SIPP Summer Orientation Curriculum

Executive Summary:

The SIPP Summer Orientation official begins a student's journey through the Spectrum Innovates Pathway Program.

The Spectrum Innovates Pathway Program (SIPP) is a 12–month transition program for young adults on the autism spectrum as they navigate the path to college, employment and adult life and share an interest in aeronautics, aviation, engineering or technology.

Spectrum Innovates Pathway Program integrates academic, social-emotional, and life skills learning in an engaging, highly dynamic and supportive environment: the Innovation Hub. Course concepts and instruction are made relevant, absorbed and reinforced through this experiential, project-based approach. Skills such as goal-oriented thinking, problem solving, self-advocacy, self-regulation, perspective taking, collaboration and communication emerge and are utilized as a natural consequence of engaging in work in the Innovation Hub.

Students successfully completing the program receive a certificate, 13 college credits and fast–track admission to Vaughn College and the myriad career programs they offer. Vaughn provides students, who complete Vaughn's programs, extensive career placement assistance. Alternatively, students may apply to other institutions or pursue entry positions in the workforce.

Development of SIPP is funded in part by an Advanced Technological Education grant from the National Science Foundation. For more information on the program visit https://www.spectruminnovates.org/Admissions.

This 6 week program is designed to develop a broad skill set designed to be a foundation for their year-long project based educational journey partnered with Vaughn. Skills include basic workshop safety and knowledge, a broad knowledge of materials used in aviation, machining, computer programing and mechatronics.

The Summer Program has three core modules: a computer programming and electronics module, a manufacture and workforce module and the SEL (social-emotional learning) modules. The SEL module has two sessions per day, one in the morning and late in the afternoon*, with SEL check-ins throughout the day.* The computer and electronics module and maker shop skills module are 3 hour workshops, one in the morning and one in the afternoon.
The SIPP program has 20 students. The program is split into two cohorts of 10 students each.
A typical daily schedule:

	Cohort A	Cohort B
Morning: 8:30am to 9:00am	SEL	SEL
9:00am to 12:00pm	Computer Programming	Maker Shop Skills
12:00pm to 12:30pm	Lunch	Lunch
12:30pm to 3:30pm	Maker Shop Skills	Computer Programming
3:30pm to 4:00pm	SEL	SEL
4:00pm to 5:00pm	Social/Flex Time	Social/Flex Time

Manufacturing & Workforce Skills Module

Framework: The Manufacturing and Workforce Skills module develops foundational skills through a maker's perspective. Making, as defined by _____, is the exploration of materials, techniques and mindset centered around passion-driven projects. The Summer Orientation in the Innovation Hub explicitly matches passion projects with certain manufacturing skills and techniques to make the connection for the learner between exploration and the workforce. Students begin the summer session with a safety orientation and an exploration with computer-aided design software. Early projects include cardboard prototypes with basic linkages and mechanisms. Once students master the basics of CAD, additive and subtractive manufacturing techniques and tools are explored, such as 3D printing, plasma and laser cutting, metal machining and more. Composites and casting techniques are explored in later weeks. Finally, students utilize their skills to manufacture the chassis of a small robot or robotic arm.

Timeline:

Week 1:

Day 1: Safety
Cardboard Design
Day 2: CAD, Sketch/Extrude
Day 3: CAD, Assembly, Mates/Joints
Day 4: CAD Design Prompt
Day 5: Additive Manufacture, 3D Printing

Week 2:

- Day 1: CAD, Technical Drawings
- Day 2: CAD, Practice Parts
- Day 3: 3D Scanning
- Day 4: CAD Design Prompt #2, Optimizing Prints
- Day 5: 3D Printing Tests

Week 3:

- Day 1: Subtractive Manufacture (Laser/Plasma, GCode)
- Day 2: Plasma Visit
- Day 3: Sheet Metal Tools, Cardboard Challenge #2
- Day 4: Sheet Metal in CAD, Raspberry Pi Case Design
- Day 5: Laser/Plasma Production Day

Week 4:

- Day 1: Maker Materials (Wood, Cardboard, Textiles, Metal, Fiberglass, Epoxy, Carbon Fiber)
- Day 2: Casting With Molds
- Day 3: Vacuum Forming Plastics w/ Desktop Thermoformer
- Day 4: Laser Cut Gears with Delrin; CAD Design Prompt #3
- Day 5: Cast/Vacuum Forming/Laser Production Day

Week 5:

- Day 1: Basic CNC Safety & Terms
- Day 2: CNC Part Design & CAM Set Up
- Day 3: CNC Mill Set Up, Mill Part #1
- Day 4: CNC Part #2 Design & CAM Set Up
- Day 5: CNC Mill Set Up, Mill Part #2

Week 6:

- Day 1: CNC Part #3 Design & CAM Set Up
- Day 2: CNC Mill Set Up, Mill Part #3
- Day 3-6: Smart Car Chassis Design & Robot Arm Design

Week 1: Prototyping 101 & CAD 101

Topics:

- Basic Workshop Safety
- Basic Workshop Tool Use (Hand Tools, Powered Hand Tools, Woodworking Equipment)
- Intro to Solidworks/Fusion 360 Parametric CAD
- Intro to Part Design
- Intro to Assembly
- Intro to 2D Drawings
- 3D Printing
    - Materials
    - Use-Cases
    - Design Techniques
    - SLA

Suggested Project: Cardboard/Plywood Furniture, Design Centered Problems

Week 2: Composites & Materials, CAD 102

Topics:

Basic Material Science

- Wood
- Metals
- Carbon Fiber
- Plastics

Basic CNC Router

Basic Laser

Intermediate Parametric CAD

Rendering Visuals

In-Depth Part Design

In-Depth Assembly

In-Depth Detailed Drawings

Suggested Project: Drone Frames, Arduino Project Enclosures, Curved Wing Models, Molded Seats, Molded Cosplay projects, Controller, CAD Project

Week 3: CNC Mill

Topics:

Basic Mill/Lathe Safety

Workholding

Measuring

Feeds/Speeds

Drilling/Boring

Conventional/Climb Milling

End Mills

CAM

- Adaptive Clearing,
- Pocket, Contours,
- Finishing Techniques

Suggested Project: Titans of CNC; Junkyard Downhill Racer; Project Enclosures, materials: aluminum, plastics. Bucks for vacuum forming next topics, Challenge Coin Design

Week 4, 5, 6: Robotics

Topics

Design Process

Basic Sheet Metal Construction in CAD

Casting & Mold making

Vacuum-Forming

Testbed with Arduino (ShieldBot)

- Introduction
- Unpack and Identify Parts
- Install Programming Software
- Basic Hardware Test
- Test Digital Outputs
- Test Servomotor Outputs
- Camera Test
- Final Check

Open-Loop Navigation with Arduino (ShieldBot)

- Introduction
- Gather Parts
- Build Robot: Mobility Subsystem
- Build Robot: Power Subsystem
- Build Robot: Control Subsystem
- Test Drive Motors
- Drive Forward
- Move then Turn
- Making Improvements

Camera Integration with Arduino (ShieldBot)

- Introduction
- Check Testing Area
- Add Camera to ShieldBot
- Configure Signatures
- Understanding Blob Data
- Blob Test Program and Reference Values
- Integration Test
- Hardware Conflicts Part 1
- Hardware Conflicts Part 2
- Program Configuration: LED Status Lights
- Program Configuration: The Approach
- Program Configuration: The Centering
- Challenge: Parking Stall Test Track

Project: Parrallax ShieldBot; Crane/RoboGripper, Shark Tank Pitch Project: develop a electronic device/machine in Hackathon, junkyard racer (develop electronic readings and ratings for racer), flight simulator

Suggested Project: Junkyard Downhill Racer, Aero/recumbent bicycle build, Bottle Flipping Robot

Computer Programming Module

The Computer Programming Module teaches students to code in a project-based learning environment. Students will be introduced to initial concepts and skills, and then develop their own understanding and skills by working for extended periods of time investigating and responding to authentic problems and challenges.

Week 1: Intro to Microcontrollers and the CPX

Objectives:

Overview of the course:

imagine, envision, create, innovate, play, formatively learn, experiment, collaborate, share, and most of all dream of possibilities.

Intro to how computers and Microcontrollers work

Intro to Circuit Playground Express microcontroller

Programming: Learn Makecode / Javascript

- Explore inputs and Outputs
- Explore Blocks
- Write Code

Week 2 : CPX Project work

Project 1 Objectives:

Synthesize concepts and skills of CPX/Makecode in a project

Design Process: Brainstorm, Plan and Design

Project 2 Objectives:

Learn to program radio communication between two CPX's

Activity - guess other people's numbers..

Week 3 : Intro to Arduino (microcontroller and programming environment)

Objectives:

Intro to Arduino microcontroller and programming language

Learn about arduino circuits

Learn structure of Arduino code -

Code sensors and outputs

Getting started activities to work with sensors and outputs (LEDS, motors, sound))

Beginning Arduino Projects

Week 4 : Arduino Weather Station

Objectives:

Basic Understanding of instruments used in a weather Station

Data Collection - professional weather stations v homemade ones - what data can be collected with arduino?

Plan, design, build, program weather station

Analyze Data

Week 5: Arduino Autonomous Smart Cars

Objectives:

Use arduino concepts, skills, and knowledge to make an autonomous car that senses its environment

Design Process: Brainstorm, Plan and Design

Use Maker skills to build car

Week 6: Final Project

Objectives:

Passion Project - Integration with Electronics & 3D Printing

SEL Module

The Social Emotional Learning and Life Skills summer module consists of a basic introduction of concepts and skills that will be practiced and revisited throughout the entire year of SIPP. These concepts will be taught using videos, short presentations, and more. The concepts will then be practiced as skills through free-standing SEL time blocks of role play, short activities, and reflections. The concepts will be integrated and the skills practiced within the Computer Programming module and Maker Shop module, as well.

SEL Standards

Week 1: Intro to SEL and Core Concepts

Objectives:

- Learners share interests
- Transition Expectations
- SEL Standards & Benchmarks
- Environment Expectations and schedule
- Thoughts, feelings, & behaviors
- Growth Mindset vs. Fixed Mindset (feedback & asking for help included)
- Self-efficacy, self-worth, self-esteem

Week 2: Relationship skills and Self-management

Objectives:

- Personal and professional life

Building and identifying a support network

Supporting adults/mentors and peers

Support Needs (Activities of Daily Living, Instrumental ADL, Spoons Theory/Energy Meter)

Self-Care and Energy Management Strategies

Week 3: Self-awareness

Objectives:

Identifying one's strengths

Identifying one's growth areas

Basics of goal setting (short-term and long-term goals) - The ACT Matrix, values

Setting own short-term and long-term goals

Week 4-5: Self-management - Executive Functioning

Objectives:

Attention

Working memory

Verbal reasoning

Cognitive Flexibility (flexible thinking)

Planning

Organization

Self (inhibitory) control

Metacognition (awareness of your thoughts)

Task Initiation

Monitoring Tasks

Problem Solving

Week 6: Relationship Skills and Communication

Objectives:

Communication Skills 101

Listening - Empathy & Perspective-taking: Active listening

Speaking - Sharing thoughts, feelings, and opinions; adapting communication style to audience

Group Activity skills

Objectives: SEL, Maker, Computer Sciences

Wk	Objectives	SEL	Maker	Computer Science
1	**B - Technical Skills** **D - Critical Thinking** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values** **1.Self-Awareness** **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	1, 2, 3, 4, 5, D, F, I - environment (Inn. hub) & yearly SEL expectations, basic intro concept of thoughts, feelings, behaviors, values, growth mindset (asking for help & feedback), self-efficacy, self-worth, self-esteem	Basic competency with maker tools, understand safe usage, safe work practices and shop awareness Basic competency with CAD - use of Sketch and Solid tools	B. D. E.1, 2, 3, Basic understanding of microcontrollers, specific understanding of the CPX Basic competency in programming in MakeCode and debugging skills Basic understanding of

				inputs/outputs/analog/digital
2	**B - Technical Skills** **D - Critical Thinking** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values** **1.Self-Awareness** **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	1, 2, 4, F - Balancing personal & professional life, how to build support network, supportive professional life (mentors & peers), support needs, basics of self-care/energy management strategies	Intermediate competency with CAD Intermediate competency with 3D Printing Understanding of different materials and their properties	B, D, E, 1, 2, 4, 5 Synthesize concepts and skills - demonstrate/ knowledge of CPX into project Brainstorm, Design, Plan and execute a project Basic understanding of programming radio communication and engage in interaction with classmates
3	**B - Technical Skills** **D - Critical Thinking** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values** **1.Self-Awareness** **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	1, 2, I - identifying one's strengths, growth areas, basics of goal setting (The ACT Matrix), setting own short-term and long-term goals	Demonstrates technical ability with laser cutter - safe work practices, acceptable work practices, independent use of tool	B, D, E, 1, 2, Basic understanding of the arduino microcontroller and circuits Basic competency writing arduino code (starting from example files) Conditional statements, functions, variables Basic competency in debugging skills - and understanding the difference between syntax and logic errors Build capacity to use online resources to direct independent

				learning
4	**B - Technical Skills** **D - Critical Thinking** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values** **1.Self-Awareness** **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	1, 2, 5, D - basics of executive functioning & strategies for EF success = components: attention, working memory, verbal reasoning, mental flexibility, planning, organization, self-control, awareness of thoughts, task initiation, monitoring tasks, and problem solving	Demonstrates technical ability with CNC router & benchtop mill - safe work practices, acceptable work practices, independent use of tool	B, D, E, 1, 2, 3, 5 Increasing capacity to detect and fix bugs in arduino program Demonstrates deeper level working with arduino Develop and execute project, engaging in problem solving, iterating, Demonstrates independent learning
5	**B - Technical Skill** **D - Critical Thinkings** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values** **1.Self-Awareness** **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	1, 2, 5, D - basics of executive functioning & strategies for EF success = components: attention, working memory, verbal reasoning, mental flexibility, planning, organization, self-control, awareness of thoughts, task initiation, monitoring tasks, and problem solving	Demonstrates basic understanding of robotics components Build a working chassis of a machine	Project - based learning Basic Understanding of a Weather Station Build a weather station Analyze Data
6	**B - Technical Skills** **D - Critical Thinking** **F – Diverse Perspectives** **E - Quantitative Reasoning** **I - Ethics and Values**	1, 3, 4, 5, D, F - basics of communication skills, active listening (perspective-taking	Integrate previous knowledge into novel project Develop and execute project,	Demonstrates deeper level working with arduino Develop and

	1.Self-Awareness **2.Self-Management** **3.Social Awareness** **4.Relationship Skills** **5.Responsible Decision making**	& empathy), sharing our thoughts, feelings, opinions, adapting communication style to audience, group activity skills basics	engaging in problem solving and iteration Demonstrate independent effort and learning	execute project, engaging in problem solving, iterating, Demonstrates independent learning

Appendix:

Competency-Based Assessment Tool

Competency	**Benchmarks**	**Evidence** *Portfolio, Project-Based, Evaluation, Summative, Formative, Observation*	**Rating** 0- *Not Yet Demonstrated* *1 - Emerging* *2 - Competent* *3 -Highly Competent*	**Narrative Feedback for Student** *Faculty, Mentor, Peer, Self*
Fluency using CAD software to develop working prototypes of assigned projects	*Develop CAD models of moderate complexity using a variety of sketch and modeling tools in novel ways* *Develop assemblies and sub-assembly using to defined tolerance* *Develop engineering drawings to workplace standard* *Refine CAD model, integrating feedback from multiple sources.*	*Student Work from Week 1 Project*		
Demonstrate safe use and work practices for a variety of tools.	*Demonstrates safe work practices in multiple novel environments* *Demonstrates safe tool practice for multiple tools* *Identifies and mitigates unsafe working conditions, notifies others utilizing proper*	*Student Work from Week 1 Project* *Field Observations of Week 1 to 6*		

	procedures			
Materials	*Properly selects and prepares materials based on project-specific needs* *Properly selects tools to cut, bend, heat, melt, fasten materials during project builds*	*Passion project in Week 6* *Projects in Week 2* *Sheet Metal in Week 5*		
Process	*Generate Ideas* *Devise Plans* *Build Prototype* *Develop strategies for optimizing prototypes* *Develop and complete testing of prototype for selected criteria*	*Observation through all projects* *Formative assessments during labs*		
Demonstrate ability to program microcontrollers to interact with the physical world	*Attain fundamental concepts of programming: syntax,, language, conditional statements, variables,* *Develop strategies for Debugging and troubleshooting*	*Series of projects completed using CPX and Arduino*		*Checklist /rubric*

Demonstrate ability to build working prototypes in conjunction with physical computing devices	*Devise plans* *Use tools and materials for construction* *Test* *Iterate on design / troubleshoot*	*Series of projects completed using CPX* *and* *Arduino*		
Consistently demonstrating a growth mindset during assigned projects and activities	*Embrace challenges* *Persist through setbacks* *View failures as opportunity for growth* *Maintain effort & strong work ethic* *Learn when to ask for help* *Take inspiration from the setbacks of others*	*Week 1: end of week check-in, reflection* *Continually evaluated at end of week check-ins*		*Checklist/rubric*
Consistently aware of one's thoughts, feelings, behavior, energy levels, and support needs to reflect on one's experiences and learning progress	*-Define thoughts, feelings, behavior, energy levels, and support needs* *-Bring awareness to thoughts, feelings, behavior, energy levels in past experiences* *-Bring awareness to thoughts, feelings, behavior, energy levels in current moment* *-Define, implement, and reflect on strategies for self-regulation of thoughts, feelings, behavior, energy levels, and support needs*	*Week 1: end of week check-in, reflection* *Week 2: end of week check-in* *Week 3: end of week check-in* *Continually evaluated at end of week check-ins*		

Successfully identify and build a support network and self-care plan	*-Show evidence of understanding what a support network is and its purpose* *-Identify people and the specific ways they can be in one's support network* *-Identify activities in one's support network* *-Identify regulation strategies that support overall health and decrease chances of autistic burnout* *-Identify regulation strategies that work for different situations (e.g. stimming for processing, taking breaks, etc.)* *-Implement strategies and reflect on their effectiveness* *-Build a comprehensive self-regulation arsenal*	*Week 2: end of week check-in* *Continually evaluated at end of week check-ins*		
Identify one's strengths, growth areas, and values as they contribute to goal-setting & goal-directed behavior	*-Identify one's strengths, growth areas, and values using a range of strategies (e.g. VIA, reflection, past experiences, noticing feelings, ACT Matrix, etc.)* *-Self-define goals that consider one's strengths, growth areas, and values* *-Create and follow action steps → goal-directed behavior*	*Week 3: end of week check-in* *Continually evaluated*		

Understand the basics of executive function and one's own executive function strengths, weaknesses, and strategies	*-sub-areas that make up the system of executive functioning* *-one's own executive functioning profile* *-how executive functioning impacts all different areas of life (e.g. personal hygiene, school, work, etc.)* *-Identifies, implements, and monitors progress of strategies for executive functioning success & makes changes as necessary*	*Week 4-5: end of week check-in, reflections, student work, etc.* *Continually evaluated*		
Successfully communicates and collaborates with others	*-Communicates needs, wants, information, negotiates, resolves conflict, and asks for help when needed* *-Understands giving and receiving feedback and constructive criticism* *-Develops positive relationships with supportive peers and adults* *-Participates in group/team activities using teamwork and collaborative problem-solving*	*Week 6: end of week check-in* *Continually evaluated during any group/team activities*		

Software Foundations with Arduino (ShieldBot)

Sensing with Arduino (ShieldBot)

This unit introduces students to sensors: A touch sensor (in the form of whiskers), and a Light Sensor (Phototransistor). Students will learn how to integrate the sensors with ShieldBot, and then program the robot to sense its environment. Students will learn programming concepts along the way like variables, if/else structures, incrementing, and comparators.

- Introduction
- Sending Breadboard Signals
- ShieldBot Whiskers
- Vacuum Challenge
- Phototransistors
- Nighttime Vacuum
- Counting Vacuum
- Sensing with ShieldBot Quiz

Camera Programming with Arduino (ShieldBot)

This unit takes students through using the ShieldBot Camera to store a unique image/signature that represents its parking spot. In the challenge for this unit, the robot must check over different parking spots and move into the spot only if it matches the unique signature.

- Introduction
- Mini-Project: Matching a Signature
- Challenge: Unique Parking Stall
- Camera Programming Quiz
- Post-Course Survey

Machine Vision

Learn how Machine Vision can be integrated into robotics systems to automatically perform tasks such as image detection and quality control.

- Introduction
- Networked Vision Sensor Part 1
- Configure Signatures
- Understanding Blob Data
- Networked Vision Sensor Part 2
- Machine Vision
- Quality Control Simulator
- Quality Control Simulator Level 2
- Quality Control Challenge
- Collect Your Thoughts

SUMMER I Maker Schedule Version IV

Week 1:

Day 1: Safety
Cardboard Design
Day 2: CAD, Sketch/Extrude
Day 3: CAD, Assembly, Mates/Joints
Day 4: CAD Design Prompt
Day 5: Additive Manufacture, 3D Printing

Week 2:

Day 1: CAD, Technical Drawings
Day 2: CAD, Practice Parts
Day 3: 3D Scanning
Day 4: CAD Design Prompt #2, Optimizing Prints
Day 5: 3D Printing Tests

Week 3:

Day 1: Subtractive Manufacture (Laser/Plasma, GCode)
Day 2: Plasma Visit
Day 3: Sheet Metal Tools, Cardboard Challenge #2
Day 4: Sheet Metal in CAD, Raspberry Pi Case Design
Day 5: Laser/Plasma Production Day

Week 4:

Day 1: Maker Materials (Wood, Cardboard, Textiles, Metal, Fiberglass, Epoxy, Carbon Fiber)
Day 2: Casting With Molds
Day 3: Vacuum Forming Plastics

Day 4: Laser Cut Gears with Delrin; CAD Design Prompt #3
Day 5: Cast/Vacuum Forming/Laser Production Day

Week 5:

Day 1: Basic CNC Safety & Terms
Day 2: CNC Part Design & CAM Set Up
Day 3: CNC Mill Set Up, Mill Part #1
Day 4: CNC Part #2 Design & CAM Set Up
Day 5: CNC Mill Set Up, Mill Part #2

Week 6:

Day 1: CNC Part #3 Design & CAM Set Up
Day 2: CNC Mill Set Up, Mill Part #3
Day 3-6: Smart Car Chassis Design & Robot Arm Design

Spectrum Innovates
Spectrum Innovates Program
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Spectrum Innovates Pathway Program at Vaughn College