

K-12 Systems Thinking Standards
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These standards have been refined over the past two years in an attempt to provide a scope and sequence for grade level systems thinking activities in our district. The standards describe the knowledge and skills that should be attained by students at specified grade levels. The need for this framework originated through our staff development efforts and teachers' classroom experiences.

Elementary

At the elementary level, the standards for systems thinking encourage students and teachers to explore systems they already know in terms of family, nature, and the elementary program. Systems thinking is not another subject added to the curriculum; instead it is a tool you use to model and understand interrelationships in the curriculum, including literature, social studies, science, language, mathematics, the arts, and school citizenship. Based on our successful efforts as a district to teach higher order thinking skills, we believe that the place to introduce students to systems thinking is in kindergarten and the lower primary grades.

By grade 1, students should be able to:

1. list examples of how "everything is connected to everything", how events can occur in cycles, and how several causes can lead to one event using literature, classroom themes, and family structures.
2. draw and explain an event using simple maps and models that include stocks and flows and causal loop diagrams using whole language strategies.

By grade 3, students should be able to:

1. create maps and models within curriculum content using simple connectors and converters in structured diagrams and causal loop diagrams.
2. explore maps and models provided by the teacher, modify and extend the maps, and explain why all systems are dynamic.

By grade 5, students should be able to:

1. develop maps and models using curriculum topics, research, class discussions, and experimentation, stressing methods of graphing the actions of systems over time and the impact of leverage on a system. (Learner-directed learning.)
2. collaborate in teams as they articulate and explore curriculum maps and models using grade appropriate computer and game simulations.
3. expand their understanding of systems to the world around them using current events and social/environmental problems.

Middle School

Our middle schools are organized by grade level teams composed of an English, mathematics, science, and social studies teacher. The teams are given planning time on a daily basis and integrate their curricula through team projects, field trips, convocations, and macrocognitive challenges. The use of systems thinking in grades 6, 7, and 8 impacts the interdisciplinary approach used by the middle school teachers.

By grade 8, students should be able to:

1. design maps and models that show the complexity and interrelated structures of a subject or system across the disciplines. This could include the historic, scientific, and cultural aspects of a region or environmental problem.
2. collect and analyze information and results from experiments, determine the importance of their data, and construct sophisticated maps and models of their findings.
3. explain through modeling and writing how nature and human actions have caused change in the natural and manmade systems around them.
4. evaluate their maps and manipulate the models so that they can determine the best places to apply leverage in a problem or situation.
5. assess a local problem using a systems thinking approach, create refined model, take an action that will impact the problem, and attempt to determine the result of the leverage that was applied through their action. (These actions could involve working with student action groups, meeting with school administrators, or writing to local government officials to impact a problem.)

High School

At the high school, systems thinking activities are limited to individual classes and teachers. There is a movement towards a more integrated approach to learning, but the departmental structure of the high school and the pressures of Advanced Placement and Achievement Tests slow the process of change. A course on systems thinking is in the planning stage for next year.

By grade 12, students should be able to:

1. create models that simulate a range of topics in the curriculum, while showing an understanding of mathematical expressions that give models meaning.
2. apply the archetypes of systems thinking to events in the natural sciences and social sciences, explaining the similarities and differences of the archetypes across the curriculum.
3. discuss the uses of systems thinking in industry, research, economics, education, and government.
4. evaluate the impact of personal activities and social policies on the systems that effect their lives.

Note: These standards mention several terms related specifically to Stella II, a modeling program available through High Performance Systems, Hanover, New Hampshire (1-800-332-1202).

While the use of this creative technology supports, enhances, and enriches the understanding of systems thinking in grades 4 through 12, the use of a systems thinking approach in the K-12 program does not require specific technology.

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