



iTeachly

Technological Design Process

Unit 1 Lesson 3

Technological Design Process

Students will be able to:

- Outline the steps involved in the technological design process.
- Compare the technological design to the scientific method.

Key Vocabulary:

- Biological Science, Empirical Evidence, Evaluation, Experiment, Formal Science, Hypothesis, Inference, Interpretation, Nature of Science, Observation, Physical Science, Qualitative, Quantitative, Questioning, Scientific Method, Social Science, Subjective

Technological Design Process

Think, peer, share...

Instructions...

1. Think about the answers to the questions on the next slide silently.
2. Swap answers with a peer.
3. Share an answer with the class.

Technological Design Process

Think, peer, share...

Questions...

1. Why does technology change?
2. How does it change?

Technological Design Process

1. Changes in equipment/technology are often due to a need or demand
2. Equipment/technology changes over time to become:
 - ✓ safer
 - ✓ more user-friendly,
 - ✓ more durable,
 - ✓ more cost-effective

Technological Design Process

- The process which oversees the development of new equipment is called the technological design process.

Technological Design Process

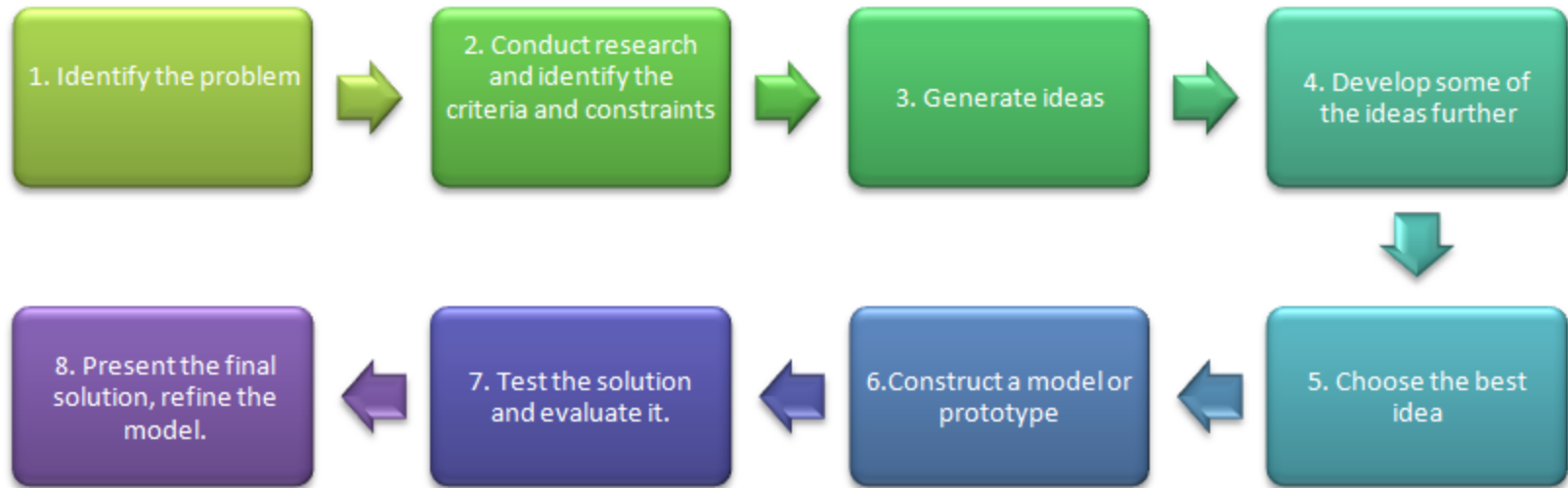
What is the Technological Design Process?

- The technological design process is a series of steps that scientists and engineers follow to solve a problem.
- The solution may be:
 - to design an entirely new product which meets a certain set of criteria or accomplish a particular task, or,
 - to modify to a pre-existing design

Technological Design Process

The technological Design Process

The eight steps are as follows:



Technological Design Process

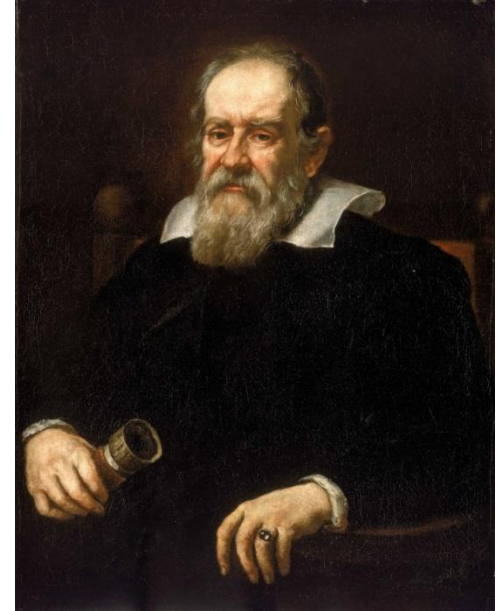
Case Study: The Optical Microscope

- The first microscope was invented in the 1300's when two glass lenses were placed at either end of a tube. This design was very limited due to the poor quality of glass that was available which affected the microscope's magnification quality, limiting it to a power of 10.
- However, this development would begin centuries of progress which would uncover an entire world which was previously unknown to man.

Technological Design Process

Case Study: The Optical Microscope

- Galileo Galilei perfected the first compound microscope by refining his design for the telescope in 1609.
- This design used lenses with a shorter focal length than he had previously used in his telescope design.
- This was achieved by using a combination of convex and concave lenses.



Technological Design Process

Case Study: The Optical Microscope

- It was Galileo's design that was then modified by the Dutch spectacle makers, Janssen and Lipperhey who discovered that if different types and sizes of lenses were placed in front of each other, the magnification could be changed.



Technological Design Process

Case Study: The Optical Microscope

- In 1676, a biologist named Antonie van Leeuwenhoek (pictured right) began to carefully polish, grind and shape his own lenses.
- This enabled a magnification of up to 270 times greater than what had previously been achieved.



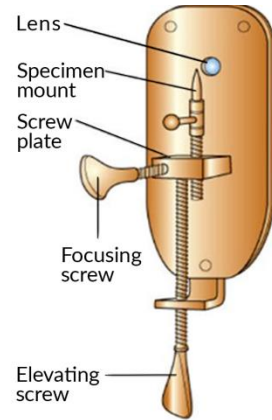
Technological Design Process

Case Study: The Optical Microscope

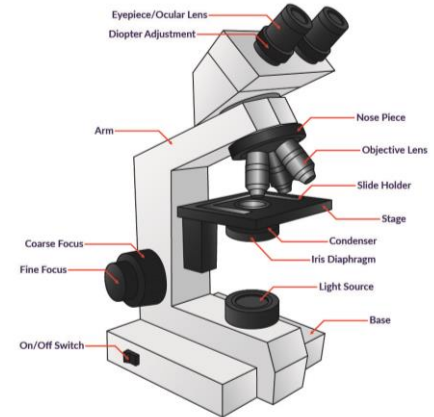
- Leeuwenhoek's design, (pictured center) allowed him to study blood, yeast cells and bacteria for the first time.



Early compound microscope



Leeuwenhoek's microscope

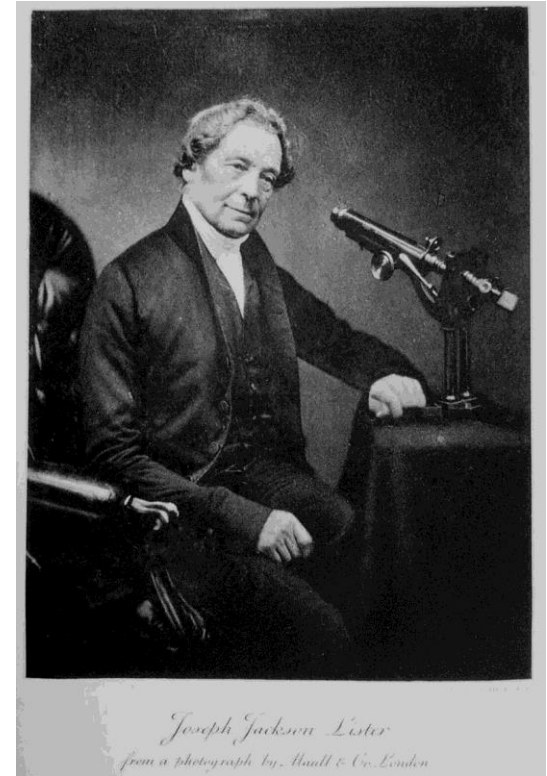


The modern microscope

Technological Design Process

Case Study: The Optical Microscope

- Now that magnification of an object had been achieved, the development of the microscope changed to focus on the definition of the image.
- This was solved in 1830 by Joseph Jackson Lister, who discovered that by using several weak lenses together at certain distances he was able to produce good magnification without blurring the image that he was viewing.



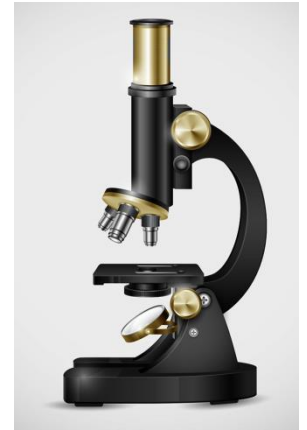
Technological Design Process

Case Study: The Optical Microscope

- As a follow on from Lister's work, in 1870, Ernst Abbe invented the condenser, which helps to illuminate the image in the microscope as well as developing the equation to calculate the resolution limit for the microscope.

Top image: The monocular microscope in use from 1897.

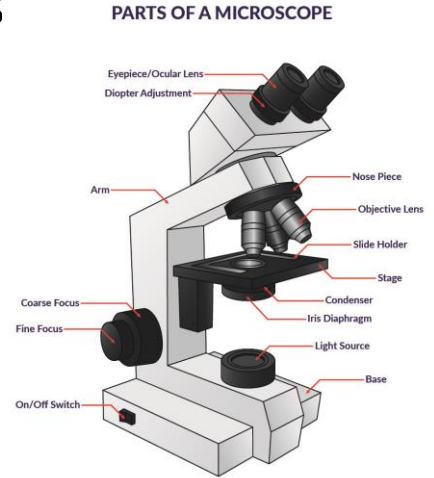
Bottom image: The antique microscope in use from the early 1900s.



Technological Design Process

Case Study: The Optical Microscope

- Over time, the optical quality of lenses has increased leading to the compound microscopes which are similar to the ones in current use.
- Throughout their development, the magnification the microscope has increased and is currently at its maximum magnification of around 1500 times.
- The modern microscope found in many school labs is pictured to the right.



Technological Design Process

Questions:

1. Describe the prototype microscope initially developed in the 1300s. What was the limitation of this design?
2. Who perfected the first compound microscope? What did he use as the basis for his design?
3. How did the Dutch spectacle-makers Janssen and Lipperhey further develop the design of the microscope during the 1600s?
4. What improvements did Leeuwenhoek make to the microscope?
5. Who developed the condenser? What is it this instrument used for on a microscope?

Technological Design Process

Answers

1. Describe the prototype microscope initially developed in the 1300s. What was the limitation of this design?

A tube which had a lens at each end

The magnification was limited to 10 times by the poor quality of glass which was available during this time.

Technological Design Process

Answers

2. Who perfected the first compound microscope? What did he use as the basis for his design?

Galileo

He used his telescope as the basis for his design, with convex and concave lenses which shortened the focal length.

Technological Design Process

Answers

3. How did the Dutch spectacle-makers Janssen and Lipperhey further develop the design of the microscope during the 1600s?

They used a variety of lenses of varying sizes and types which allowed them to further alter the magnification.

4. What improvements did Leeuwenhoek make to the microscope?

Refined the lens quality by grinding and polishing them

Technological Design Process

Answers

5. Who developed the condenser? What is it this instrument used for on a microscope?

Ernst Abbe – allows the image to be illuminated, allowing it to be better seen.

Technological Design Process

Technological Design vs Scientific Investigation

- Technological design is very similar to a scientific investigation. Both processes rely on evidence and reason and follow a logical sequence of steps to solve a problem.

Technological Design Process

Technological Design vs Scientific Investigation

- **Science** is defined as the process of analysis and examination which clarifies the relationship between the non-living, living and designed world.
- Whereas, **technology** is the application of scientific discoveries in order to meet human need or demand by developing certain products and processes.



Technological Design Process

The table below compares the steps for scientific vs. the technological design process:

Scientific investigation	Technological design
Identify a problem and ask questions	Identify a need or problem
Researching and gathering related information	Researching and gathering related information
Design an experiment to determine the relationship between variables	Design a system or product to improve and overcome the problem
Conducts the experiment as repeated trials	Tests the design or prototype
Analyses the trial results	Analyses the test results
Evaluate the results and verify the hypothesis	Evaluate the process or the product and its efficiency in solving the problem.