FIRST® Technical Learning Progression Summary

The table below outlines the scaffolding of student learning that occurs when students participate in *FIRST*® programs. Whether a student progresses through the various programs or experiences only one, these progressions demonstrate the age-appropriate outcomes, knowledge, and skills students learn as part of a *FIRST* program in technical and STEM (science, technology, engineering, and math) skills. Technical and STEM skills include the engineering design process, computer science, and STEM topics.

SKILL	FIRST LEGO League DISCOVER GRADES • PreK - 1	FIRST LEGO League EXPLORE GRADES • 2-4	FIRST LEGO League CHALLENGE GRADES • 4-8	FIRST Tech Challenge GRADES • 7-12	FIRST Robotics Competition GRADES • 9-12
Engineering Design Process	Explore, create, and share	Explore, create, test, and share	Identify, design, create, iterate, communicate	Understanding complex problems with complex strategies, time constraints, and budgets. Developing criteria and constrains to meet the problem. Using iteration to optimize a design solution, through real-world testing. Defending design process and strategies through presentations	Understanding complex problems with complex strategies, time constraints, and budgets. Developing criteria and constrains to meet the problem. Using iteration to optimize a design solution, through real-world testing. Defending design process and strategies through presentations
Design and Prototyping	Sketching, diagrams, and simple models	Sketching, diagrams, and simple models	Sketching, diagrams, and simple models; Computer-Aided Design (CAD), Tinkercad, SketchUp, AutoCAD, Inventor, 3D printing	Technical drawing, Computer-Aided Design (CAD), 3D printing, and other rapid prototyping techniques Industry tools from OnShape, a PTC company, SOLIDWORKS, and Autodesk CAD	Technical drawing, Computer-Aided Design (CAD), 3D printing, and other rapid prototyping techniques Industry tools from OnShape, a PTC company, SOLIDWORKS, and Autodesk CAD
Technical Reading and Writing	Early STEM language and skill acquisition Handwriting and drawing	STEM word recognition and use in team presentation	Research, sourcing, data analysis, and presentation of innovative STEM topics	Comprehension and creation of technical documentation	Comprehension and creation of technical documentation
Mechatronics				Engineering skills including applied physics to a robot design and making design choices based upon the physics behind the design. Mechanical assembly, control system, microprocessors, electronic circuits, fabrication, power systems. Machine and robotic sensors	Engineering skills including applied physics to a robot design and making design choices based upon the physics behind the design. Mechanical assembly, control system, part fabrication, power systems, advanced fabrication. Machine and robotic sensors
Computational Thinking/ Programming	Pattern recognition and sequence events	Block/Icon-based programming, computational thinking: algorithmic thinking and decomposition	Computational thinking, complex programs using variables to create specific robot behaviors in Scratch, block-based languages, or Python	Computational thinking, graphic-based programming and object-oriented programming, app development, robot behaviors controlled with state machines	Computational thinking, object-oriented programming with Java, C++, LabVIEW, and robot behaviors controlled with state machines
Machine Learning and AI		Early coding skills	Programming using robot sensors	Machine vision and machine learning using TensorFlow and Vuforia	Machine vision and machine learning using TensorFlow
Manufacturing and Fabrication				Measurement, parts fabrication, quality assurance control, and use of tools	Machining tools, measurement, technical instructions, planning, quality assurance control, and workplace safety
Business			Leadership, project management, innovation, and entrepreneurship	Leadership, project management, innovation, entrepreneurship, video production, graphic design, and business communication	Leadership, project management, innovation, entrepreneurship, video production, graphic design, and business communication

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