Objective 3.03

Explain the universal systems model

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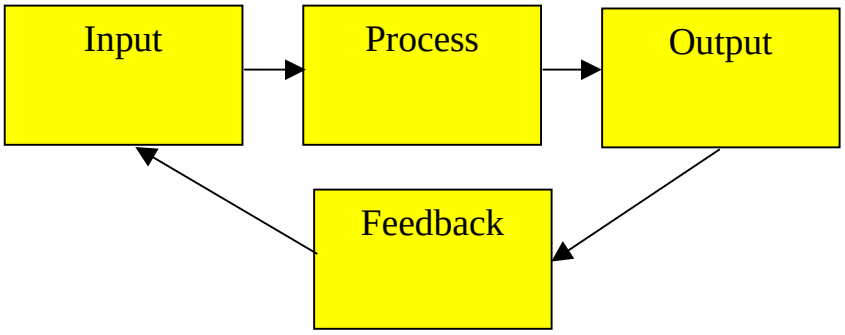
The following outline characterizes what should be taught under Objective 3.03

- Explain the components of the universal systems model
- Explain systems models in the context of the systems of technology such as communication and transportation
- Explain the elements or resources of technology as inputs to systems



The universal systems model is an attempt to graphically depict processes of all sorts. Viewing something through the scheme of the universal systems model is an attempt to simplify something that is relatively complex. The model typically includes a look at system inputs, processes, and outputs for open loop systems and a fourth component, feedback, is included in systems that are perceived to be closed loops. In addition to very specific things, any system is generally thought of as having the following inputs. These are often referred to as the “resources of technology.”

System Inputs

- People
- Information
- Tools and Machines
- Materials
- Energy
- Time
- Capital

Processes vary depending on the area of endeavor. For example, one of the main processes for a manufacturing company would be secondary material processes: separating, combining, conditioning, forming, and casting. However, a communication company would be encoding, storing, retrieving, transmitting, receiving, and decoding information.

Outputs generally include certain *eventualities* such as expected, unexpected, desirable, and undesirable. For example, a manufacturer expected to make a profit, and this is desirable. However, the company did not expect to pollute the water when it accidentally spilled chemicals onto its loading dock. This output is undesireable.

System Outputs

Desirable, Undesirable, Expected, Unexpected

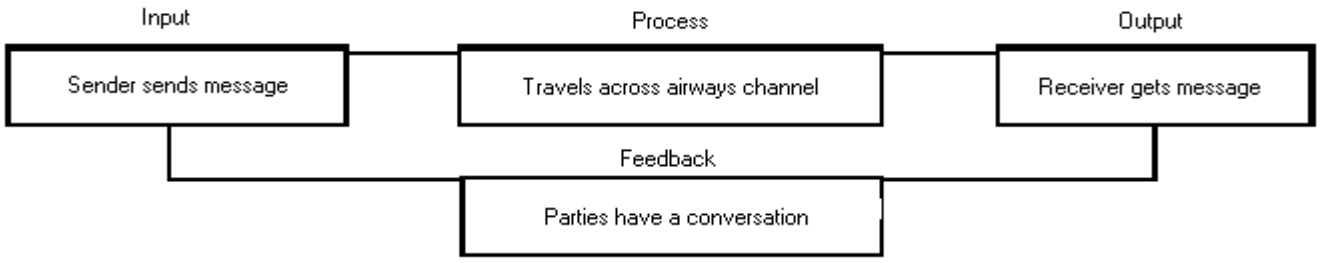
Feedback can take obvious, technical forms, such as the use of sensors for determining the temperature in a room for a thermostat system. However, a break even analysis or a sales report for a company also provide information that will cause the system to change something about its inputs and processes.

Systems experience **entropy**. Entropy is the degradation of all systems whether man-made or natural. For example, the fuel system in an automobile malfunctions over time. Systems and sub-systems are interdependent. For example, in order for the automobile's fuel and electrical systems to work together, the engine must be correctly timed.

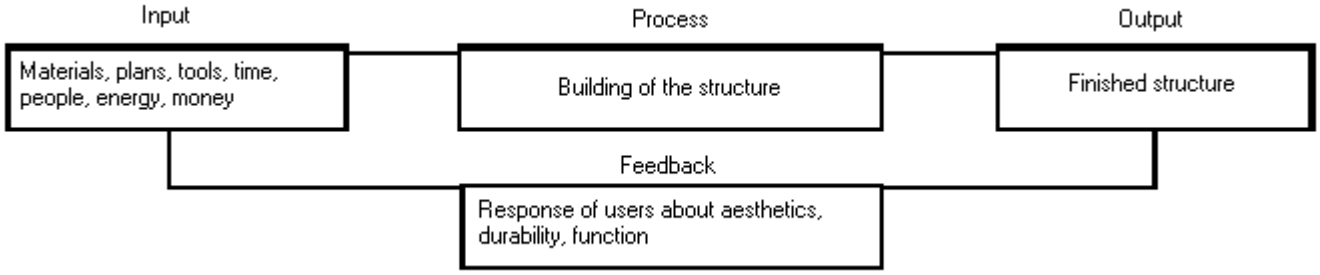
Component Systems of Technology

The component systems of technology are:

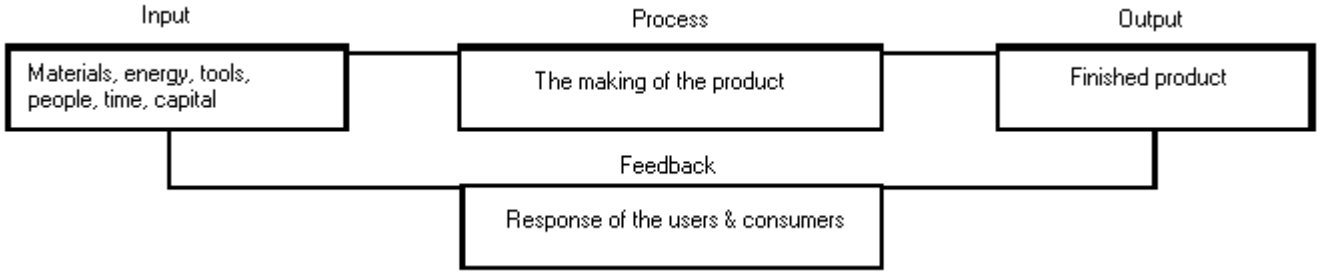
B. Communication Systems – Systems that change information into messages that can be transmitted. These systems include a sender, message, receiver, and feedback.



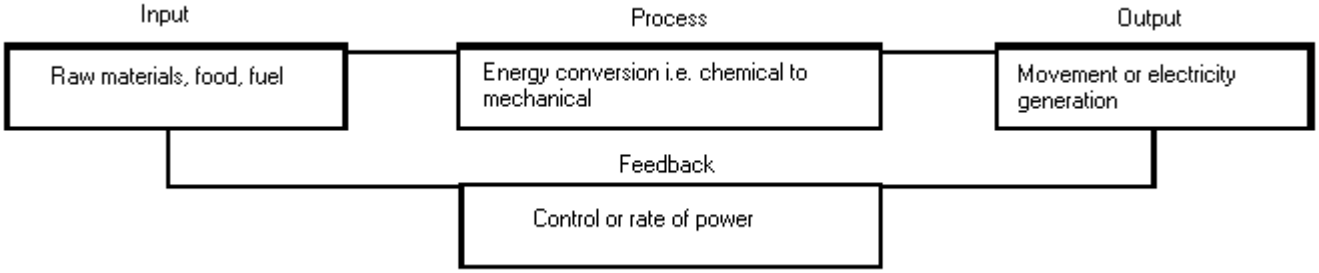
B. Structural Systems - Systems that use goods and materials to build structures that will resist external force, support a load, and hold each structural element in a relative position to other parts.



C. Manufacturing Systems – Systems using materials and processes to produce usable products.



D. Energy, Power and Transportation Systems – Systems that convert energy into mechanical, fluid, electrical, radiant, chemical, and thermal energy.



Barden, R. A. & Hacker, M. (1993). Living with Technology. Albany, NY: Delmar Publishers, Inc., 1993.
Exploring Technology Education Videos (1-9). Blommington, Indiana: Mid-America Vocational Curriculum Consortium, Inc.

Resources of Technology

People People are the creators of technology. People use the other resources that have been around for billions of years, to create technology. People are also the consumers of technology. We USE technology.
Information Technology requires information. It is the use of that information that helps us to meet our needs and wants. The big differences between us and other species is that we can learn and increase our knowledge and information based on past experiences.
Capital Any form of wealth is capital. Capital is barter, money, credit, or property. We require the assistance of others to assemble our necessary resources and this requires capital.
Materials Materials are the goods that we develop into products. Materials are found in nature are called **natural resources or raw material**s. These can be found in the land, sea, or air. There are two kinds of natural resources renewable and non-renewable. Renewable raw materials are those that can be grown and therefore replaced. Non-renewable raw materials are used up and can not be replenished. **Synthetic** materials are created artificially. They are not natural materials. They are made by combining chemicals and elements. Plastics like acrylic and nylon are made from chemicals. Many synthetics are more costly than natural materials. Synthetics can also be used in place of some of our scarce raw materials helping us save our natural resources.
Tools Tools include hand tools and machines. Tools extend our human capabilities to do work. They allow us to do jobs easier and faster. Hand tools are powered by human muscle. Tools become machines when we use a power system to make the tool work better. Some machines use mechanical power systems and some use electrical or electronic power systems.
Energy Energy is the source of power for all of our technological systems. This may be mechanical energy, chemical energy, light energy, nuclear energy, or wind energy. Energy sources may be natural or synthetic, renewable or nonrenewable. The fact is that without energy technology would cease to exist.
Time Since the industrial era, time has been measured in hours, minutes, and seconds. Our forefathers measured time by the setting and rising of the sun. We now measure time in nanoseconds (billionths of a second). The cost of making any product must include the time (or labor cost) to make it (R1, 42-43; R2, 48-57; R3, 25-32).

Reference: Barden, Robert, A. and Hacker, Michael. Living with Technology. Albany, NY: Delmar Publishers, Inc., 1993.
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Pierce, Alan and Karwatka, Dennis. Introduction to Technology. St. Paul, MN: West Publishing Company, 1993.