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STEL Benchmark Verb Alignment to Cognitive, Affective, and Psychomotor Domains

Curriculum developers and classroom teachers often need to make sure they are teaching and assessing students at the appropriate levels of the cognitive, affective, and psychomotor domains. The STEL benchmarks are written with active verbs to target different levels of these domains. In addition, curriculum developers and classroom teachers want to know whether the benchmarks are at the factual, conceptual, procedural, or metacognitive level of knowledge. The second resource being provided on ITEEA's interactive STEL website will identify these factors for all 142 STEL benchmarks. This tool was developed to help insure the alignment of the three domains to the technology and engineering dimensions and to student outcomes. This relationship is depicted in the following table:

Domains of Learning	Technology & Engineering Dimensions	Student Outcomes (as defined by Benchmark verbs)
Cognitive →	Knowing & Thinking →	Knowledge
Psychomotor →	Doing →	Skills
Affective →	Knowing, Thinking, & Doing →	Dispositions

The following pages contain the information that will be available on the interactive online tool. The tables that follow contain the eight core standards, the key ideas for each standard, and a table listing the benchmarks for each standard. The table has columns for each domain and the applicable levels have been identified for each benchmark. The levels for each domain are:

Cognitive Domain (Anderson & Krathwohl, 2001)

- Remember
- Understand
- Apply
- Analyze
- Evaluate
- Create

Affective Domain (Krathwohl, Bloom, & Masia, 1964)

- Receiving
- Responding
- Valuing
- Organization
- Characterization by Valuing

Psychomotor Domain (Bixler, 2011)

- Observing
- Imitating
- Practicing
- Adapting

Levels of Knowledge

- Factual
- Conceptual
- Procedural
- Metacognitive

References

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Standard 1: Nature and Characteristics of Technology and Engineering

Key Ideas: The study of technology and engineering requires knowledge of the natural world and the human-made world.
The study of technology and engineering as a human activity is interdisciplinary.
The study of technology and engineering involves the ability to understand, use, assess, and create products, systems, and ways of thinking.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Compare the natural world and human-made world.	Evaluate				
	B	Explain the tools and techniques that people use to help them do things.	Understand				
	C	Demonstrate that creating can be done by anyone.	Understand				Conceptual
	D	Discuss the roles of scientists, engineers, technologists, and others who work with technology.	Understand	Responding			
3-5	E	Compare how things found in nature differ from things that are human-made, noting differences and similarities in how they are produced and used.	Evaluate				
	F	Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation.	Understand				
	G	Differentiate between the role of scientists, engineers, technologists, and others in creating and maintaining technological systems.	Analyze				
	H	Design solutions by safely using tools, materials, and skills.			Practicing		
	I	Explain how solutions to problems are shaped by economic, political, and cultural forces.	Understand				
6-8	J	Develop innovative products and systems that solve problems and extend capabilities based on individual or collective needs and wants.	Create		Adapting		
	K	Compare and contrast the contributions of science, engineering, mathematics and technology in the development of technological systems.	Analyze				
	L	Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations.	Understand				
	M	Apply creative problem-solving strategies to the improvement of existing devices or processes or the development of new approaches.			Practicing		
9-12	N	Explain how the world around them guides technological development and engineering design.	Understand				
	O	Assess how similarities and differences among scientific, mathematics, engineering, and technological knowledge and skills contributed to the design of a product or system.	Evaluate	Responding			
	P	Analyze the rate of technological development and predict future diffusion and adoption of new technologies.	Evaluate	Responding			
	Q	Conduct research to inform intentional inventions and innovations that address specific needs and wants.	Analyze		Practicing		
	R	Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.	Create		Practicing		

Standard 2: Core Concepts of Technology and Engineering

Key Ideas: Habits of mind are traits that, taken together, describe the ways that people think and act within technology and engineering.
A system is a group of interrelated components designed collectively to achieve a desired goal.
Basic technology and engineering resources (or inputs) include tools and machines, materials, capital, money, knowledge, energy, time, and, most importantly, people.
Requirements are the expected outcomes of a completed product or system and present the designer with limitations, criteria, constraints, and opportunities during the development process.
Trade-offs encompass a choice or exchange for one quality (or requirement) over another.
Optimization is a process or methodology of designing or making a product, process, or system to the point at which it is the most fully functional and effective.
A process is a systematic sequence of actions used to produce an output.
Controls are the mechanisms or activities that apply information to cause systems to behave in desired ways.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Illustrate how systems have parts or components that work together to accomplish a goal.	Apply				
	B	Safely use tools to complete tasks.			Practicing		
	C	Explain that materials are selected for use because they possess desirable properties and characteristics.	Understand				
	D	Develop a plan in order to complete a task.	Create				
	E	Collaborate effectively as a member of a team.		Responding			
3-5	F	Describe how a subsystem is a system that operates as a part of another, larger system.	Understand				
	G	Illustrate how, when parts of a system are missing, it may not work as planned.	Analyze				
	H	Identify the resources needed to get a technical job done, such as people, materials, capital, tools, machines, knowledge, energy, and time.	Remember				
	I	Describe the properties of different materials.	Understand				
	J	Demonstrate how tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.	Apply		Practicing		
	K	Describe requirements of designing or making a product or system.	Understand				
	L	Create a new product that improves someone's life.	Create		Practicing		
6-8	M	Differentiate between inputs, processes, outputs, and feedback in technological systems.	Analyze	Receiving			
	N	Illustrate how systems thinking involves considering relationships between every part as well as how the system interacts with the environment in which it is used.	Apply				
	O	Create an open-loop system that has no feedback path and requires human intervention.	Create		Imitating		
	P	Create a closed-loop system that has a feedback path and requires no human intervention.	Create		Imitating		
	Q	Predict outcomes of a future product or system at the beginning of the design process.	Analyze	Responding			
	R	Compare how different technologies involve different sets of processes.	Analyze				
	S	Defend findings related to a design problem.		Valuing			
9-12	T	Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.	Apply		Adapting		
	U	Diagnose a flawed system embedded within a larger technological, social, or environmental system	Evaluate		Imitating		
	V	Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.	Analyze		Practicing		
	W	Select resources that involve tradeoffs between competing values, such as availability, cost, desirability, and waste while solving problems.	Apply	Responding			
	X	Cite examples of the criteria and constraints of a product or system and how they affect final design.	Understand				
	Y	Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.	Apply		Practicing		
	Z	Use management processes in planning, organizing, and controlling work.	Apply		Imitating		

Standard 3: Integration of knowledge, technologies, and practices from other content areas.

Key Ideas: Technology and engineering are interdisciplinary, relating to more than one content area.
Technology and engineering impact, and are impacted by, technology transfer with other fields.
Technology and engineering knowledge and practices advance and are advanced by other fields.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Apply concepts and skills from technology and engineering activities that reinforce concepts and skills across multiple content areas	Apply		Imitating		
3-5	B	Draw connections between technology and human experiences.	Evaluate	Organization			
	C	Demonstrate how simple technologies are often combined to form more complex systems.	Apply				
	D	Explain how various relationships can exist between technology and engineering and other content areas.	Analyze	Valuing			
6-8	E	Analyze how different technological systems often interact with economic, environmental, and social systems	Analyze	Responding			
	F	Apply a product, system, or process developed for one setting to another setting.	Apply		Practicing		
	G	Explain how knowledge gained from other content areas affects the development of technological products and systems.	Understand				
9-12	H	Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose.	Analyze	Responding			
	I	Evaluate how technology enhances opportunities for new products and services through globalization.	Evaluate	Responding			
	J	Connect technological progress to the advancement of other areas of knowledge, and vice versa.		Organization			

Standard 4: Impacts of Technology on Humans, Society, and the Environment

Key Ideas: Technology and engineering have both positive and negative impacts on society and the environment.
Decisions made about technology and engineering involve consideration of costs, benefits, and trade-offs.
Responsible creation and use of technology requires the sustainable use of renewable and non-renewable resources and handling of waste.
Use of technology can lead to fundamental changes in individuals, in human cultures, and in the environment.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Explain ways that technology helps with everyday tasks.	Understand				
	B	Illustrate helpful and harmful effects of technology.	Apply				
	C	Compare simple technologies to evaluate their impacts.	Evaluate	Organization			
	D	Select ways to reduce, reuse, and recycle resources in daily life.	Evaluate		Imitating		
	E	Design new technologies that could improve their daily lives.	Create		Adapting		
3-5	F	Describe the helpful and harmful effects of technology.	Understand	Valuing			
	G	Judge technologies to determine the best one to use to complete a given task or meet a need.	Analyze	Organization			
	H	Classify resources used to create technologies as either renewable or non-renewable.		Organization			
	I	Explain why responsible use of technology requires sustainable management of resources.	Understand				
	J	Predict how certain aspects of their daily lives would be different without given technologies.	Analyze				
6-8	K	Examine the ways that technology can have both positive and negative effects at thesame time.		Responding			
	L	Analyze how the creation and use of technologies consumes renewable and non-renewable resources and creates waste.	Analyze	Responding			
	M	Devise strategies for reducing, reusing, and recycling waste caused from the creation and use of technology.		Organization	Imitating		
	N	Analyze examples of technologies that have changed the way people think, interact,and communicate.	Analyze	Responding			
	O	Hypothesize what alternative outcomes (individual, cultural, and/or environmental) might have resulted had a different technological solution been selected.	Create	Responding			
9-12	P	Evaluate ways that technology can impact individuals, society, and the environment.	Evaluate	Responding			
	Q	Critique whether existing and proposed technologies use resources sustainably.	Evaluate				
	R	Assess a technology that minimizes resource use and resulting waste to achieve a goal.	Evaluate	Responding			
	S	Develop a solution to a technological problem that has the least negative environmental and social impact	Create		Practicing		
	T	Evaluate how technologies alter human health and capabilities.	Evaluate	Responding			

Standard 5: Influence of Society on Technological Development

Key Ideas: The needs and wants of society often shape technology and engineering more than individual needs and wants.
The values and beliefs of societies shape attitudes toward technology.
Societies are at different stages of development which affects the diffusion of technological innovation.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Explain the needs and wants of individuals and societies.	Understand				
	B	Explore how technologies are developed to meet individual and societal needs and wants.	Analyze				
	C	Investigate the use of technologies in the home and community.	Analyze	Responding			
3-5	D	Determine factors that influence changes in a society's technological systems or infrastructure.	Analyze				
	E	Explain how technologies are developed or adapted when individual or societal needs and wants change.	Understand				
6-8	F	Analyze how an invention or innovation was influenced by its historical context.	Analyze	Responding			
	G	Evaluate trade-offs based on various perspectives as part of a decision process that recognizes the need for careful compromises among competing factors.	Evaluate	Responding			
9-12	H	Evaluate a technological innovation that arose from a specific society's unique need or want.	Evaluate	Responding			
	I	Evaluate a technological innovation that was met with societal resistance impacting its development.	Evaluate	Responding			
	J	Design an appropriate technology for use in a different culture.	Create		Practicing		

Standard 6: History of Technology

Key Ideas: Technological knowledge accelerated along with other fields of endeavor during the Renaissance.
Historical eras are often defined by technological advancements.
The history of technology chronicles positive and negative aspects of humanity.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Discuss how the way people live and work has changed throughout history because of technology.	Understand	Responding			
3-5	B	Create representations of the tools people made, how they cultivated to provide food, made clothing, and built shelters to protect themselves.	Create		Imitating		
	C	Compare various technologies and how they have contributed to human progress.	Analyze	Organization			
6-8	D	Engage in a research and development processs to simulate how inventions and innovations have evolved through systematic tests and refinements.	Create		Practicing		
	E	Verify how specialization of function has been at the heart of many technological improvements.		Characterization			
9-12	F	Relate how technological development has been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.	Apply	Receiving			Conceptual
	G	Verify that the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools, materials, and processes.		Characterization			
	H	Evaluate how technology has been a powerful force in reshaping the social, cultural, political, and economic landscapes throughout history.	Evaluate	Organization			
	I	Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.	Analyze	Responding			
	J	Investigate the widespread changes that have resulted from the Information Age, which has placed emphasis on the processing and exchange of information.	Evaluate	Receiving			

Standard 7: Design in Technology and Engineering Education

Key Ideas: Design is a fundamental human activity.
There is often no single, correct solution in technology and engineering design; furthermore, designs can always be improved and refined.
Design in technology and engineering is iterative.
There is a range of skillls needed to carry out technology and engineering design.
There are universal principles and elements of design.
Making is an inherent part of technology and engineering design.
Design optimization is governed by criteria and constraints.
There are many approaches to design.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Apply design concepts, principals, and processes through play and exploration.	Apply				
	B	Demonstrate that designs have requirements.	Apply				
	C	Explain that design is a response to wants and needs.	Understand				
	D	Discuss that all designs have different characteristics that can be described.	Understand		Observing		
	E	Illustrate that there are different solutions to a design and that none are perfect.	Apply				
	F	Differentiate essential skills of the technology and engineering design process.	Analyze	Organization			
	G	Apply skills necessary for making in design.	Apply		Imitating		
3-5	H	Illustrate that there are multiple approaches to design.	Apply				
	I	Apply the technology and engineering design process.	Apply		Imitating		
	J	Evaluate designs using criteria, constraints, and standards.	Evaluate	Responding			
	K	Interpret how good design improves the human condition.	Analyze	Valuing			
	L	Apply universal principles and elements of design.	Apply		Practicing		
	M	Evaluate the strengths and weaknesses of existing design solutions, including their own solutions.	Evaluate				
	N	Practice successful design skills.	Apply		Practicing		
	O	Apply tools, techniques, and materials in a safe manner as part of the design process.	Apply		Adapting		
6-8	P	Illustrate the benefits and opportunities associated with different approaches to design.	Apply				
	Q	Apply the technology and engineering design process.	Apply		Practicing		
	R	Refine design solutions to address criteria and constraints.	Create		Adapting		
	S	Create solutions to problems by identifying and applying human factors in design.	Create		Practicing		
	T	Assess design quality based upon established principles and elements of design.	Evaluate	Responding			
	U	Evaluate the strengths and weaknesses of different design solutions.	Evaluate	Responding			
	V	Improve essential skills necessary to successfully design.	Evaluate		Practicing		
9-12	W	Determine the best approach by evaluating the purpose of the design.	Analyze				
	X	Document trade-offs of the technology and engineering design process to produce the optimal design.		Organization			
	Y	Optimize a design using desired qualities within criteria and constraints.	Analyze		Adapting		
	Z	Evaluate principles of human-centered design.	Evaluate		Adapting		
	AA	Illustrate principles and elements of design.	Evaluate				
	BB	Implement the best possible solution to a design.	Create	Valuing			
	CC	Apply a broad range of design skills to their design process.	Apply		Practicing		
	DD	Apply a broad range of making skills to their design process.	Apply		Practicing		

Standard 8: Applying, Maintaining, and Assessing Technological Products and Systems

Key Ideas: Technologically literate people are better equipped to learn and use technological products and systems than those individuals who lack prior technological experience. Maintenance of a technological product, system, or process is crucial to keeping it in proper working order, and when malfunctions do occur, appropriate repair is necessary. People should gather, synthesize, and analyze information before drawing conclusions when assessing a technological product, system, or process.

Band	Benchmark		Cognitive	Affective	Psychomotor		Knowledge Dimension
P-2	A	Analyze how things work.	Analyze		Observing		
	B	Identify and use everyday symbols.	Remember	Responding	Observing		
	C	Describe qualities of everyday products.	Understand	Receiving			
3-5	D	Follow directions to complete a technological task.			Imitating		
	E	Use appropriate symbols, numbers, and words to communicate key ideas about technological products and systems.	Apply		Practicing		
	F	Identify why a product or system is not working properly.	Analyze				
	G	Examine information to assess the trade-offs of using a product or system.	Analyze	Responding			
	H	Research information from various sources to use and maintain technological products or systems.	Analyze	Responding			
6-8	I	Use tools, materials, and machines to safely diagnose, adjust, and repair systems.			Adapting		
	J	Use devices to control technological systems.			Practicing		
	K	Design methods to gather data about technological systems.		Responding	Practicing		
	L	Interpret the accuracy of information collected.	Evaluate				
	M	Use instruments to gather data on the performance of everyday products.	Apply		Practicing		
	N	Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.	Apply		Practicing		
9-12	O	Develop a device or system for the marketplace.	Analyze	Responding	Practicing		
	P	Apply appropriate methods to diagnose, adjust, and repair systems to ensure precise, safe and proper functionality.	Apply		Imitating		
	Q	Synthesize data and analyze trends to make decisions about technological products, systems, or processes.	Create	Responding	Observing		
	R	Interpret the results of a technology assessment to guide policy development.	Apply	Valuing	Practicing		