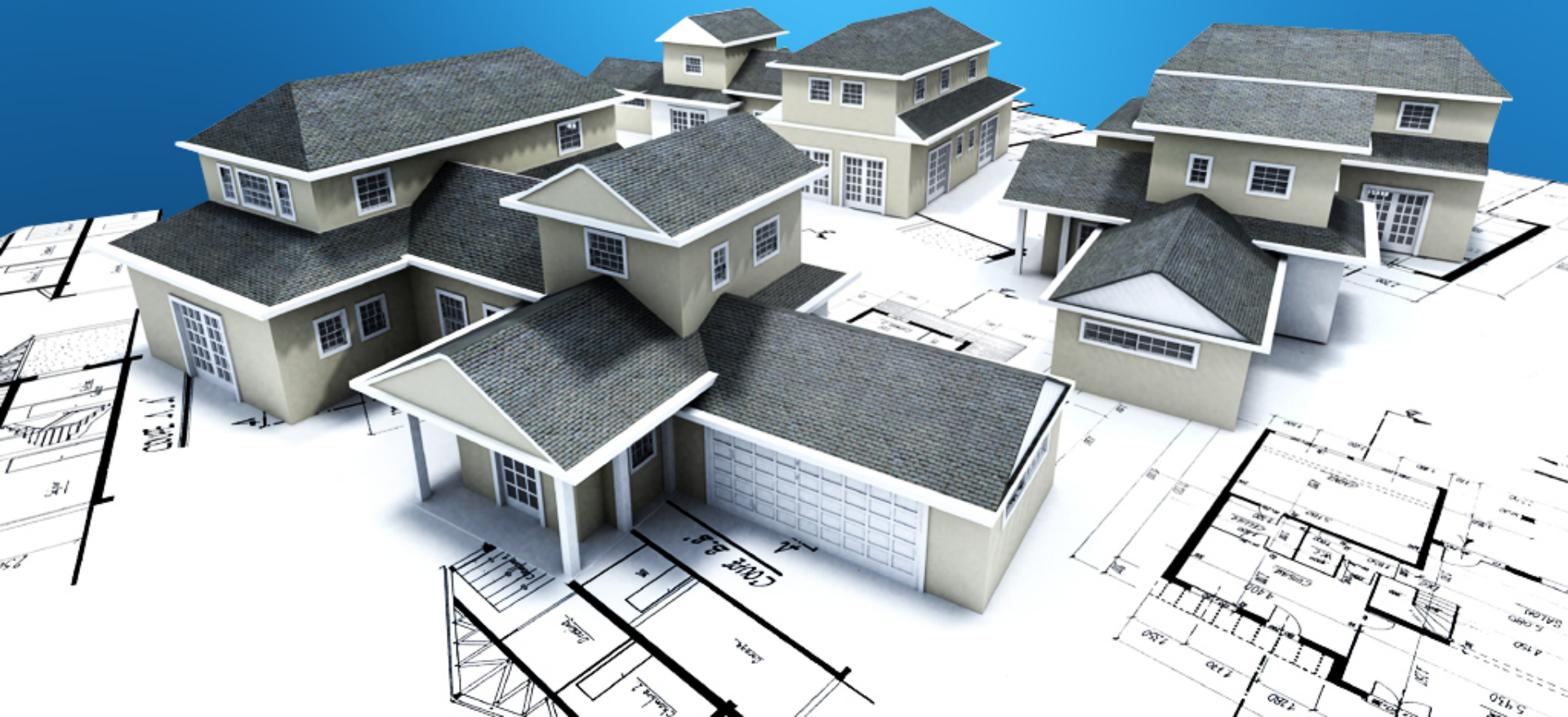
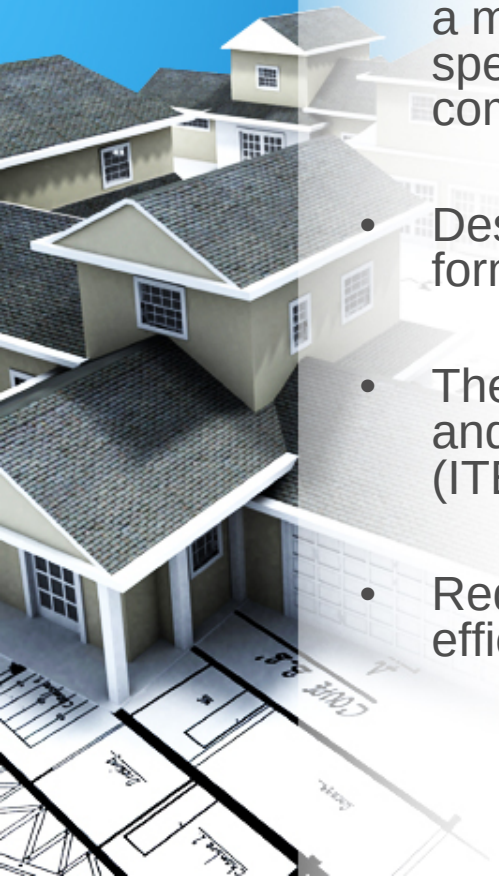
Attributes of Design

Foundations of Technology (FOT)



Outcomes



In this presentation, you will learn…

- The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes or results. (ITEA 8-H)
- Design problems are seldom presented in a clearly defined form. (ITEA 8-I)
- The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (ITEA 8-J)
- Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA 8-K)

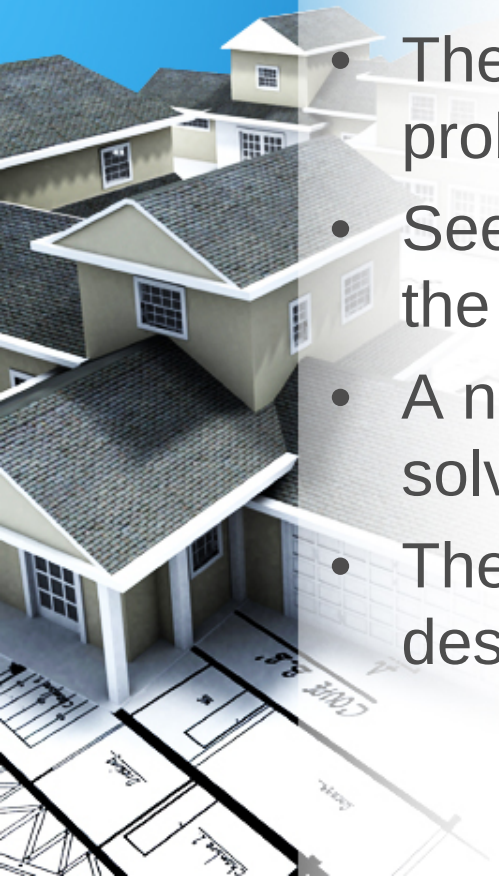
Design is…

Design is the core problem solving process used in technological development. It is to technology what inquiry is to science.

Design is one type of problem solving process, fundamental to technology, although not all technological problems are design problems.

Design is the first step in the process of creating a product or system. Technological design is a distinct process that has a number of characteristics specific to technological design.

The attributes of design include:



- The design is purposeful.
- It is based on specific requirements.
- It is iterative.
- It is creative.
- There are often multiple solutions to the design problem.
- Seeking multiple solutions is an important part of the design process in technology.
- A non-linear approach can be most productive in solving technological design problems.
- The design process serves as a guide to approach design problems in a systematic manner.

The Design Process

1. Define the problem
2. Brainstorm solutions
3. Research possible solutions to generate ideas
4. Identify criteria and constraints (specifications)
5. Explore possibilities
6. Select an approach
7. Develop a design proposal
8. Make a model or prototype
9. Test and evaluate the solution against specifications
10. Refine the design
11. Create or make the designed product
12. Communicate the process and results

Beginning the process

1. The design process begins with a clear description and understanding of the problem to be solved by the designed solution.
2. Brainstorming helps to consider a wide range of creative and intuitive solutions.
3. Research refines the brainstormed ideas into practical possible solutions. Additional ideas may be developed through the research.
4. Specific criteria and constraints are identified to become a set of design specifications.

The design process continued

5. Exploring the possibilities in your brainstormed set of possible solutions helps to narrow the solutions.
6. Having explored possible approaches, one approach or possible solution is selected for further development.
7. A design proposal is developed to justify and explain the solution selected.
8. Developing a prototype or model of your selected solution is the next step in the process.

Completing the design process

9. The design solution is tested and evaluated against the specifications to be sure the solution not only works, but solves the original problem within the identified criteria and constraints.
10. The design is refined, based upon the results of the testing and evaluation.
11. Tested and refined, the solution is now developed from prototype to final product.
12. Your results and the process are communicated to others. Sharing technologies advances related technologies, math, and science.

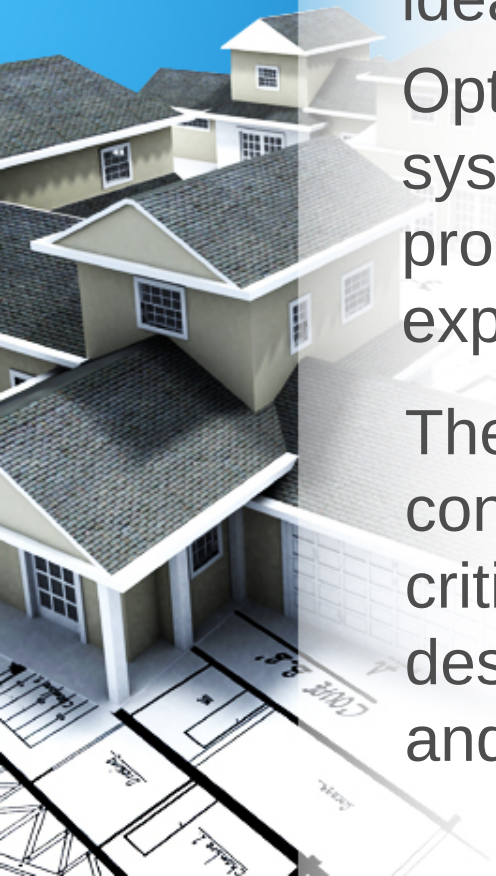
Design is never done

- Design is an iterative process. The process is ongoing for continuous improvement. The design process is often approached sequentially, but should also be approached in a non-linear manner, repeating and revisiting those parts of the process that need to be revisited or redeveloped for improvement of the product or system. A design needs to be continually checked against criteria and constraints. These criteria and constraints may change over time and the design needs to be refined to adapt to changing requirements. All designs can be improved. By using an iterative process, improvement is built into the design process.

Competing Requirements

Do you want it done fast or do you want it done right? Quite often we are placed in a situation, within constraints, where we cannot fully satisfy competing requirements. Needing a big car and fuel economy in the same vehicle is an example of competing requirements, as either requirement makes it more difficult to satisfy the competing requirement. Working to satisfy competing requirements, determining priorities, and developing to specifications is made more challenging where requirements are not compatible with each other.

Efficiency and Optimization



In general, efficiency is central to the requirements for nearly every technological design. Efficiency specifies how well a given product or system performs and how close that performance is to the ideal.

Optimization can help insure that a product or system is as efficient as possible. Optimization processes include features such as experimentation, trail and error, and development.

The design needs to be continually checked and critiqued, the ideas of the design must be redefined and improved.

Final considerations for design

The design process also involves considering how designs will be developed, produced, maintained, managed, used, and assessed. As a result, multiple solutions are possible. More knowledge or competing technologies cause a design to change with time.

When such competition happens, trade-offs occur, and the design is modified to accommodate these requirements. Different people may choose different solutions, depending on how they weigh factors.

Summary

- The design process is a systematic, iterative process to problem solving that promotes innovation and yields design solutions
- To systematically seek an optimum design solution, engineers and other design professionals use experience, education, established design principles, creative intuition, imagination, and culturally specific requirements
- Design problems are seldom presented in a clearly defined form
- Design goals and requirements must be established and constraints must be identified and prioritized during the time when designs are being developed
- Design decisions typically involve individual, familial, economic, social, ethical, and political issues
- The design needs to be continually checked and critiqued, refined and improved
- More knowledge or competing technologies cause a design to change with time
- Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other resulting in a trade-off and the design is modified to accommodate the requirements