Civic Systems

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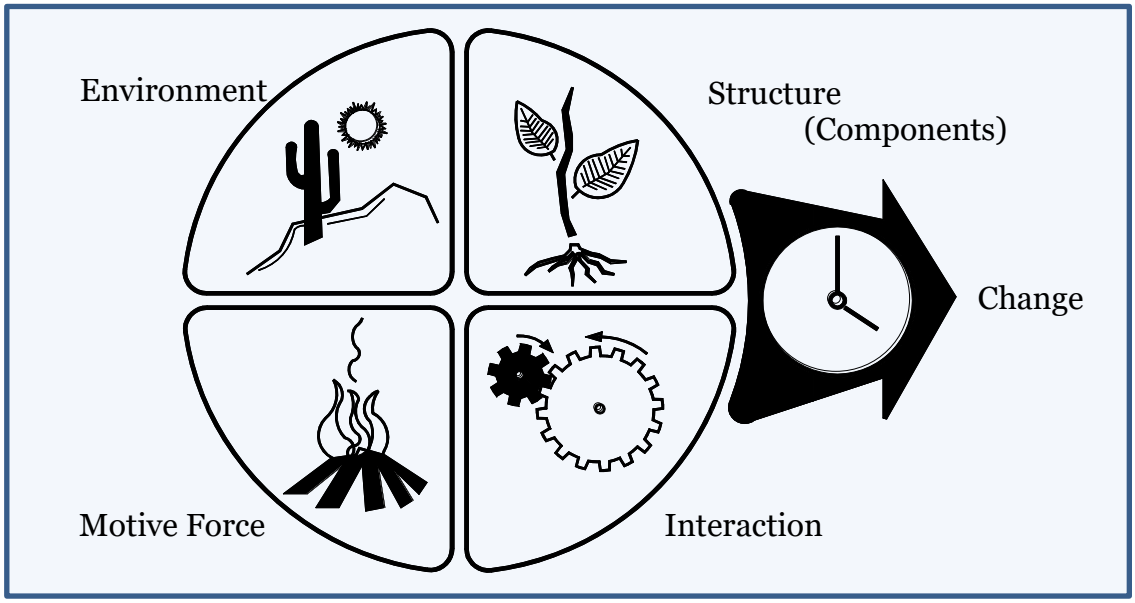
2: Analyzing systems

Useful categories for analyzing systems

Five important things to find out when you investigate a system:

- Its environment
- Its structure (the components, and how they fit together)
- Interaction between components within the system, and between the system and its environment.
- Forces that make the system operate
- System changes as time passes.

These categories, combined, become a "model," a mental map for investigating systems. This "systems model," shown below as a diagram, is a tool for scientific investigation.



Investigation: Target Area support systems

RHRN Project

1: ***Your target area will contain many systems—systems for communicating, for controlling indoor climate, for managing time, for disposing of waste, and so on. Working with others, identify and list as many as you can.***

2: ***Choose one system to analyze, using the system categories shown above. Record your group's conclusions in your journal.***

3: ***Build category trees as part of your analysis.*** The main parts of most systems are made up of sub-parts, and those sub-parts are made up of sub-sub-parts, and so on. Category trees also help you organize your analysis of environments, interactions, and forces.

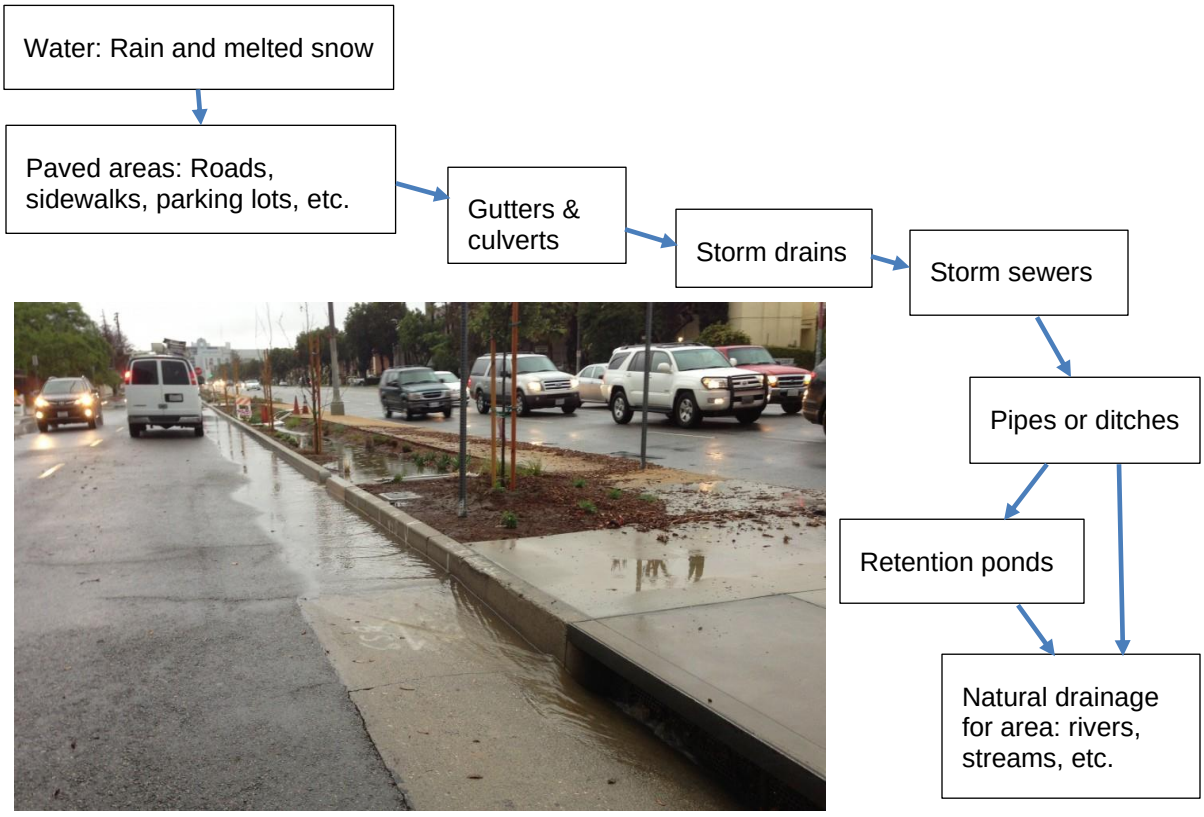
Every science is a study of systems. If you remember and use the principles of systems analysis, you'll make better sense of whatever interests you.

Investigation: Analyzing a physical civic system

Below is a diagram of the non-human parts of one of the civic systems you learned about in the previous unit. The diagram identifies parts of the system *structure* for handling storm water.

1: ***In your journal, write a description that tells precisely how and why your system works. Use pictures and additional diagrams if they help. Make sure you describe the system's environment, structure, interactions, motive forces, and changes over time (dry vs wet weather).***

2: ***What relationships are suggested by the arrows? What interactions occur in retention ponds? (You'll probably need some research to answer this.) How is engineering design related to motive force for this system?***



The version of the Model shown on page 2 works well for non-human systems, such as those studied in science. However, for systems with humans as main components, we'll modify the categories to improve their "fit" with those systems.

Investigation: Another government system

You've analyzed the storm water drainage system supplied by local government.

Identify one additional physical system supplied by local government, and perform the same kind of system analysis—identifying environment, structure, interactions, and motive forces. Use diagrams and category trees wherever possible.

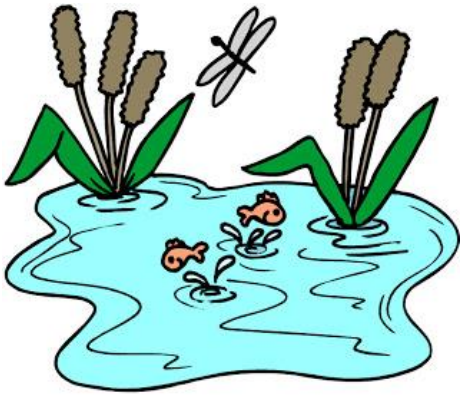
Investigation: Ecology

One possibly confusing thing about systems is the "overlap" of components. If you go to the edge of the nearest pond and look for systems, you'll discover a huge variety. Each living thing—algae, plant, insect, tadpole, etc.—is both a system and a component of larger systems.

Ecology is the study of large systems in nature—investigations such as the following:

- Organisms and their support systems
- Kinds of organisms and controls on their number
- Interrelationships: Predator/prey, food chains, oxygen and nitrogen cycles, etc.

Studying the ecology of even a small environment is complicated—requiring months or years to do thoroughly. However, just beginning a study will suggest systemic links. Working and talking with others about what's being studied will help.



1: ***Choose a small but complex part of your local environment.*** Possibilities: A section of ditch, the edge of a pond or stream, a corner of an overgrown field, vacant lot, or other area with a wide variety of organisms.

2: ***Identify the significant non-living parts of the environment that affect living organisms. (Examples: soil, water…)***

3: ***Identify the most significant organisms (plants, insects, etc.), within the selected area.*** (If you don't know the name of an organism, describe it with sketches or take a picture of it.)

4: ***Estimate the population of each organism within the area.***

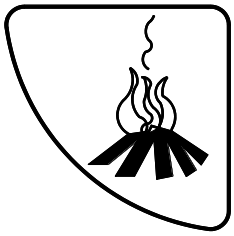
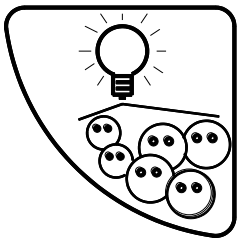
5: ***Describe the ecology of your area using the main categories for system analysis: (environment, structure, etc.)*** Identify as many interrelationships between elements of the environment as you can, and show interrelationships in a diagram. Which parts of the environment are food for other parts? Why do populations of various organisms differ? Etc.

Systems with human components

You're a component—a working part—of many human systems, some large, some small, some extremely complicated. These systems have a great deal to do with how you think and act. The better you understand them, the more likely it will be that your life works out as you hope it will.

As you study systems with human components, categories for describing and analyzing them will expand. The most important changes will be in "motivating forces." Motive force/energy is important, but **when humans are involved, ideas, values, beliefs and assumptions drive the system.**

Nothing you can know is more useful than an understanding of the Shared Ideas that motivate humans.

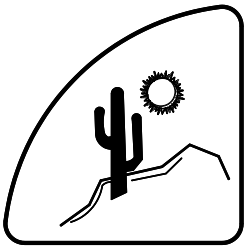
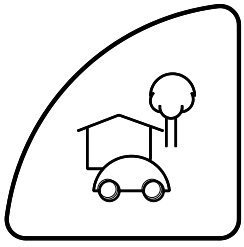
This:  becomes this: 

Motive force Shared Ideas

Note: Shared Ideas of the members of human systems are the most important thing that can be known about them, but of course those ideas can't be seen. They have to be inferred from the ways people act.

Investigation: Systems with several humans

In human systems, the category "environment" expands to include both the natural and the *human-made* environment—*buildings, roads, equipment for transportation, communicating, tools*. "Environment" becomes "Setting."

This:  becomes this: 

Environment Setting

1: Analyze a simple system involving a few humans working together, such as at a pizza shop or similar small business. Look for patterns and relationships.

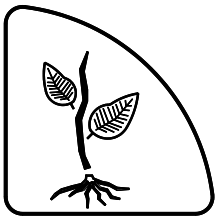
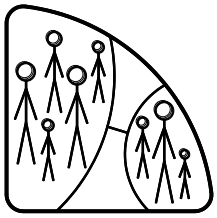
2: ***In your journal, describe the system, using category trees, pictures or diagrams as needed. Identify everything that makes the system work, including important human-made parts of the Setting.***

3: ***In every system, if something significant changes, other important changes follow. Devise and describe a change you think might improve system functioning.***

Investigation: Civic system analysis

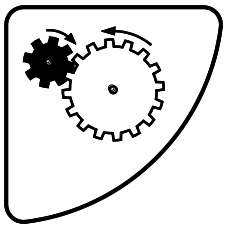
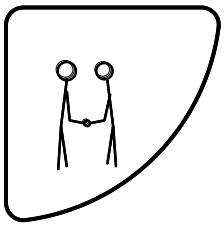
In human systems, the most important components are, of course, the humans. The analytical category "structure" expands to include all the information about them that has to do with how the system functions—their number, *ages,* male/female ratio, subgroups and so on—everything that makes it possible for them to do what they do.

The study of population characteristics is called "Demographics."

This:  becomes this: 

Structure People/Demographics

The system analysis category of "interactions" also expands when you deal with human systems. The most important interactions in human systems occur between people. These are usually patterned—they occur over and over in about the same way.

This:  becomes this: 

Interaction Action Patterns

The systems you investigated earlier—storm sewers, streets and traffic, and so forth—all had humans as important system parts. For the storm sewer system, these humans include the engineers that designed the system, the workers who

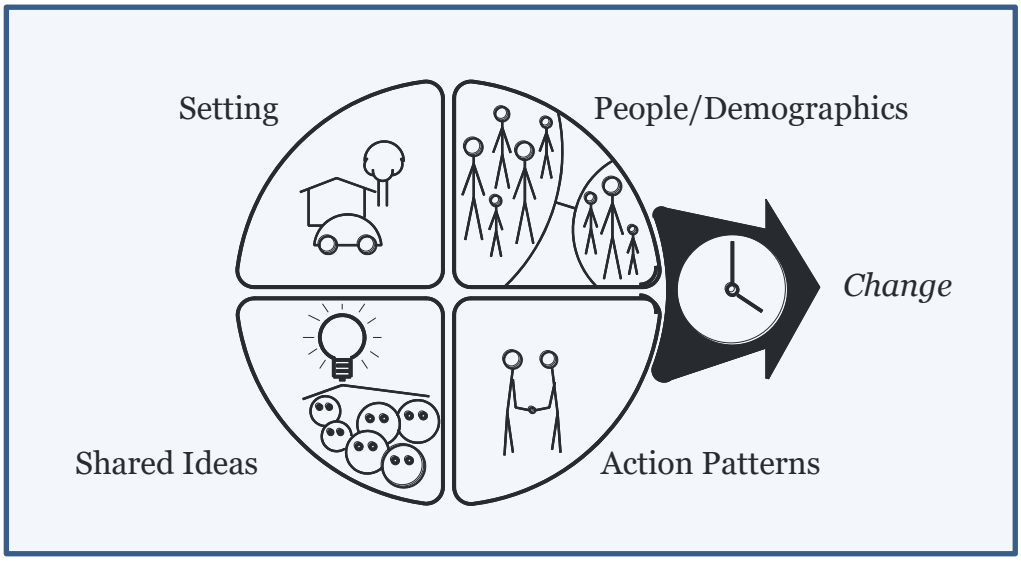
built it, and the workers who maintain it; they are all parts of the system. The Shared Idea is (obviously) "maintaining safe traffic flow in wet weather."

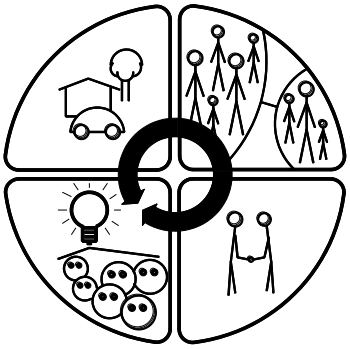
1: ***Working with others, analyze the remaining civic systems you investigated earlier, identifying Setting, Demographics, Action Patterns, and the Shared Ideas that are important in the way each system operates.***

2: ***Identify one additional local civic system, and analyze it in the same way.***

The human systems Model

You now have the main elements of a Model for investigating any human system or organized human group.





A reminder: Human systems, like all systems, are integrated. Every part relates directly or indirectly to every other part, and a change in any part will cause changes elsewhere. Population increases or decreases, for example, will probably change patterns for work, for obtaining and distributing food, for housing. These, in turn, will cause changes in Settings and in ideas about human relationships. Such changes may occur too slowly to be noticed, so understanding them requires a look at information over time—history.

Investigation: Target Area systems that include humans

RHRN Project

1: Identify and list the significant human sub-groups within your target area.

2: Describe each sub-group in the target area—number of members, age ranges, and other distinguishing characteristics.

3: Using the system Model as a guide, identify major Shared Ideas and Action Patterns for each sub-group in the target area.

Investigation: How universal is the human systems Model?

News reporters know that to tell a story, they must answer the five "W" questions:

Who? What? When? Where? Why?

Note that these questions "fit" logically with the main categories of the Model.

1: Match each of the five "W" questions with its corresponding Model category.

2: Test the Model by reviewing the "who, where, what, when and why" of human affairs in several sources—news stories similar to the one shown here, a happening described in a history book, an elderly person's recollection, an incident in your school, etc. In your journal, paste in news clippings or copies of other printed accounts, or write information from verbal accounts, then draw circles around the information that answers each of the "W" questions, and indicate which question is answered.

Fire severely damages local dentist office

TITUSVILLE — A dentist office sustained extensive damage after a Thursday night fire in Titusville, Fire Departments officials said.

Fire crews got a call at 6:11 p.m. for the fire at Christie Dental of Titusville in the 600 block of Country Club Drive, Battallion Chief Greg Sutton said. Crews saw smoke coming from the windows of the business when they arrived on the scene.

Crews extinguished the fire in 30 minutes and no injuries are reported. But the dentist office sustained extensive smoke damage throughout the building and is uninhabitable.

The cause of the fire is under investigation and the State Fire Marshal's office has been contacted, Sutton said.

Note: The question "Why?" sometimes isn't answered in news stories, either because the answer is obvious, or because the reporter doesn't know the answer.

3: For each story, identify possible systemic relationships between the components.

4: Dramas and plays model reality but use different words for major categories. What are they?

Investigation: Criminal investigation and the Model

Even if experts don't realize they are using the Model, they use it, intuitively, in every in-depth investigation of events or situations involving humans.

1: ***Match each of the following terms used in criminal law enforcement with its general Model category. (Some terms may fit in more than one category.)***

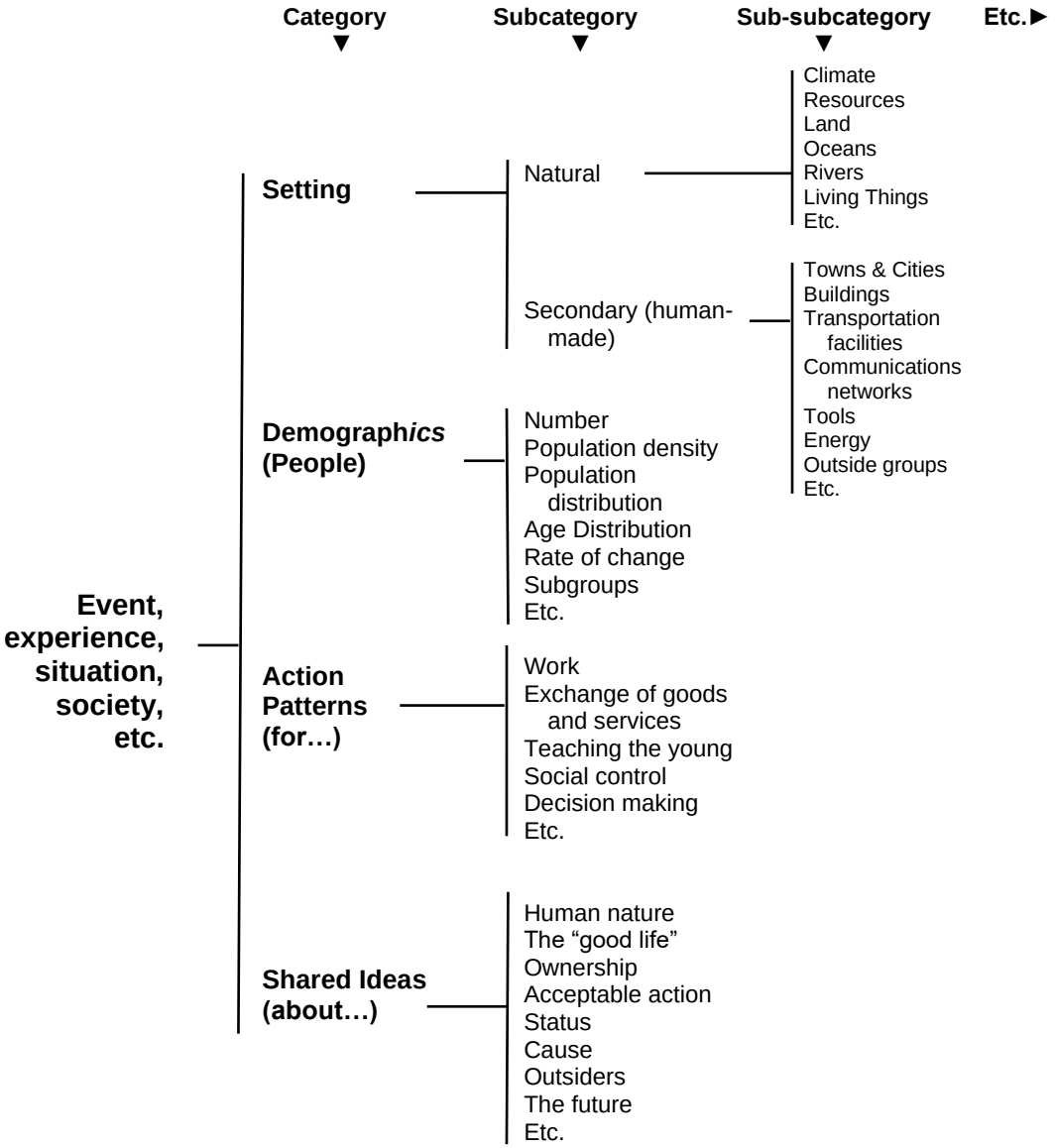
2: ***Choose a term from the list, and describe its relationship with one other term. Repeat this relationship linking for several other terms.***

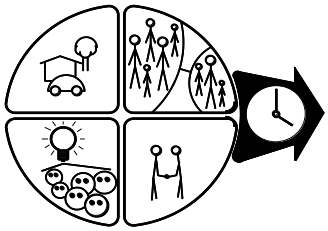
Clue	Perpetrator
Motive	Police detective
Investigation	Suspects
Sequence of events/timeline	Arrest
Victim	Witnesses
Prison	Questioning of suspect
Prosecuting attorney	Sentencing
M. O. (modus operandi)	Defense attorney
Crime scene	Fingerprints
Weapon	DNA analysis
Prosecution	Lineup
Evidence	Surveillance
Lie detector	Ballistics
Criminal laws/statutes	Criminal court
Jury	Constitutional rights
Miranda warning	

http://oureverydaylife.com/crime-investigation-schools-25466.html

A detailed version of the Model

Understanding systems is easier if your system categories are expanded with useful sub-categories. Here's an expanded Model that may help with your investigations. Note that every subcategory and sub-subcategory may be expanded further:





Time & Systemic Relationships: In every situation, each category (and sub-category) is affected by many others. Changes across time can occur in every category, triggering other changes.

For teacher/mentor:

The Model categories shown here for analyzing non-human systems can be a powerful tool for making sense of a lot of science. A model like this is missing from conventional science courses, but is needed to sort out the huge mass of information aimed at learners in typical classes. Without such a model, confusion and forgetting are the main mental outcomes from many science courses.

The Model

Every human, every waking moment, is subconsciously thinking, "What's going on here, and what should I do next?" Lifting this question into consciousness and approaching it systematically will provide learners with powerful tools that will be useful for the rest of their lives. The Model that's elaborated in this course provides analytical questions that have substance, depth, and vast explanatory power. Its four "super-concepts" are complex enough to have within and between them a complete network of interrelated sub-concepts, keys to tracing the dynamics of change.

The first four components of the Model are the standard, traditional categories used to construct stories or drama, (setting, actors, action, plot). Elaborated, the four are extremely efficient information organizers and conceptual tools for analysis.

- **"Setting**," As within any drama, the setting includes both natural and human-made elements—everything physical that relates systemically to what happens.
- **"Actors,"** focuses on the people involved, particularly their demographic characteristics. **Demographics** is a second super-concept.
- **"Action"** is not only the specific, idiosyncratic actions of each person, but (much more importantly) the **action patterns** shared by actors, learned as a part of the society in which they've been reared.
- **"Plot,"** encompasses the important ideas and values shared by the participants that color their perceptions and shape their way of life. **Shared Ideas** is the fourth, and most important, super-concept.

These four categories of the Model, adequately elaborated and expanded, can be used to analyze any situation. They direct attention to important but often ignored factors shaping events, conditions, situations and historical trends. Each category contains logical, usually familiar sub-categories:

Setting: Constructions, tools, climate, resources, outside groups, transportation systems, communications networks, etc.

Demographics: Number, population density, population movement, age profile, sex ratios, subgroups, etc.

Patterns of Action: (for) work, economic transactions, decision-making, child-raising, movement of goods and people, communicating, controlling deviance, etc.

Shared Ideas: (about) causation, human nature, status, outsiders, the future, the supernatural, etc.

These four categories and their sub-categories provide an effective way to begin analysis of any situation, event or change.

Each of the four is systemically related to all others. A change within any of the four categories will tend to cause changes elsewhere. Although it plays little or no role in conventional study, "system" is the most powerful of all super concepts. For example, when population density increases significantly, changes in the setting will be necessary to house more people. These changes, in turn, will affect work patterns and much else. Eventually, ideas about levels of personal freedom (and many other important ideas) are likely to change.

Some important characteristics of any society or group will, of course, relate to more than one of the four main categories. For example, social stratification and class structure related to occupations, wealth, family or clan will relate to all four categories.

As the famous Irish legal philosopher (Murphy) said, "You can't change just one thing." One ancient change in setting—learning to plant seeds in cultivated patches—led to another change in setting: permanent settlements, plus growth in population (demographics). Permanent settlements led to shared ideas about land ownership and boundaries. Internal and external disputes over boundaries led to either organized conflict or organized dispute settlement (patterns of action). (The list of cascading changes is endless.)

Without the key idea "system," the causes and consequences of change can't be understood. Learning isn't simply a matter of absorbing facts; it's a process of developing and enhancing the ability to discern and explore systemic relationships between aspects of reality not previously thought to be related.

For further information, we suggest reading the free book, *What's Worth Learning?*, available (PDF file) at http://www.marionbrady.com/Books.asp.

Investigation: Target area support systems

Every target area contains or is affected by multiple, easily accessed systems. As with earlier investigations, this one may require considerable time depending on the systems being investigated, level of learner interest, etc.

Possible systems for investigation: The target area's indoor climate control, water, electrical, and waste disposal (both sewage and solid waste systems). Identifying energy use and loss may be of interest and significance. What's the source of energy for heating and/or cooling? How does the system work? Where does energy come from? At what cost? What components distribute warm or cold air? Does energy production generate carbon dioxide as a side product? If so, how much? Are there other byproducts, e.g. ash? What happens to other byproducts? What's the source of the electrical energy used for light and other energy needs? How much does it cost? How much energy does the school waste?

Analyzing waste disposal systems may be particularly productive, including questions such as: What types of waste are produced? Where does it go? How is it processed? How much is recycled? Where will the waste be when learners are 60 years old?

What communication systems are used by the school? Are links bidirectional or unidirectional? Are they adequate? How might they be improved? Note that communications may be spoken, written, graphic, direct, at a distance, etc. Don't overlook such things as bulletin boards, handouts and bells or alarms as communications systems.

Investigation: Analyzing a physical civic system

The simplest of the civic systems identified earlier is the focus here, to give learners a head start in applying the Model. The main components are shown in the diagram, and their structure (i.e. how they fit together) is suggested. The environment is the town or city; the main interaction is the channeling of water flow to prevent flooding, and the primary motive force is gravity. In the retention pond, sediment falls to the bottom, and contaminants (mainly oil from vehicles, and organic debris such as fallen leaves) is at least partially broken down by action of bacteria and fungi. Retention ponds may allow water to percolate down to recharge the water table, and of course some water is lost by evaporation. An important function of these ponds is to buffer the water flow, releasing it into local natural drainage gradually to help avoid flooding.

Investigation: Looking at other systems

This extends the previous activity. Although straightforward, some learners may have difficulty "filling in the blanks" in some parts of their descriptions. Working in groups will help younger learners. In some cases, outside research may be useful.

Investigation: Another government system

For most learners, the obvious choice is the municipal water system. Another possibility is the traffic management system (not including the human parts).

Investigation: Ecology

A great deal of evidence and common sense say kids learn more when they're not confined to seats. If possible, involve teachers whose specializations are appropriate. The logistics of teams of four or five learners working together, each at a different location, may be difficult, likely requiring aides, parents, or others.

Boundaries between fields of study are human inventions that don't exist in the real world. This activity tackles that problem.

A side benefit of team teaching is the possibility of combining class periods to give teams more time in the field. An initial data-gathering trip to the selected site for a couple of hours is suggested. Data gathering should include notes, photos, sketches, samples (take collection jars), measurements of various sorts, etc. Make sure learners don't ignore plant life.

Successful field trips raise questions. (How do water striders do it? What do they eat? How long do they live?) At this point, encourage learners to avoid external information, and find out as much as they can directly from nature instead of secondhand sources. Once they've gone as far as they can on their own in the

time allowed, one can hope that at least some will raise questions that prompt them to check the Internet, the library, or someone knowledgeable.

After the initial field trip, a first attempt at putting together an analysis will almost certainly reveal that the initial gathering of data was inadequate, requiring another visit to the area.

For language arts purposes, the focus should be on effective communication—clear, precise descriptions. Good science requires specificity about what's not known, separates fact from conjecture and demands honesty, including giving credit when information from outside sources is used.

The activity could, of course, proceed indefinitely. It's impossible to know everything about an ecological site, so establish a schedule and deadlines. What's most important is breaking through the barrier created by the too-familiar. Focusing intently on a tiny aspect of reality can make it "strange enough to see."

Investigation: Systems Involving multiple humans

Observing a fast food or similar retail operation may be difficult if some of the operation is hidden behind equipment or walls. Observation is best done during non-school hours, and should not interfere with the business or customers. The point is to transition the Model's system concept from "environment" to "Setting"—buildings, equipment, layouts, tools, and so on.

A possible alternative to the analysis of a fast food or similar business with more accessibility (and probably quicker), could be observing or just remembering a sports team, including those in roles other than players—coaches, equipment managers, referees, etc. Again, the focus is on the way the environment becomes a Setting, with the configurations of venues, constructions (e.g. grandstands, goals, field marking, etc.), and equipment affecting system functioning.

Investigation: Target area systems that include humans

The school (if that's the learning environment) is a microcosm of society, with all the elements of reality identified by the Model. Here, learners begin their more-detailed system-based analysis of the Target Area. It will continue for the rest of the course.

Investigation: Civic system analysis

This is, of course, the logical next step toward understanding of the first level of local government.

Investigation: How universal is our human systems Model?

Investigation: Criminal investigation and the Model

These investigations underline the validity of the Model in any in-depth analysis of human events. The second applies the Model to crime scene investigations, likely familiar to learners through countless TV dramas.

The investigations provide additional evidence to learners that the Model is an effective tool for analyzing reality. The second is perhaps optional, but some learners may be more interested in this one than in the first. (HLB August 2019)