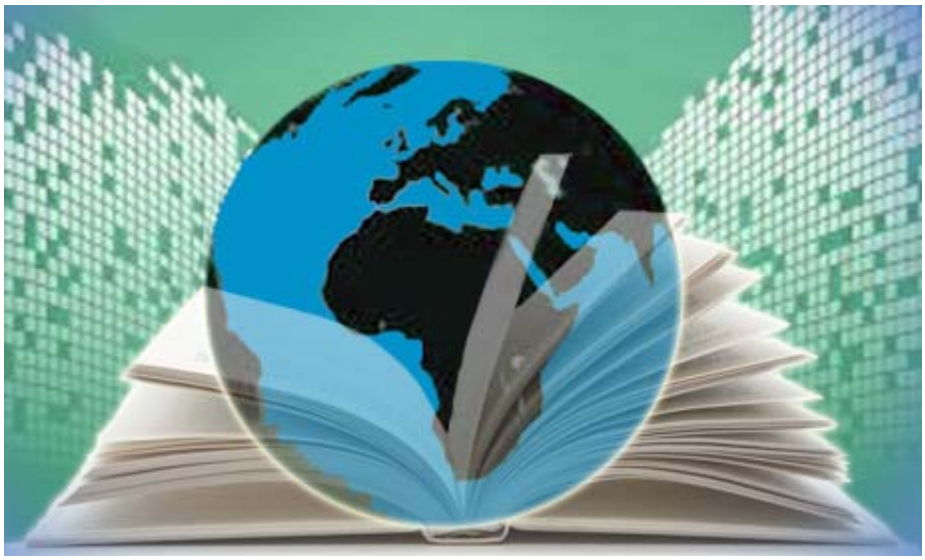
Boulder Valley School District
Excellence and Equity

Technology Innovation Design and Engineering (TIDE) Middle Level Educational Technology Curriculum Essentials Document



Boulder Valley School District
Department of Educational Technology
September 2011

Boulder Valley School District Technology – An Introduction to The Curriculum Essentials Document

Background

* This BVSD Curriculum Essentials Document incorporates the International Society for Technology in Education's (ISTE) National Educational Technology Standards for Students (NETS) and the integrated essentials from the Colorado Academic Standards for 21st Century Learning Skills.

The NETS for Students from ISTE do not delineate how courses should be created or taught. Each teacher must determine appropriate lesson planning. As technology rapidly evolves with new dynamic tools, there is no set of prescribed software, tools, or technologies that students and teachers may adopt to achieve these rigorous and robust standards. It is with experience, trust, and teacher consensus in ISTE that the Technology Teachers and Educational Technology Department at BVSD adopted these same NETS for our Boulder Valley students. The writing teams took the ISTE NETS for Students and carefully and thoughtfully divided them into courses for the creation of the 2011 BVSD Educational Technology Curriculum Essentials Documents (CED).

The ISTE 2007 Standards

The expectations in these documents are based on mastery of the topics at specific grade levels with the understanding that the standards, themes and big ideas reoccur throughout PK-12 at varying degrees of difficulty, requiring different levels of mastery. The Standards are:

1. **Creativity and innovation**
   Students demonstrate creative thinking, construct knowledge, and develop innovative products and process using technology.
   Students:
   a. Apply existing knowledge to generate new ideas, products, and processes
   b. Create original works as a means of personal or group expressions
   c. Use models and simulations to explore complex systems and issues
   d. Identify trends and forecast possibilities
2. **Communication and Collaboration**
   Students use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others. Students:
   a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
   b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats
   c. Develop cultural understanding and global awareness by engaging with learners of other cultures
   d. Contribute to project teams to produce original works or solve problems
3. **Research and Information Fluency**
   Students apply digital tools to gather, evaluate, and use information. Students:
   a. Plan strategies to guide inquiry
   b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
   c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
   d. Process data and report results
4. **Critical Thinking, Problem Solving, and Decision Making**
   Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources.
   Students:
   a. Identify and define authentic problems and significant questions for investigation
   b. Plan and manage activities to develop a solution or complete a project
   c. Collect and analyze data to identify solutions and/or make informed decisions
   d. Use multiple processes and diverse perspectives to explore alternative solutions
5. **Digital Citizenship**

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

a. Advocate and practice safe, legal, and responsible use of information and technology
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
c. Demonstrate personal responsibility for lifelong learning
d. Exhibit leadership for digital citizenship

6. Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

a. Understand and use technology systems
b. Select and use applications effectively and productively
c. Troubleshoot systems and applications
d. Transfer current knowledge to learning of new technologies

Components of the Curriculum Essentials Document

The CED for each grade level and course include the following:

- An At-A-Glance page containing:
  - approximately ten key skills or topics that students will master during the year
  - the general big ideas of the grade/course
  - the Standards of Technology Practices
  - assessment tools allow teachers to continuously monitor student progress for planning and pacing needs
  - Description of Technology at that level
- The Grade Level Expectations (GLE) pages.
- The Grade Level Glossary of Academic Terms lists all of the terms with which *teachers should be familiar and comfortable using during instruction. It is not a comprehensive list of vocabulary for student use.*

TIDE Overview

Course Description	Topics at a Glance
The T.I.D.E. (Technology-Innovation-Design-Engineering) course of study prepares middle school students for the changing demands and professions of the 21st century. This program combines the best of design-build learning with modern tools of technology, an awareness of interest-based preparation, and an exposure to the workforce skills required to give all Boulder Valley students a competitive advantage in their educational and workforce pursuits.	• **Graphic Design** • **Product Design** • **Environmental Design** • **Interactive/Experiential Design** • **21st Century Competencies**
Assessments T.I.D.E. concepts are assessed within the classroom using authentic, performance-based, project-based methods	Achieving these goals may be reached by a variety of projects and/or programs. Use of specific software programs or technology equipment were deliberately not mentioned due to the variation in resources among different schools. **Standards:** The National Education Technology Standards (NETS) for Students were developed in 1998 and updated in 2007 by ISTE, the International Society for Technology in Education. 1. Creativity and innovation 2. Communication and Collaboration 3. Research and Information Fluency 4. Critical Thinking, Problem Solving, and Decision Making 5. Digital Citizenship 6. Technology Operations and Concepts 7. Careers.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard: 1. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

Prepared Graduates:

Apply existing knowledge to generate new ideas, products, or processes
Create original works as a means of personal or group expression
Use models and simulations to explore complex systems and issues
Identify trends and forecast possibilities

GRADE LEVEL EXPECTATION

Concepts and skills students master:

a. Apply existing knowledge to generate new ideas, products, or processes
b. Create original works as a means of personal or group expression
c. Use models and simulations to explore complex systems and issues
d. Identify trends and forecast possibilities

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Apply prior learning to develop an innovative solution to a new problem individually or in a group, while working independently or with appropriate scaffolding. b. Produce a checklist of design constraints for a project and/or indicates that they met or worked around provided constraints c. Demonstrate problem-solving strategies to make a solution comply with design constraints. d. Test, modify, and retest solutions to produce an improved final product e. Provide written documentation of how they came up with their solution and took it to completion (as evidenced by proposal, planning, and organization). f. Complete a career search project and written reflection that identifies emerging career trends and forecasts possible directions of growth and future opportunities.	**Inquiry Questions:** 1. How is creativity different from problem solving? 2. Why are there always tradeoffs in design problems? **3.** What are some of the ethical responsibilities that a designer should consider? **Relevance and Application:** 1. Technological design involves tradeoffs among competing constraints and requirements. **Nature of Discipline:** 1. Work in a design or engineering team to solve a problem.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard: 2. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

Prepared Graduates:

Communicate information and ideas effectively to multiple audiences using a variety of media and formats
Contribute to project teams to produce original works or solve problems

GRADE LEVEL EXPECTATION

Concepts and skills students master:

b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats
d. Contribute to project teams to produce original works or solve problems

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Communicate effectively about the purpose, process, and/or application of their project by creating a written or electronically published report (e.g. journal, blog, wiki), reflection, or reaction paper; or by crafting an authentic assessment (e.g. oral presentation, poster, podcast, website, portfolio, or podcast.) b. Successfully complete a group design challenge project and demonstrate cooperation, teamwork, and division of labor to complete the assigned task c. Select and utilize appropriate digital and social media applications to support collaborative design processes.	**Inquiry Questions:** 1. Why care about technology, innovation, design, engineering, or workforce competencies? 2. Which technologies are we most/least comfortable with and why? 3. What skills do you think you will need to have a successful career? Why? 4. How do you think people will collaborate in the future? **Relevance and Application:** 1. Technology and workforce competencies including communication and collaboration affect everyday life. **Nature of Discipline:** 1. Having skills to complete tasks and communicate solutions as an individual and as a team member is essential for the 21st Century graduate.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard: 3. Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

Prepared Graduates:

Plan strategies to guide inquiry
Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
Process data and report results

GRADE LEVEL EXPECTATION

Concepts and skills students master:

a. Plan strategies to guide inquiry
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
d. Process data and report results

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Plan design strategies and processes by creating a project management document listing steps in the design process, a timeline to completion, and/or division of workload. b. Locate, analyze, and evaluate design precedents (exemplars) to devise strategies and formulate design questions or problems to address. c. Evaluate and select appropriate tools and materials for a project to meet design specifications or intentions. d. Test design solutions and compile a report to communicate results of data collected.	**Inquiry Questions:** 1. What role does research play in the design process? 2. How can we assess/measure the quality of design solutions? **Relevance and Application:** 1. Technology drives invention and innovation as a dynamic process. **Nature of Discipline:** 1. Project-based design and implementation.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard: 4. Critical Thinking, Problem Solving, and Decision Making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources.

Prepared Graduates:

Identify and define authentic problems and significant questions for investigation
Plan and manage activities to develop a solution or complete a project
Collect and analyze data to identify solutions and/or make informed decisions
Use multiple processes and diverse perspectives to explore alternative solutions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Identify and define project goals and intentions by describing the design problem or challenge and explaining what they hope to accomplish and why. b. Define the strategies they will use to meet project goals and intentions while addressing constraints. c. Explore and refine design solutions by starting from thumbnail or loose sketch drawings, then moving to a rough draft, and work between hand drawings and CAD applications when the project requires finished design drawings. d. Assess the strengths and weakness of alternative design solutions through analysis or design drawings or testing a prototype design. e. Demonstrate evidence of creativity in the design process and final product. f. Evaluate design projects for creativity (novelty) and appropriateness.	**Inquiry Questions:** 1. How and why do we use the design process? 2. What are the steps or stages of a typical design process? **Relevance and Application:** 2. Technological design is a systematic process used to initiate and refine ideas, solve problems, and maintain products and systems. **Nature of Discipline:** 2. Design and engineering.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard 5. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Prepared Graduates:

Advocate and practice safe, legal, and responsible use of information and technology
Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
Demonstrate personal responsibility for lifelong learning
Exhibit leadership for digital citizenship

GRADE LEVEL EXPECTATION

Concepts and skills students master:

a. Advocate and practice safe, legal, and responsible use of information and technology
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
c. Demonstrate personal responsibility for learning
d. Exhibit leadership for digital citizenship

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Demonstrate knowledge of copyright, patent, and fair use practices through published work (e.g. websites, posters, journals, b. Illustrate issues of technology's impact on quality of life, collaboration, learning, and productivity in written work (e.g., journal, blog, wiki, reflection, published item, or reaction paper) or through authentic assessments: (e.g., oral presentation, display, podcast, or capstone project) c. Describe and discuss ethical and human impact issues in technology through written work, oral presentations, or classroom discussion. d. Exhibit personal initiative, leadership, and responsibility for own learning through capstone projects.	**Inquiry Questions:** 1. Is technology's impact positive or negative? 2. What is the relationship between technology and our quality of life? 3. Who wins and who loses when technology changes? **Relevance and Application:** 1. Technological change can be positive and/or negative, and can have intended and/or unforeseen consequences. 2. Technology is the basis for improving on the past and creating the future. 3. Individuals should know how to evaluate the benefits, limitations, and risks associated with existing and proposed technologies. 4. Technology impacts society. **Nature of Discipline:** 1. Self-awareness of how technology impacts our lives will become more and more prevalent for a 21st century graduate.

Content Area: Technology - Middle Level Technology Innovation Design Engineering

Standard: 6. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems, and operations.

Prepared Graduates:

Understand and use technology systems

Select and use applications effectively and productively

GRADE LEVEL EXPECTATION

Concepts and skills students master:

a. Understand and use technology systems
b. Select and use applications effectively and productively

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Achieve a passing grade on class Safety Test b. Correctly follow safety procedures (e.g., wear protective safety glasses, retract hair, follow project safety guidelines) c. Demonstrate appropriate workplace behaviors by respecting their own and others' workspace, including workspace clean up. d. Correctly identify, categorize, and use project-relevant tools. e. Follows BVSD acceptable use guidelines. f. Evidence basic operational computer skills: navigation, the efficient use of the Internet for research, server and folder access, printer use, and peripheral use.	**Inquiry Questions:** 1. How do I use technology or tools responsibly and safely? **Relevance and Application:** 1. Technology requires the acquisition of the knowledge needed to use and operate various technological devices and systems. **Nature of Discipline:** 1. Using tools and equipment to design and build projects with a real world application.

Academic Vocabulary

Applied Academics: Applying basic reading, writing and math skills to real-world problems
Applied Problem Solving: Creating solutions for real, yet motivating challenges presented through hands-on projects
Personal Achievement: The satisfaction that comes with a project completed, a challenge met, or a job well done
Competency with tools: The safe and competent use of tools and equipment used at home, in business, and in modern industry.
Workforce Essentials: Applying the importance of quality of work, reliability, completing assigned tasks, using basic skills, comfort with technology, and both individual and team responsibility
Interest Education: An exposure to various fields of work interest and the high school preparation that will be necessary to pursue those interests.
Diverse Learning Styles: Project choices, which accommodate the many interests and learning preferences of students

Word	Definition
"concept to completion"	Taking an idea in a mind to a completed project
"Test, modify, retest"	Making improvements on a design by retesting after modifications
abrasion	Wearing away of material
apparatus	System allowing something to function
arch	Curved structure
architectural design	Architectural design values make up an important part of what influences an architect and designer when they make their design decisions
architecture	Building design or style
back saw	Hand saw with a stiff metal strap on the back to cut precise angles
band saw	Power tool with a band of teeth for a blade
chop saw	Common name for a power miter-box saw
CNC	Computer Navigated Control
CNC lathe	A Lathe controlled by a computer
CNC mill	A Mill controlled by a computer
constraints	Limiting factors in the design due to cost or other set limits
coping saw	Hand tool for cutting curves in thin materials
cost accounting	The recording of all the costs incurred in a business in a way that can be used to improve its management.
criteria	Standard for judging or evaluating things by
cutting	The process of making materials smaller precisely
decision making	The cognitive process of reaching a decision;
design	Create detailed plan of something
Design brief	A comprehensive written document for a design project
design constraints	Refers to some limitation on the conditions under which a system is developed, or on the requirements of the system
design/build	Taking the design into a lab to build
drafting	Drawing a project or invention to technical specifications so it can be manufactured.
Drafting board	Board for drawing technical drawings
Drill press	Power machine for boring accurate holes in material
Electrical current	Flow of electric charge through a medium
Energy	The capacity of a physical system to perform work
engineering	The branch of science and technology concerned with the design, building, and use of engines, machines, and structures.
fastener	To attach firmly to something else, as by pinning or nailing.
Final draft	The draft of a project after revisions that is ready to build
fixture	A device to increase productivity by either making a shop procedure safer

	or faster.
French curve	A design tool for making curves
Graphic design	The art or skill of combining text and pictures in advertisements, magazines, or books.
Gripping	Type of tool that grips materials
hammer	Tool used for striking other materials
hand drill	Drill may be electric or hand powered put is portable and held by hand
hand tool	A tool that is held in the hand and used on materials
hydraulics	The branch of physics or technology concerned with the mechanical properties of liquids.
inference	In computer drawings using a point on one part of a drawing to line up another point
innovation	A new method, idea, product
invention	A new device, method, or process developed from study and experimentation:
jigs	A Fixture made for holding parts in manufacturing to simplify the process
laser	A device that generates an intense beam of coherent monochromatic light (or other electromagnetic radiation) by stimulated emission of photons from excited atoms or molecules
layout	1. The way in which the parts of something are arranged or laid out. 2. The way in which text or pictures are set out on a page.
leveling	To make the project flat or even
Materials	The matter from which a thing is or can be made.
measurement	The size, length, or amount of something,
mock-up	A model or replica of a machine or structure, used for instructional or experimental purposes.
pneumatics	The branch of physics or technology concerned with the mechanical properties of gases.
power tool	A power tool is a tool powered by an electric motor, an internal combustion engine, a steam engine, compressed air, direct burning of fuels and propellants
printer	A machine for printing text or pictures onto paper, esp. one linked to a computer.
Problem solve	To focus on the problem as stated and tries to synthesize information and knowledge to achieve a solution.
prototype	A first or preliminary model of something, esp. a machine, from which other forms are developed or copied
protractor	An instrument for measuring angles, typically in the form of a flat semicircle marked with degrees along the curved edge.
Research brief	The basic objectives and instructions concerning a market-research project.
robotic arm	A robotic arm is a robot manipulator, usually programmable, with similar functions to a human arm.
rough draft	A preliminary drawing of a design with measurements but not up to technical specifications.
safety glasses	Glasses worn over the eyes for protection in a lab or hazardous environment.
sander	A machine for holding abrasive paper to remove and smooth materials
sandpaper	An abrasive paper used to make surfaces smooth by abrasion
scale,	Drawing an object in proportion
Schematic	Diagram, in particular of an electric or electronic circuit.
screwdriver	Tool for turning screws into materials for fastening materials
scroll saw	A reciprocating saw for cutting curves in materials
server	A computer or computer program that manages access to a centralized

	resource or service in a network.
specifications	A detailed description of the design and materials used to make something.
square	Making cuts in materials at precisely 90 degrees
strength tester	A device for testing the fatigue of materials or projects
striking	A tool used to hit materials
sublimation	The process of an ink going from solid to gas in material to transfer a design into fabric
technical drawing	The practice or skill of delineating objects in a precise way using certain techniques of draftsmanship, as employed in architecture or engineering.
technology	The application of scientific knowledge for practical purposes, esp. in industry: "computer technology"; "recycling technologies
template	A shaped piece of metal, wood, card, plastic, or other material used as a pattern for processes such as cutting out, shaping, or drilling.
tools	Any device to aide in manufacturing projects
Trade-offs	Conceptual design involves a series of tradeoff decisions among significant parameters – such as operating speeds, memory size, power, and I/O bandwidths – to obtain a compromise design which best meets the performance requirements.
Try-square	A try square is a woodworking or a metal working tool used for marking and measuring a piece of wood.
troubleshoot	The processing of methodically figuring out what is wrong in a system
T-square	Device for drawing parallel and perpendicular lines in drafting.
turning	Using a lathe to shape material
vise	Device for holding material to free up the hands
voltage	An electromotive force or potential difference expressed in volts
working plan	Plan used to start the manufacture of a design but may need to change to overcome manufacturing problems.
working sketch	A preliminary drawing to get an idea on paper but more than likely changes will be needed.