November 2025, Version 1.0

# STEAM TOOLKIT

## (SCIENCE, TECHNOLOGY, ENGINEERING, ARTS, MATH)

Improving Access to STEAM Learning
as Part of a Well-Rounded Education

OREGON DEPARTMENT OF EDUCATION

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*“Education is not preparation for life; education is life itself.”*

-John Dewey

Our world and the education landscape are changing before our eyes, and we are tasked with educating our youth for a future that may look very different from our current reality. To keep up with this pace of change, students will benefit from deep learning experiences that center on solving problems and developing critical thinking skills. There are many ways educators and education leaders can approach this process, including centering educational practices, classrooms, and student experiences in STEAM learning opportunities. The acronym STEAM has many different definitions across educational spaces and means different things to different people. Most basically, STEAM stands for Science, Technology, Engineering, Arts, and Math, focusing on the importance of including multiple content areas within a well-rounded education. However, STEAM also goes beyond teaching individual content areas by emphasizing inquiry and problem-solving that explores the natural interconnectedness embedded within projects and work throughout a student’s entire lifetime. For the purposes of creating a common language in the Oregon education network, in this toolkit, in general, references to “STEAM” represent the concept of “STEAM Pedagogy”, or as the National Science and Technology Council defines it, “convergence education,” incorporating teaching practices and structures that allow educators to teach multiple content areas together, similar to real-world experiences.

According to the “STE(A)M Hubs of Oregon Shared Impact 2023” report, STEAM education initiatives in Oregon have demonstrated significant benefits for students statewide. This holistic approach not only prepares students for careers in fast-paced industries like technology, computer science, and engineering, but also nurtures a well-rounded skill set essential for success in any field.

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# INTRODUCTION

## Purpose

The purpose of this resource collection is to support all schools in providing standards-aligned STEAM-based learning opportunities for students in grades K-12. Through this toolkit, educators, families, and community leaders in Oregon can explore a wealth of resources, curriculum ideas, and project-based learning resources that promote STEAM principles. By leveraging these resources, administrators, educators, and families can help increase access to and quality of student learning opportunities in our schools.

The foundations of STEAM education are built on the same priorities as the Oregon Department of Education's (ODE) Accountability Framework, which centers:

**EDUCATION ACCOUNTABILITY**
**SHARED RESPONSIBILITY. REAL RESULTS.**

- **HIGH-QUALITY LEARNING EXPERIENCES FOR ALL STUDENTS**
- **ALIGNED AND FOCUSED EDUCATIONAL SYSTEMS**
- **ENGAGED PARTNERS AND COMMUNITIES**
- **SAFE AND INCLUSIVE SCHOOLS**
- **COMMITTED AND SUPPORTED STAFF**

These priorities are woven throughout this toolkit and called out in various sections that center this alignment.

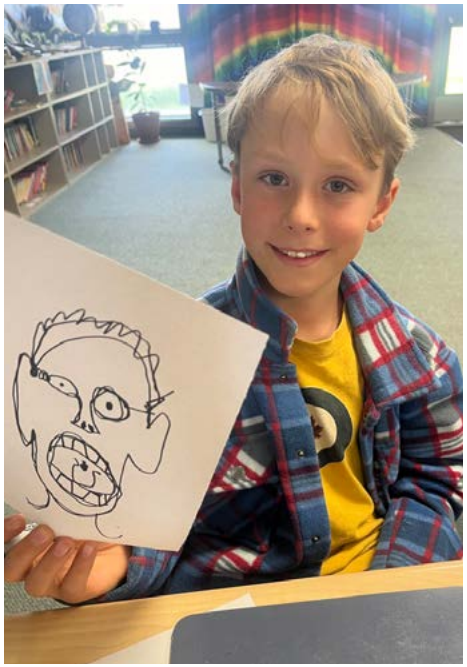
## Why STEAM?

The world of work is not separated by content area, and in our daily lives we use problem solving, creativity, and critical thinking that draw from and integrate multiple academic disciplines. When designing a building, assessing the environmental impact of a policy, or pitching a new product, we use skills from many academic domains. Incorporating STEAM practices and pedagogy transcends traditional academic boundaries between disciplines, offering a more authentic and holistic approach to education that students will utilize throughout their lives.

This toolkit differs from a "STEM" toolkit in that it emphasizes the "A" in STEAM as a critical content area to be included, above and beyond a typical STEM approach. Throughout these resources, designated "arts integration focus" sections provide targeted strategies and recommendations for embedding artistic learning into STEAM instruction—supporting deeper engagement, creative thinking, and interdisciplinary connections. This interdisciplinary approach not only prepares students with technical skills but also nurtures creativity, critical thinking, and empathy — essential qualities for navigating an increasingly interconnected and diverse society. And if done well, integrating multiple disciplines can improve learning outcomes for all of the subject areas taught.

> By authentically integrating arts and design thinking into STEM education, educators can foster a more comprehensive understanding of complex concepts, connecting them to real-world applications and cultural contexts.

- Cultivating Identity and Belonging in STEAM



## How These Resources Are Organized

These resources are grouped into programmatic, classroom, and communications resources. Although these resources can be used by a broad audience, each resource is curated with a particular purpose and audience in mind and contains links to promote further exploration and connections to related resources.

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# Programmatic Resources:

**(EDUCATION LEADERS)**

- DESIGN THINKING PLANNER FOR NEW AND EMERGING STEAM PROGRAMS

  This resource provides program, school, and district leaders with a planning document to kickstart the development of a successful STEAM program in their school.

- STEAM ACADEMIC STANDARDS AND REQUIREMENTS

  This resource clarifies content area requirements in Oregon public schools for program, school, and district leaders and educators. It provides an overview of the Oregon rules, statutes, and governing bodies and systems that inform and support the STEAM ecosystem in Oregon.

- STEAM PROGRAM APPROACHES AND MODELS

  This resource provides program, school, and district leaders an overview of education program instructional approaches that provide standards-aligned STEAM instruction, examples of the student experience through these opportunities, and an overview of models which can comprise a comprehensive program.

- STEAM PROGRAM IMPLEMENTATION RESOURCES

  This tool can be utilized by program, school, and district leaders to support implementation of new, emerging, or existing STEAM programs.

- SPACE AND EQUIPMENT NEEDS FOR STEAM PROGRAMS

  This resource provides program, school, and district leaders and educators recommendations for space and equipment for learning in various STEAM program scenarios.

- FUNDING STEAM PROGRAMS

  This resource provides program, school, and district leaders information about various funding sources available to support STEAM access in Oregon K-12 schools.

- SUPPORTING EDUCATORS AND DEEPENING STEAM PARTNERSHIPS

  This resource provides program, school, and district leaders recommendations to ensure support for educators to offer STEAM programming, considerations for collaborating with STEAM-related education organizations in schools, and paths for school staff, students, and community to collaborate in support of STEAM programs.

- SUMMER LEARNING AND STEAM

  This is a summary of how to incorporate STEAM into your summer learning programs.

- STEAM SCHOOL RUBRIC

  This rubric supports implementation and evaluation of STEAM schools.

- STEAM OER QUALITY FRAMEWORK EVALUATION TOOL

  This resource provides program, school, and district leaders and educators a framework to conduct a review of educational resources, including STEAM curriculum, to assess and ensure that it is high quality and ready for use in the classroom.

## Classroom Resources:

**(TEACHERS)**

- STEAM EDUCATION INSTRUCTIONAL PRACTICES

  This resource provides program leaders and educators information about student-centered learning and instruction in STEAM programs.

- STEAM ASSESSMENT AND GRADING PRACTICES

  This resource provides promising practices for incorporating formative and interim assessments and equitable grading practices for STEAM learning.

- STEAM INSTRUCTIONAL MATERIALS RESOURCES

  This resource provides educators with instructional materials to apply in STEAM courses and learning opportunities.

- STEAM LESSON TEMPLATE

  This resource provides more information about supporting thoughtful AI integration with STEAM.

- LITERACY AND STEAM

  This resource provides more information about supporting literacy instruction through STEAM instructional practices.

- ARTIFICIAL INTELLIGENCE (AI) AND STEAM

  This resource provides more information about supporting thoughtful AI integration with STEAM.

## Communication Resources:

**(FAMILIES AND ORGANIZATIONS)**

- COMMUNICATING THE BENEFITS OF STEAM EDUCATION

  This resource provides program, school, and district leaders, educators, and community members information about the benefits of STEAM education, data, and research on STEAM and convergence education, and examples of the ties between STEAM programs and educational equity.

- CULTIVATING IDENTITY AND BELONGING

  This resource provides more information about supporting inclusive practices and a sense of belonging in the STEAM classroom.

- STEAM LEARNING FAMILY LETTER TEMPLATE

  This tool can be utilized by educators or school leaders to communicate with families about STEAM learning opportunities.

- OREGON ARTS AND STEAM EDUCATION ORGANIZATION LOOKUP TOOL

  This tool can be utilized by school leaders or educators to connect to regionally specific arts and STEAM organizations.

- GLOSSARY AND KEY TERMS

  This document provides definitions and explanations of key terms used across the STEAM Toolkit.

- REFERENCES

  This document provides the citations for reference materials and linked resources included across the STEAM Toolkit.

# DESIGN THINKING PLANNER FOR NEW AND EMERGING STEAM PROGRAMS

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# DESIGN THINKING PLANNER FOR NEW AND EMERGING STEAM PROGRAMS

This resource provides programs, school, and district leaders with an editable planning document to kickstart the development of a successful STEAM program in their school. Grounding in the design process can help focus the program on community needs, feedback, and strategies to ensure equitable access for all students in the program.

**The design thinking process is used in many fields, including engineering and the arts, to design creative solutions. This process generally incorporates five stages: Empathize, Define, Ideate, Prototype, and Test. This process can also be used with students to incorporate STEAM principles into the learning process!**

## Community Engagement

What does your community see as the greatest assets and challenges that your learning community faces? Before deciding to implement any program, ensure effective and inclusive outreach to educators, school staff, students, and families about focal areas for your school's programming.

ODE has created a suite of community engagement tools, connected to the community engagement process for Student Investment Account (SIA) grantees. These tools include a community engagement toolkit, offering useful tools to integrate community engagement work across all kinds of programs and initiatives, including STEAM.

Additionally, the Student Investment Account site includes resources such as sample social media messages, community input session materials, and templates for communications around community engagements. Utilize these tools to center your community's priorities with your work, driving an effective STEAM program in your school or district.


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### ARTS INTEGRATION FOCUS: ART AS REFLECTIVE PRACTICE

The arts offer powerful pathways for reflection, insight, and continuous growth. Integrating artistic processes—like visual journaling, collaborative art-making, or sensory and movement-based debriefs—gives life to insightful moments and allows a STEAM development team to pause, process, and make connections to various contexts. This strengthens the outcomes of long-term planning in educational environments.

- Explore protocols such as Visual Thinking Strategies or the Center for Leadership and Educational Equity's Art Shack Protocol to support reflective practice and strengthen community connections throughout your STEAM leadership work.

# Developing a STEAM Program Using Design Thinking

Utilize this editable planner to document your thinking around STEAM program development, utilizing the stages of design thinking to support your improvement process.

## STAGE 1: EMPATHIZE — RESEARCH YOUR LEARNING COMMUNITY NEEDS

***The first stage of designing a STEAM program is to understand your learning community and its needs.***

### Empathize Stage - Guiding Questions:

- Why are you considering developing a STEAM program?
- Who is driving this change?
- Who at your school is willing to participate in this development process, and what are their collective strengths?
- Who is not at the table, and how can they be included?
- What level of involvement is reasonable for different engagement partners (students, families, educators, administrators, board members, etc.)?
- What do your students and larger community members want to develop, and what is their reasoning for these changes?

## STAGE 2: DEFINE — STATE YOUR USERS' NEEDS AND PROBLEMS

***Defining your program's needs, goals, and how to gather the data that will help you understand if you have met them is key to an effective program design process.***

### Define Stage - Guiding Questions

- What conditions need to change in your school community or program?
- What are the needs of the school community that could be met with this programmatic shift, and how do you know?
- What are some natural intersections between what a STEAM program could achieve and the larger needs of the school community?
- What data would you like to track to show improvements that meet the needs of your learning community?
- How will you measure the success of the changes and plan for improvement?
- What are some potential program models and approaches that could work for your school?
- What are the upsides and drawbacks of these models and approaches?
- How can you get feedback from your community on additional considerations for these different program options?

## STAGE 3: IDEATE—CHALLENGE ASSUMPTIONS AND CREATE IDEAS

***Consider these elements of data collection and equity considerations as you develop your ideas.***

### Ideate Stage - Guiding Questions:

- What changes would make an impact on the needs you have identified? What data sources will best reflect growth in these areas? (e.g. attendance, engagement measures, assessment results, etc.) What qualitative data and quantitative data can you gather to represent growth and change? (e.g. interviews, assessment results, attendance, student look-fors, surveys, etc.) What is the timeline for gathering and tracking this data?
- What challenges do you anticipate with funding, materials, and resources? What connections can you make to address these challenges at the early stages of program development?
- Do all student groups currently have equitable access to aspects of STEAM programming? How will you ensure that all students will have equitable access and that their needs will be represented and met by this new program?
- How could you address these equity considerations within the structure of your STEAM program?
- What are some options for program models and approaches that could meet your needs? For examples of different program models, access the STEAM Program Approaches and Models resource.

## STAGE 4: PROTOTYPE—START TO CREATE SOLUTIONS.

***Begin planning your pilot year, making sure the scope of your pilot is realistic and you have the resources for an effective test of the program.***

### Prototype Stage - Guiding Questions:

- What kind of program have you identified as the best fit for your community?
- What resources, staffing, and structures do you need to fully implement this program model?
- What are 1-3 goals that have come up in previous stages of the design process that are a priority for beginning this work, to move forward implementing the model you have chosen?
- Who will implement this program in their classrooms first? What supports do they identify they will need for implementation?
- Are there professional development or community of practice needs that require connecting to experts, building a support structure, or securing funding?
- What resources exist at your school, in your district, Education Service District (ESD), and STEM hub to support the development of the program? See the Funding Sources for STEAM Programs resource for ideas.
- Plan your data tracking system. How will you gather data about the success of your first steps toward implementation of a STEAM model? (e.g. Student surveys, teacher surveys, community surveys, test scores, attendance numbers, class visit protocol, interview responses, etc.) The Institute of Education Sciences, Regional Education Laboratory Program, has developed an Evaluation Toolkit that may be helpful in designing an evaluation for your program.

**Consider tracking your goals on a template, such as a Student Learning and Growth Goals template.**

## STAGE 5: TEST—TRY YOUR SOLUTIONS OUT

***Implement the strategies that you identified in Step 4 throughout the school year. Incorporate this into your school planning and goal setting process so that the work is woven into your existing systems and processes for continuous improvement. Ensure that those implementing your program have opportunities to check in, report progress, and request support and resources as needed throughout the pilot.***

***Toward the end of the year, gather data about your program.***

## TEST STAGE - GUIDING QUESTIONS:

- What additional supports are needed to implement your program that you may or may not have identified in earlier stages of the design process?
- What does the data say about the success of your pilot program? Take time as a staff to analyze, reflect, and iterate on your strategies.
- What did you learn from piloting your program?
- What changes do you need to make, and additional resources do you need to gather to iterate on this program model for the next design cycle?
- Did all students have access to the program? If not, what can you do to remove barriers to access for the next iteration?
- How will you share your progress with your entire community to engage their support and ideas?

# Additional Resources

These additional resources may help in the iterative stage of planning or revising your STEAM program.

- How to start a STEAM program: 6 elements for success: From the Institute for Arts Integration and STEAM, this resource walks administrators and educators through six programmatic areas to ensure elements are developed to support your STEAM program for sustainable growth.
- Portland Metro STEM Partnership STEAM School Rubric
- Portland Metro STEM Partnership STEAM School Resources Page

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# STEAM ACADEMIC STANDARDS AND REQUIREMENTS

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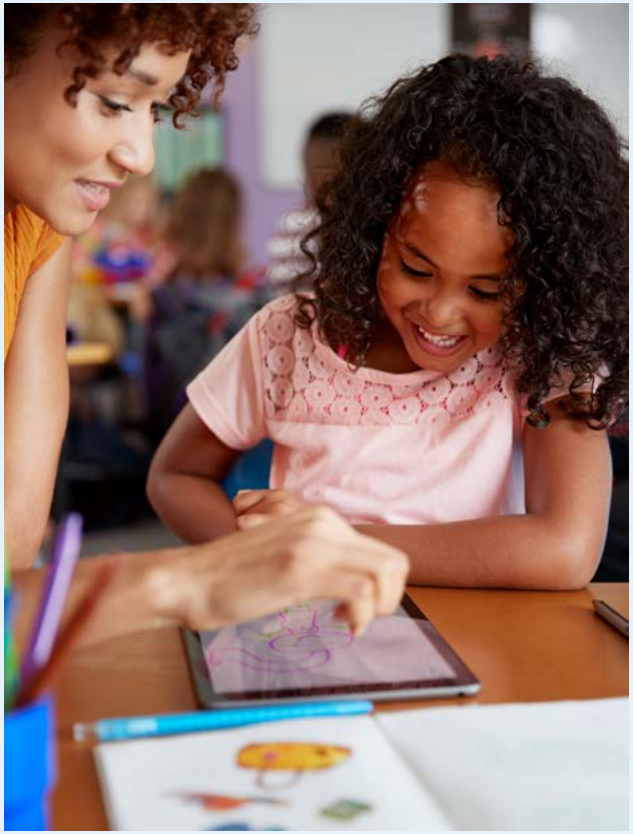
# STEAM ACADEMIC STANDARDS AND REQUIREMENTS

This resource clarifies STEAM content area requirements in Oregon public schools for program, school, and district leaders and educators. It provides an overview of the Oregon rules, statutes, and governing bodies and systems that inform and support the STEAM ecosystem in Oregon.

## Content-Area Standards

STEAM pedagogy involves integrating work across multiple content-area standards, most specifically Science, Technology (Computer Science), Engineering, Arts, and Math. For this reason, there are no specific "STEAM" standards. However, high-quality STEAM instruction involves thoughtful standards alignment to ground learning experiences in skills that Oregon students need to know. All of Oregon's required content-area standards can be found on ODE's Standards and Instruction website to assist in planning cross-content instruction.

To learn more about planning for cross-content instruction, including strategies to unpack and align standards, check out STEAM Education Instructional Practices.



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## STEM Education Plan

In Oregon, the STEM Investment Council governs funding and accountability for STEM/STEAM education initiatives. Oregon's 2021-2025 STEM Education Plan was developed by the Oregon STEM Investment Council and outlines the following overarching goals for STEM Education:

1. Inspire and empower our students to develop the knowledge, skills, and mindsets necessary to thrive in a rapidly changing, technologically rich, global society.
2. Ensure equitable opportunities and access for every student to become a part of an inclusive innovation economy.
3. Continuously improve the effectiveness, support, and number of formal and informal P-20 STEM educators.
4. Develop a sustainable funding and policy environment for STEM and CTE that provides reliable, seamless, and sufficient support across biennia.

This report also names key indicators, performance targets, and methods to ensure progress toward these goals.

## Oregon STEM Investment Council

Goals for innovation, equity, and workforce development through education require sustained investment. The STEM Investment Council assists "the Superintendent of Public Instruction and the executive director of the Higher Education Coordinating Commission (HECC) in jointly developing and overseeing a long-term strategy that advances educational goals related to science, technology, engineering and mathematics" (ORS 326.500). Voting and advisory members consist of Oregonians in the public and private STEM/STEAM and education sectors. You can access notes from STEM investment council meetings on this page. For records of the past public meetings of this council, please contact the HECC Office of Workforce Investments.

# Oregon's Regional STEM Hub Network

The Oregon Regional STEM Hub Network is central to implementing innovation, scaling best practices, and addressing workforce needs across Oregon. Oregon's Regional STEM Hub Network was formally established in 2015 with the passage of House Bill 3072 and resulting in ORS 327.372, with the aim of improving student outcomes in STEM education, increasing participation in STEM and CTE majors, and increasing the number of Oregon youth who enter high-wage, high-demand STEM and CTE professions. The Network has grown to 13 Regional STEM and STEAM Hubs that now cover all counties in Oregon. The Hub Network is unique in that it is a statewide ecosystem that embraces the notion that education is a collective responsibility and that learning takes place throughout one's life in all manner of settings and interactions. STEM Hubs empower their communities to build inclusive, sustainable, innovation-based experiences, creating opportunities for all students to fully contribute to an increasingly complex global society while addressing high-demand, competitive workforce needs through piloting programs, establishing best practices, and scaling successful approaches across the state. Find your regional STE(A)M Hub here!

Oregon STEM is a non-profit organization that coordinates work for STEM education across the state, including work with the regional STEM and STEAM hubs. You can learn more about Oregon STEM and the priorities they've set for the STEM hub network in Oregon STEM Vision & Strategic Priorities (2023-2026).

### ARTS INTEGRATION FOCUS: ARTS STANDARDS AND REQUIREMENTS IN OREGON

In Oregon, Division 22 rules make clear that every student should have access to a comprehensive, standards-based arts education. Integrating the arts within STEAM is an option to help schools meet these requirements while engaging students in creative, hands-on learning that connects disciplines and deepens understanding.

Use this toolkit alongside ODE's Academic Standards and Requirements for the Arts in Oregon to ensure your STEAM programming provides meaningful artistic learning opportunities for all students.

# STEAM-related Laws & Rules

## OREGON STATE LAWS AND RULES RELATED TO STEAM

These state laws and rules provide information about the systems that support STEAM education in our state. Visit the Oregon Legislature website for updated information about statutes and the Oregon Administrative Rules Database on the Secretary of State website for updated Oregon Administrative Rules.

### Oregon Revised Statutes (ORSs):

- ORS 326.500: establishes the STEM Investment Council and determines its purpose and organizational structure
- ORS 327.372: outlines the funding structure and requirements for STEM education in Oregon and provides details about reporting requirements for these efforts.
- ORS 327.380: provides details around grant applications and evaluation for the STEM Investment Grant Program.
- ORS 327.385: provides information on the STEM Investment Grant account.

### Oregon Administrative Rules (OARs):

- OAR 581-017-0301: provides definitions related to STEM education and strategic investments in STEM
- OAR 581-017-0302: provides information about fiscal agents for STEM & CTE grants
- OAR 581-017-0306: establishes the Regional STEM Hubs
- OAR 581-017-0309: outlines eligibility of Regional STEM Hubs
- OAR 581-017-0312: provides criteria for the regional STEM hub network grant awards
- OAR 581-017-0315: details the implementation of grant funding of Regional STEM Hubs
- OAR 581-017-0318: details the reporting requirements of Regional STEM Hubs
- OAR 581-017-0321: establishes the STEM Innovation Grants
- OAR 581-017-0324: outlines the eligibility for STEM Innovation grants
- OAR 581-017-0327: provides the criteria of the STEM Innovation grant awards
- OAR 581-017-0330: provides details about the implementation of STEM Innovation grants
- OAR 581-017-0333: details the reporting requirements for STEM Innovation grants

## FEDERAL GUIDANCE AROUND STEAM EDUCATION

The U.S. Department of Education has released guidance and resources to support STEM and STEAM education.

- STEM 2026: A vision for STEM education (2016)
- Charting a Course for Success: America's Strategy for STEM Education (2018)
- YOU Belong in STEM

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# STEAM PROGRAM APPROACHES AND MODELS

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# STEAM PROGRAM APPROACHES AND MODELS

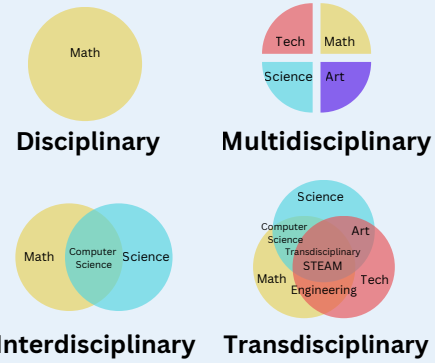
*"Convergence education is an approach that best equips students to tackle the world's most pressing challenges and opportunities of the 21st century, which are inherently transdisciplinary."*

*-from* Convergence Education, A Guide to Transdisciplinary STEM Learning and Teaching

This resource provides program, school, and district leaders an overview of education instructional approaches with standards-aligned STEAM instruction, examples of the student experience through these opportunities, and an overview of varying models which can comprise a comprehensive program.

## STEAM Pedagogy and Convergence Education

The acronym STEAM has many different definitions across educational spaces and means different things to different people. For the purposes of creating a common language in the Oregon education network, in this toolkit, "STEAM" represents the concept of "STEAM Pedagogy", or as the National Science and Technology Council defines it, "convergence education".




What are the qualities of STEAM Pedagogy and Convergence Education?

- Subject areas are taught with approaches that go beyond learning in a single academic discipline to address a larger issue, problem, or challenge.
- Instruction includes opportunities to learn skills in multiple academic disciplines, in disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary formats.
- Individual academic disciplines are still taught thoroughly and with rigor, to build the foundation for this pedagogy.
- Learning experiences are intentionally planned, with clear and explicit connections between subjects within the experience.
- Learning experiences prioritize depth, quality, and authenticity to encourage real-world learning and problem solving.

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## A PLACE FOR ALL DISCIPLINES

There is a place for all academic disciplines within STEAM pedagogy and convergence education. As disciplines interact in different ways to support the development of projects and solutions, they naturally lead to learning opportunities in all subject areas. For instance, although there is no "L", "R", or "W" in STEAM to represent literacy, reading, or writing, students will likely be applying many of the skills they have developed in those individual academic areas to learning within STEAM pedagogy. Additionally, STEAM pedagogy can help students develop an academic vocabulary in many different disciplines, opening doors and opportunities for them to pursue careers and fields of study that deal with complex and multifaceted problems.

For more information about instructional methods for integrating content across all subject areas, see the STEAM Instructional Practices Resource and the Literacy and STEAM resource.

## HOW DISCIPLINES INTERACT IN STEAM PEDAGOGY

Providing comprehensive STEAM learning experiences requires a mix of different instructional approaches and opportunities, both in individual academic disciplines and multiple, integrated academic disciplines. But what is meant by disciplinary versus interdisciplinary? And where does transdisciplinary fit into the picture? The infographic on page 19 helps to illustrate the differences between the terms Disciplinary, Multidisciplinary, Interdisciplinary, and Transdisciplinary.

The US Office of Science, Technology, and Policy's report on *Convergence Education*[1] defines these terms as follows:

- Disciplinary: **Concepts and skills are approached separately**, allowing students to engage and be assessed on a singular discipline, with minimal integration.
- Multidisciplinary: A common theme or approach is used to allow students to connect concepts and skills learned separately in each discipline. Multiple disciplines are incorporated but they are **not integrated**.
- Interdisciplinary: Students learn concepts and skills from two or more disciplines that are tightly linked so as to deepen knowledge and skills. Educators and learners collaborate to identify a concept involving multiple disciplines in an **integrated** way that makes the concept authentic to real-world experiences and challenges.
- Transdisciplinary: Learners identify complex problems and work together to create a shared conceptual framework and draw together theories, concepts, and practices that transcend individual disciplinary boundaries. Focus is on broad, real-world constructs drawn from an increasingly interconnected world, societal relevance, and student interest. Transdisciplinary (including applied interdisciplinary approaches) is distinct from multi- or interdisciplinary in that **subjects are blended in a transformative manner that provides important gateways for student-centric, student-defined problems** or topics that lead to authentic and meaningful learning experiences and student-driven innovations.

In summary, STEAM education is successful when students have domain specific knowledge in many academic content areas and are also provided opportunities to apply this learning utilizing skills from multiple subject areas. STEAM or convergence education goes beyond tinkering; it involves strategic uses of instructional strategies and explicit planning and scaffolding to support students in solving complex problems and developing workable solutions.

1 IWGC defined convergence education as driven by compelling or complex socioscientific problems or topics, where learners apply knowledge and skills using a blended approach across multiple disciplines (i.e., transdisciplinary) to create and innovate new solutions.

## HOW EDUCATORS INTERACT WITHIN STEAM PEDAGOGY

For more information about building supportive partnerships across a school team to make STEAM possible, see the Supporting Teachers & Deepening Partnerships resource.

### ARTS INTEGRATION FOCUS: ARTS IN CENTER STAGE

The Arts are central to STEAM—they are a powerful catalyst for connecting ideas to relevant current events, encouraging student voices, and inspiring cross-disciplinary creativity. Placing the arts at the center helps students make sense of complex concepts through expression, intentional design, and storytelling—cultivating deeper understanding, historical and cultural context, and authentic engagement within learning opportunities.

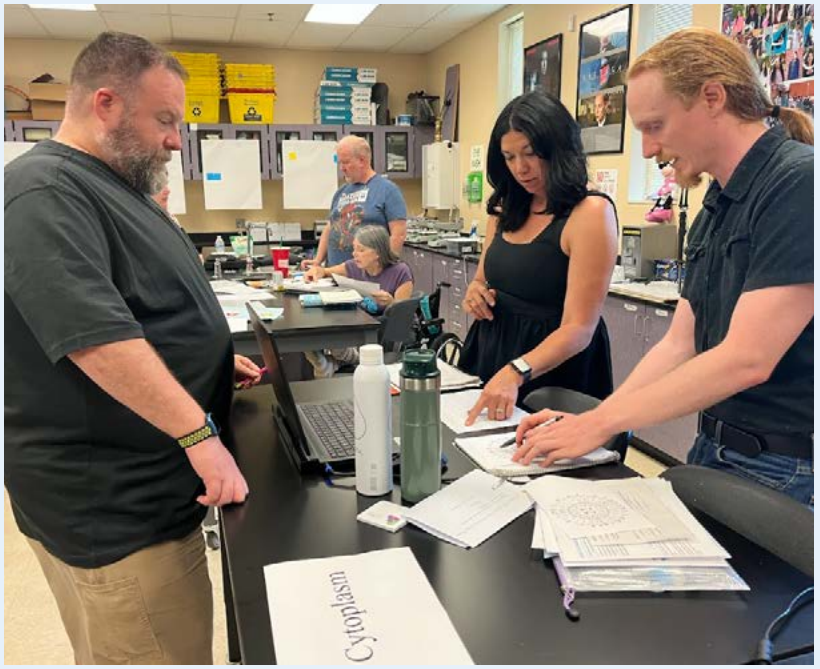
Here are some starting places to use the arts to support connections within your STEAM programming:

**Begin with Big Ideas:** Use works of art, music, or performance pieces as provocations for inquiry across a topic or theme. Explore the history of diverse artists, musicians and creatives for relevant stories that can make your content come alive for students.

**Student-Created Artifacts:** Encourage students to demonstrate understanding through an artistic mode that lends itself to your theme or focus—sketching prototypes, composing music, creating infographics, or performing skits that explain content. Portfolios are a beautiful way to document and share your student's work.

**Visual Thinking Routines:** Use drawing and visual journaling to help students reflect on their learning processes and questions.

**Celebrate and Showcase:** Exhibitions, performances, or student-curated galleries highlight student learning in an engaging way, while providing opportunities to connect through your exploration with families and the larger community.



# Examples of STEAM Instructional Approaches

STEAM programming is flexible by design and can look and feel very different, depending upon the strategies used. Listed below are several common instructional approaches for incorporating STEAM practices, many of which are outlined in the US Office of Science, Technology, and Policy's report on *Convergence Education*. Teachers and Administrators can choose to use specific approaches or interweave them to develop STEAM programs that best support their students and local communities.

## APPLIED LEARNING APPROACH:

Applied learning encourages students to actively engage with real-world problems and scenarios. This approach often involves hands-on activities, projects, and experiential learning opportunities that help students connect academic concepts with practical experiences.

In essence, applied learning seeks to bridge the gap between theory and practice, fostering deeper comprehension and retention by enabling students to apply what they've learned in meaningful contexts. It promotes critical thinking, problem-solving, and the ability to transfer skills across various situations, preparing students for practical challenges they may face in their personal and professional lives.

### RESEARCH BASED:

Applied learning via an engineering design process resulted in a group of 32 middle school students' positive self-reported knowledge construction, intrinsic motivation, satisfaction and interest in STEM fields (Nguyen et al., 2020).

A study using a nationally representative data set of high school students found that applied STEM courses have potentially a particular benefit for students with disabilities, by increased math scores, graduation rates, and post-secondary school enrollment (Plasman & Gottfried, 2018).

## CAREER-CONNECTED LEARNING APPROACH:

Career-connected learning "creates pathways for all youth to prepare for their best possible futures. This approach to learning brings together community partners, industry leaders, families, and educators to engage youth of all backgrounds and provide learning opportunities that connect with their interests, life experience, and aspirations for their futures." (from Career Connect Oregon) Career connected learning provides students opportunities to pursue real-world work and opportunities to learn from professionals in the field. During these learning opportunities, students make direct connections to possible future careers and expand their thinking about how their current work supports their future career pathways. This approach can be blended with other approaches to provide career-connected opportunities for students within applied, project-based, place-based, and other learning opportunities.

Spark an initiative by Connected Lane County, offers youth in Lane County, Oregon, opportunities to learn, innovate, collaborate, and create through various out-of-school training programs. These programs aim to help youth develop technical and professional skills, become confident problem-solvers, and gain hands-on experiences. (from Connected Lane County)

The Agency is a Spark program providing students paid work experiences and meaningful internship opportunities. In this program, youth undertake projects commissioned by local organizations, allowing them to apply their skills to real-world challenges. Past collaborations have included projects for the Arts and Business Alliance of Eugene (ABAE), the City of Eugene, the Eugene Education Foundation, Eugene Symphony, Eugene Water & Electric Board (EWEB), Food for Lane County, Willamalane Parks and Recreation, Travel Lane County, and the Eugene YMCA. (from Connected Lane County)

### RESEARCH BASED:

A study found that in Oregon, the four year high school graduation rate for CTE concentrators was higher than for students who did not participate in CTE or did participate but did not concentrate (Arneson et al., 2020).

Career connected learning can increase students' enthusiasm about school and hopefulness about their futures (*The Power of Career-Connected Learning in New Hampshire*, 2023).

## CHOICE-BASED/FREE CHOICE/TINKERING APPROACH/PLAY-BASED:

Choice-based approaches encourage student exploration in an open-ended learning environment. Students are encouraged to make decisions about what they would like to learn, and educators utilize formative assessment and questioning strategies to highlight student learning through exploration. This may lead to deeper explorations or project-based learning experiences around themes that are uncovered through this approach.

Example: The Tinkering Studio Projects from Exploratorium: The Tinkering Studio is primarily an R&D laboratory on the floor of the Exploratorium, but they also share projects, activities, and ideas following an "open source" model. Learn how you too can enjoy these activities in your classroom.

### PROMISING PRACTICE:

Benefits of play-based learning include learning through social interaction, using an iterative approach, and a focus on student enjoyment and engagement (Blinkoff et al., 2023).

A guided play-based approach to learning can deepen students' interest in learning through fostering autonomy and discovery (Skolnick et al., 2016).

## INQUIRY-BASED LEARNING APPROACH:

Inquiry-based learning focuses on students actively exploring and discovering new knowledge and concepts through asking questions and conducting investigations. In an inquiry-based learning environment, students are encouraged to ask questions, seek out information, and engage in hands-on activities and experiments to learn about a particular topic. This approach is designed to promote deep understanding and critical thinking skills, as students are encouraged to consider multiple perspectives and draw their own conclusions based on the evidence they gather.

### RESEARCH BASED:

An inquiry-based learning approach can create an environment that fosters student engagement and motivation through increasing student voice and choice (Gholam, 2019).

Results of a study based on a nationally representative sample of middle school students using a multilevel, multivariate regression analyses found that inquiry-based learning has a positive relationship with students' perceptions of utility and self-efficacy learning science and math (Riegle-Crumb et al., 2019).

## INVENTION EDUCATION APPROACH:

Invention education is a teaching approach that emphasizes creativity, problem-solving, and the development of innovative thinking skills. This approach encourages students to engage in the process of inventing new solutions, products, or ideas, often through hands-on projects and real-world challenges. This type of learning highlights the unique ways that inventors contribute to solving problems. It can cultivate an entrepreneurial mindset, enhance problem-solving skills, and prepare students for future challenges by fostering creativity and innovation.

Additional resources related to invention education can be found at InventEd.

## PLACE-BASED LEARNING APPROACH:

Place-based programs provide students options for real work in the field, allowing them to learn more about the environment and community in which they live. In Place-Based learning, students may engage with community leaders, businesses, and organizations that do meaningful work in their community and explore firsthand the history and stories from local resources, to make deep connections grounded in place.

Examples:

- Rural STEAM Leadership Network: Place Based Education provides webinar recordings of professional learning sessions geared toward place based education in Oregon. For example, in one session, Tend, Gather and Grow was shared, a curriculum dedicated to educating people about wild plants, local landscapes, and the rich cultural traditions that surround them. It is intended for K-12 teachers and community educators with a focus on serving Northwest Native and regional youth.
- Cottonwood School of Civics and Science: Place-based projects at the Cottonwood School are grounded in the history, environment, and people of Portland and the Pacific Northwest. Each trimester concentrates on key social studies or science concepts. Reading, writing, public speaking, and geography skills are heavily embedded into the project work. Through an integrated approach, students go deep into a topic over an extended period of time. This allows them to learn the complexities of an issue while discovering how components naturally connect with other concepts.
- Ruch Community School in Medford School District has several published place-based units, including this Apiary Study located next to their middle school.

### RESEARCH BASED:

Oregon students participating in outdoor school statewide reported gains in important skills like critical-thinking, collaboration, and problem-solving as well as increases in motivation, interest in learning, and a sense of belonging (Braun, 2024).

## PROBLEM-BASED LEARNING AND PHENOMENON-BASED LEARNING APPROACHES:

In problem-based learning, students learn through the process of solving an open-ended problem, tapping into content knowledge from across disciplines and areas of study and their own personal experiences and funds of knowledge. Similarly, in phenomenon-based learning, educators anchor learning in explaining scientific phenomena, where students may design solutions and build ideas in the context of application and real-world contexts. (US Office of Science, Technology, and Policy's report on Convergence Education)

Oregon's STEM and STEAM hubs have developed STEM Bites, short lessons designed around problem-based and phenomenon-based learning approaches.

### RESEARCH BASED:

A case study of fifth grade girls experienced growth in agency, belonging, competence, and an emergence of civic efficacy when provided the opportunity to give input on changing school and district rules (Mitra & Serriere, 2012).

A quasi-experimental study of elementary teacher implementation of transdisciplinary, problem-based, computer science integrated learning modules found that the module implementation was linked to positive student academic outcomes, specifically in language arts and math (Century et al., 2020).

### PROMISING PRACTICE:

Secondary students participating in a study on problem-based learning in a virtual environment reported enjoyment of the activity and learning time management and communication skills from the experience (Sokyal et al., 2021).

## PROJECT-BASED LEARNING APPROACH:

Project-based learning is an educational approach in which students learn and gain skills through a long-term investigation of an authentic and complex problem or challenge that holds interest and meaning for them. Collaboration and subject integration are inherent in project-based learning, so it can work best when teachers plan together to help students meet grade-level standards in multiple subjects. Project-based learning also lends itself to interdisciplinary and transdisciplinary learning. A school may choose to collaborate based on specific projects happening within a school or grade level. This kind of STEAM programming allows multiple teachers to work together and develop/implement lesson plans that align to a single project taught across multiple subjects.

### EVIDENCED BASED:

A randomized control trial of over 4,000 students showed students learning physics and chemistry through project-based learning performed better on an independent summative assessment than their peers learning through traditional models. The project-based learning model in the study included teacher and student learning experiences and formative unit assessments to support students authentically engaging in science (Schneider et al., 2022).

A cluster randomized controlled trial of second grade students from low socioeconomic school districts, learning social studies and literacy through project-based learning, showed higher growth in social studies and informational reading achievement compared to their peers learning through conventional methods (Duke et al., 2021).

### RESEARCH BASED:

Hands-on, project-based learning activities can enhance autonomy, competence, and engagement in STEM learning for secondary students (Vennix et al., 2017).

## SERVICE LEARNING APPROACH:

Service learning is a method of integrating content, community needs, and student choice in a project that benefits society or the environment. This goes beyond just performing acts of service. Projects are thoughtfully integrated in the curriculum, linking standards and academic content to the project, and student engagement is deeply ingrained throughout, with opportunities for students to apply learning to the community and/or environment and to reflect deeply and make changes, as needed.

- Engaging Students Through Academic Service-Learning: National Guide to Implementing Quality Academic Service-Learning: This guide from the National Coalition for Academic Service-Learning includes guidance in providing students with quality academic service-learning experiences.
- Oregon City Service Learning Academy: This public charter high school embeds service learning into their curriculum and activities.

## RESEARCH BASED:

Research shows that teachers who use service-learning tend to use high quality teaching strategies, integrate data collection with content and technology, and help students make connections to their community and the environment (National Coalition for Academic Service-Learning, 2016).

Multiple studies have found that STEM service learning experiences can lead to increased student engagement, self-efficacy with science, increased interest in STEM careers, and aid in developing communication and collaboration skills (Collins et al., 2019), (Hamerlink, 2013), (Baumann, 2013).

A partnership between a local university and schools serving K-5 students resulted in elementary students' increasing STEM academic performance and interest in continuing STEM learning (Lopez et al., 2016).

# STEAM Education Models

Depending on a school's particular resources, program focus, and the learners they serve, various approaches may be utilized to best fit the needs of an individual learning community.

This chart highlights different STEAM program models, along with key considerations for implementing these various models.

### TABLE 1: DIFFERENT MODELS OF PROVIDING STEAM LEARNING OPPORTUNITIES

**Common elements: Standards-aligned, available to all students, taught by qualified educators**

| Program Model | Schedule | Staffing | Integrated or Standalone | Description |
|---|---|---|---|---|
| **Whole-School Implementation** | STEAM learning opportunities occur throughout the school day and year. | All school educators are trained in STEAM instructional practices to further STEAM learning opportunities across the curriculum. | Integrated into the learning opportunities in all courses offered in the school schedule. | Schools implement the STEAM instructional pedagogy across all course offerings. The primary goal of this type of program is to facilitate integration of content and teacher collaboration, with a focus on student engagement, agency, and efficiently using instructional time to teach all required standards. This may include certified or non-certified STEAM schools, storyline schools, or other models that integrate content and use transdisciplinary learning for the whole school. For more information about STEAM certified schools specifically, review the Portland Metro STEM Partnership's STE(A)M Schools information website. |
| **STEAM Electives or "Specials"** | On a weekly, quarterly, trimester, or semester rotational schedule. | Staffed by educators trained in STEAM instructional practices. | Separate, standalone class within the school schedule. | This model provides STEAM learning opportunities within electives or specials classes. In these classes, work is transdisciplinary and may apply various instructional approaches to teach skills in all content areas represented in STEAM. These classes may take place in a traditional classroom, in a makerspace, and/or in the field. It could be offered for an entire quarter, trimester, or semester, or in a regular weekly or rotating schedule. |

| Program Model | Schedule | Staffing | Integrated or Standalone | Description |
|---|---|---|---|---|
| **Linked Courses** | On a weekly, quarterly, trimester, or semester regular schedule. | Staffed by educators trained in STEAM instructional practices. | Integrated into the learning opportunities of two or more "linked" classes in the school schedule. | The linked courses model depends on teacher collaboration and integrated planning, and provides students integrated instruction in the STEAM content areas across two or more courses in their schedule. For example, students may learn skills in art and technology in a graphic design course that thematically aligns with science, math, and engineering work that occurs in their physics class. Collaborative planning time for educators is essential to the effective application of this model, as course objectives are aligned throughout. |
| **STEAM Pathways** | On a weekly, quarterly, trimester, or semester regular schedule. | Staffed by educators trained in STEAM instructional practices. | Separate, standalone series of classes within the school schedule. | This model provides STEAM learning opportunities through a particular pathway of courses that students can elect. This model can be aligned with CTE Pathways and offer students opportunities for work-based learning, dual credit courses, and industry experience at the high school level. |
| **Out-of-School** | Before or after the school day, or in the summer months outside of the regular school year. | Staffed by teachers on summer assignments or contractors. | Separate, standalone class or series of classes outside of the regular school schedule. | The out-of-school space is a valuable opportunity to build upon what students are learning in school, provide opportunities to learn transferable skills, and improve student efficacy in STEAM.<br>Multiple learning approaches may be incorporated into an out-of-school STEAM model. |

## ADDING STEAM AS A SPECIAL CLASS

*"Building a STEAM program can be daunting. As we wrap up our second year of offering STEAM as a special class to all 200 K-2 students at Warrenton Grade School, we are looking to grow the impact on the community. Resources and professional development offered by the STEM Hub organization have been invaluable and inspiring. Schoolwide staff are getting excited for the impact on student learning and engagement. Families are starting to get informed and involved. It is exciting to see how this is beginning to create a lasting legacy in our small-town community on the coast."*

- Warrenton Grade School

## Additional Resources:

- PMSP Working Definition of STE(A)M School
- Great Schools STEM School Overview
- Afterschool Alliance STEM Research
- Examining the Impact of After School STEM Programs
- AEP STEAM Resource Guide

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million Federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# STEAM PROGRAM IMPLEMENTATION RESOURCES

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# STEAM PROGRAM IMPLEMENTATION RESOURCES

This tool can be utilized by programs, school, and district leaders to support implementation of new, emerging, or existing STEAM programs. These resources provide considerations for equitable access to STEAM learning, examples of successful professional development supports and industry connections, and information related to addressing scheduling and credit needs.

Schools and districts may have varying entry points into integrating content, depending upon local policies with curriculum alignment and instructional time. The resources provided below may be more beneficial for schools and districts with flexible policies that already allow for creativity and collaboration. Before building and expanding your STEAM program, review the Design Thinking Questions for New and Emerging STEAM Programs section to evaluate your school's or district's readiness for STEAM implementation.

For schools that are building new STEAM programs, the Design Thinking Questions for New & Emerging STEAM Programs resource utilizes the design thinking framework to highlight key considerations before selecting or implementing a new program.

For programs that already exist and are looking to expand or enrich their STEAM opportunities, consider resources from the Portland Metro STEM Partnership STEAM Education Support page and the Center for Arts Integration & STEAM, such as this framework for Arts Integration and STEAM Implementation. This can provide a useful structure for developing a sustainable and scalable program.

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## Equitable Access to STEAM

Implementing STEAM programs can enhance a school's equity goals, by increasing equitable and engaging learning opportunities that are grounded in relevant, hands-on learning for all students, which can in turn increase student achievement. Every student has the right to a high-quality, well-rounded education. Integrating content and providing full access to STEAM learning can support multiple entry points for diverse students to connect their learning to their own experiences, leading to engagement and deep learning. To ensure equitable access to these learning opportunities, it's important to align to school and district equity goals.

Equity in school programs is not an isolated practice, but present across the school in structure and in practice to truly support students and staff. To this end, apply your school's equity lens and decision-making tools when considering programs or activities to increase STEAM access within school programs. To attain equitable outcomes across programs, carefully vet them for accessibility, cultural responsiveness, and relevance for the student community. ODE's Equity Decision Tools for School Leaders provides processes to consider when designing equitable programs.

Listed below are some additional resources to support equity learning in school communities:

- Engaging Equity: Equitable Mindsets, Practices, and Systems - Canvas-based Professional Development
- Principles for Equity-centered Design of STEAM Learning-through-Making
- Why it is crucial to make cultural diversity visible in STEM education
- CRSE STEAM Scorecard Toolkit
- Institute for Education Sciences' Framework for Equitable Opportunities in STEM
- Connected Learning Alliance

Any educational program also benefits from design in a way that supports multilingual learners. To learn more about resources available, visit the Multilingual/English Learner Resource Bank.

## Building Support and Buy-In for STEAM Programs

Oregon's Reimagined Accountability Framework calls out the importance of involving school communities in the development of education programs. Educational programs serve the students who are enrolled in them and their communities, and therefore are developed through meaningful relationships with students, families, and community partners. This will also support building buy-in for new programs throughout the educational community. By prioritizing collaboration with students, families, and educators, schools can create STEAM programs that reflect the lived experiences and aspirations of their students, making learning more relevant and engaging. Additionally, shared accountability encourages transparency and responsiveness, ensuring that educational strategies evolve based on continuous feedback from educators, students, and the broader community.

The Elevating Voices in Education (EVE) Survey, the Student Educational Equity Development (SEED) Survey, and the Oregon Student Health Survey can further support student centered programmatic decisions, by gathering input on workplace climate, student well-being, and learning experiences.

Many school and district funding sources and programs require Community Engagement as part of the planning process. For example, as part of the Student Investment Account (SIA) and the Aligning for Student Success Integrated Guidance, ODE released a comprehensive Community Engagement Toolkit to support these efforts. Although specific to the SIA, this toolkit can be used throughout various programs and activities and is helpful to increase awareness of and equitable access to STEAM programming within your community.

### ARTS INTEGRATION FOCUS: THE ARTS PROMOTE BUY-IN

The arts are a natural bridge between schools and the broader community. Showcasing student creativity through performance and presentation invites families, caregivers, and local partners into the process—and creates powerful opportunities to celebrate student learning. This is a great way to inspire long-term investment in STEAM education within your community.

These kinds of artistic events foster connection, pride, and shared purpose across learning communities:

**Gallery Show** – Display student artwork, design challenges, inventions, and engineering models in a gallery walk format with family-friendly, student-led tours. Make sure to document student work along the way for the displays, so attendees can see the process and work that leads to the beautiful final products.

**Student Voices Celebration** – Celebrate identity and culture through student storytelling, poetry slams, or community mural-making tied to a theme that resonates with the community.

**Film & Animation Festival** – Screen student-created stop-motion videos, digital art, or documentary projects that reflect thematic learning goals within your STEAM program. To make further community connections, consider reaching out to local venues that may be willing to host.

**Community Art + Science Walk** – Transform hallways or outdoor spaces into a collaborative exhibit space exploring student work in an inspiring setting. Consider giving attendees an engaging activity or process that models what students engage with in their classes, so they can experience it firsthand.

**Family Creativity Night** – Host hands-on, intergenerational arts activities (e.g., building instruments, painting circuits, designing wearable tech) tied to themes or content students are learning about, so they can teach their families and friends!

## Creating a School Wide STEAM Focus

To effectively implement STEAM's project-based learning approach, a school-wide strategy can be a supportive option for programs. Oregon districts host several STEM and STEAM schools as models. For guidance on creating a school-wide STEAM framework, consider connecting with the Portland Metro STEM Partnership to learn about their STEM Schools project.

The Oregon STEAM Education Rubric, developed by a consortium of Oregon STEM and STEAM hubs, provides schools a guide to:

- Transformational processes and progressions in the five domains: Leadership, Planning, Teaching, Learning, and Partnership.
- Plan for increased access to STE(A)M learning opportunities for all students.
- Plan for student engagement and performance in STE(A)M subjects.
- Reflect on a school's adoption of, or maintenance of, STE(A)M programs, and choose an area of focus for staff and community.
- Collect evidence and apply for STE(A)M School Certification in any or all of the five domains of STE(A)M Education.

The STEM High Schools Roadmap & Study can also support this process.

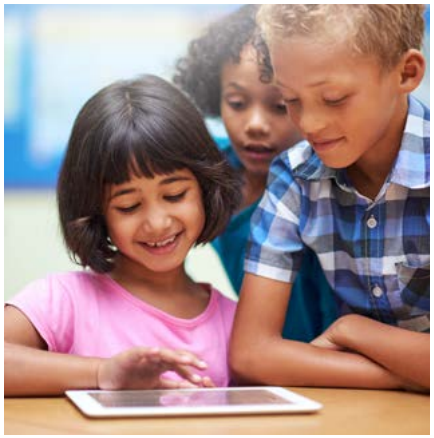
## Technology and Digital Materials Considerations for STEAM Programs

When integrating technology and digital literacy into STEAM learning in K-12 classrooms, consider how to incorporate development of information literacy skills, enabling students to evaluate online sources, detect misinformation, and use digital tools responsibly. The ISTE Digital Citizenship Lessons provide structured guidance on ethical technology use, helping students understand privacy, security, and the impact of their digital footprint. Additional resources include:

- ISTE standards provide nationally recognized competencies for learning, teaching and leading with technology
- ISTE Computational Thinking Competencies

Computer science education naturally intersects with STEAM, providing students with computational thinking skills that enhance problem-solving across subjects, whether through algorithmic thinking in math, data analysis in science, or digital design in the arts. Consider how STEAM content can align with and support computer science standards and objectives in coursework.

More information can be found in ODE's Digital Learning Instructional Resources and Digital Instructional Materials Toolkit.

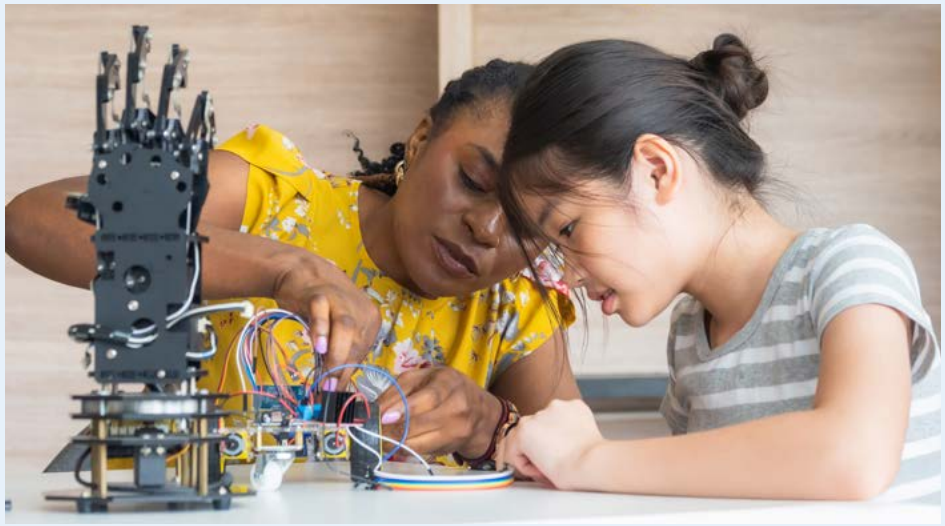


## Scheduling Courses to Support STEAM

Traditional school schedules often silo content areas and provide barriers to interdisciplinary STEAM instruction. When considering alternative schedule options to support STEAM instruction, prioritize flexibility and balance across core subjects, which may limit barriers such as tracking, limited elective options, or conflicting academic demands. It is also helpful to consider out-of-school spaces such as after-school programs, mentorship opportunities, and partnerships with local STEAM organizations in the scheduling process.

Scheduling Resources:

- TIME FOR CHANGE? Findings from a Survey of Time Use in Schools Insights Report | 2020
- Unlocking Time Schedule Library



## COURSE CODES, CREDIT, AND LICENSURE CONSIDERATIONS

Designing cross-content courses, in particular for middle and high school, begins with identifying the academic standards from multiple disciplines that align with the course's learning objectives.

Once the standards are mapped out, educators can collaboratively structure the course curriculum and the scope and sequence with the lens of the larger program, to balance depth and breadth across subjects while developing or even collaborating on hands-on, project-based learning opportunities across courses. Ideally, educators would collaborate across their subject areas to integrate key themes, concepts, or phenomena, and map where concepts and standards are being first taught and reinforced across the program, ensuring that each course provides a cohesive and interdisciplinary learning experience. This will likely lead to discussion of innovative teaching models, including co-teaching or team teaching; which may have larger implications for the school schedule or structure. For this reason, communication and collaboration with building and, if necessary, district administration can be extremely supportive and help avoid any unforeseen barriers.

Make sure to document the scope and sequence and standards addressed; if educators change or programs expand, this will make the process of future alignment and onboarding much easier. Revisit any programmatic changes at the end of the year, discuss what was successful, and make any adjustments needed to support the program further.

## COURSE CODE CONSIDERATIONS

After finalizing the course framework, the next step is to find the most appropriate School Courses for the Exchange of Data (SCED) code from the National Center for Education Statistics (NCES). Schools can match their course's content, instructional approach, and credit structure with the closest SCED code to ensure proper classification and alignment with state and district reporting requirements. This process helps legitimize cross-content courses, ensuring they meet graduation requirements and are recognized for college and career readiness.

- SCED Codes: This website is a searchable database for SCED codes.
- Oregon's Higher Education Coordinating Commission Common Course Numbering System: This website has more information about Oregon's Higher Education course numbering system.
- Core Courses for Counselors: This resource from NCAA shows the process for approving courses for scholarships, which is often used as proxy for academic preparedness for college.

## TSPC LICENSURE AND ENDORSEMENT CONSIDERATIONS

The Teachers Standards and Practices Commission (TSPC) does provide some flexibility on teacher assignment within their rules. For example, a teacher with a CTE license is eligible to teach Technical Math (code 01253) that integrates engineering and math. Computer science courses can be taught by any teacher with an unrestricted license. Consult the Course to Endorsement Catalog for which courses are allowable under a specific license and endorsement.

In addition, the Oregon Education Association (OEA) has published this License Toolkit, which helps describe the scope of the teacher of record.

## AWARDING HIGH SCHOOL CREDIT FOR CROSS-CONTENT COURSES

- Options for Awarding Credit
- Credit in More than One Content Area
- Credit Options: Applied Academics/Academic Credit through CTE Courses
- Credit Options: Project-Based Learning
- Credit Options: Performance Assessment
- Oregon Official Scoring Guide (see additional resources on this page) for awarding credit

## DUAL/ACCELERATED CREDIT OPTIONS

If districts want to offer accelerated college credit within a STEAM project, they will need to partner with a postsecondary institution, and those partnerships must align to Oregon's state standards for partnership. If the community college that serves their area is not able to meet their needs, they can reach out to other postsecondary institutions by contacting their dual credit coordinators.

- Dual Credit Partnerships
- Portland State's Senior Inquiry project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If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

WELL - ROUNDED ACCESS PROGRAM

# SPACE AND EQUIPMENT NEEDS FOR STEAM PROGRAMS

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# SPACE AND EQUIPMENT NEEDS FOR STEAM PROGRAMS

*"When the foci of design, critical problem-solving, and creation reflects learners' lived experiences and interests, it is more likely for learners to feel empowered as designers and makers of things that matter to them and their communities, thereby* ***shifting the culture of learning-through-making to be more expansive and responsive to inequities that learners experience in their daily lives****."*

-Jill Castek, Michelle Schira Hagerman, & Rebecca Woodard

This resource provides programs, school, and district leaders and educators with considerations for how to set up STEAM spaces.

## Guiding Questions for Developing STEAM Learning Environments and Makerspaces in Schools

Design STEAM and Makerspace learning environments, including both physical spaces and digital learning spaces, intentionally to meet students where they are and make learning fully accessible. The equipment and design of STEAM learning spaces will likely vary widely between sites. When design is student-centered, each space will develop according to the program focus and relevance to student work.


Illustration Credit: MCmaster's University

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Consider these initial questions from Principles for Equity-centered Design of STEAM Learning-through-Making in the first steps of designing STEAM learning spaces:

- *Who does this learning environment aim to serve, and what are its purposes?*
- *For whom does this environment open access to learning, and for whom does it limit access? Why? In what ways, and at what times?*
- *How can we design spaces to meet the diverse learning needs of those we aim to serve?*
- *Further, how might the design of these spaces, from conception to implementation, centrally involve diverse learners?*
- *How do spaces reflect, inspire, and nurture the learners we serve?*
- *Is the environment flexible and dynamic or static and intractable?*
- *How does our environment align both literally and metaphorically with the idea of low floors, wide walls, high ceilings, and reinforced corners? How does it foster mobility, diversity, and openness?" (Castek, Hagerman, & Woodard 2-3)*

## Student-Centered Design

Where possible, engage students in the design process for STEAM learning spaces. This can be a process that develops inclusive, connected relationships, promotes the development of STEAM identity, and promotes ownership and engagement in STEAM spaces within a school community. A community driven approach to design encourages students to take ownership of their learning journey and leads to exciting new possibilities for the entire educational community.

## STEAM Learning Spaces

STEAM Learning spaces, especially makerspaces, benefit from a considerable amount of equipment and materials. However, this doesn't have to be a costly or space-consuming investment. Larger school districts may have buildings that have space to host a lending library for individual teachers to check-out and borrow for certain projects or activities, and this can be woven into the district's library media program. When setting up spaces, consider the following equipment and accessibility considerations:

### ACCESSIBILITY CONSIDERATIONS:

- Consider height adjustable work surfaces and seating
- Ensure accessible tools are available on digital equipment (e.g. speech-to-text)
- Post clear labels and signage for students in multiple languages to aid in safety, organization, and care for the space
- Ensure safety equipment is available in a variety of sizes

In addition, consider how many students might be using the space at one time. This will help better gauge how many materials and how much equipment to include.

## EQUIPMENT TO CONSIDER (ALL AGES):

- Spacious, well-lit work area
- Sturdy Tables and Seating Options
- Group style seating to promote collaboration among participants
- Sink(s)
- Safety equipment including masks, goggles, and gloves
- Proper ventilation system
- Ample storage space to accommodate both 2D and 3D materials and student project storage
- Drying rack(s)
- Display boards
- Projector and screen
- Uncarpeted floors that are easy to clean
- Soundproofing and other ear protection
- Accessible and updated tablets, laptops, desktop computers, or a combination

## EQUIPMENT TO CONSIDER (OLDER STUDENTS ONLY):

- Wifi access
- Plentiful accessible outlets (**dedicated electrical circuits** to prevent tripping breakers due to high equipment power demands)
- Charging cart(s)/stations
- 3D Printer(s)
- Robotics Kits
- Microcontroller Kits
- Woodworking, Metalsmithing, or other Tools

## STEAM IN DIGITAL SPACES

- Digital Instructional Materials Toolkit
- Online & Remote Learning Guidance: Critical Requirements and Design Indicators
- Key Components of Digital Learning: A Starting Point for Design, Dialogue and Implementation

## ARTS INTEGRATION FOCUS: ART PROGRAM SPACES AND EQUIPMENT

High-quality STEAM education relies on dedicated spaces and materials that support both technical skill-building and creative exploration. Arts programs require specialized environments—such as studios, performance areas, storage solutions, and discipline-specific equipment—that serve as the backbone of integrated, hands-on learning, and can serve both arts and STEAM programs.

ODE's Space and Equipment Needs for Arts Programs resource outlines essential infrastructure considerations across visual arts, music, dance, theatre, and media arts. These supports not only ensure equitable access to standards-based arts instruction, but also enable students to fully engage in interdisciplinary STEAM experiences.

## Elementary School Considerations

Remember that STEAM spaces do not need to involve digital technology to get at the concepts of design thinking, computational thinking, tinkering, and innovation! Consider simple materials with younger students including cardboard, masking tape, straws, and recycled materials like toilet paper or paper towel tubes.

Encourage students to learn to care for their equipment and space by developing clear and collaborative guidelines for set up and clean up. Labeling and organization is paramount for this task, and for younger learners, consider picture labels to help them organize equipment. This can save a lot of time for educators and helps students become more independent designers as they grow!

If space isn't available, consider a mobile cart that can be shared amongst classrooms.

## Mobile Options


Sometimes space isn't available for a full makerspace within a school building, but there are mobile options to consider. Many STEM Hubs offer mobile maker spaces to their regional schools and are available to schedule a visit!

- GO STEM's Mobile Maker Lab
- Frontier STEM Hub's Mobile Makerspace
- Umpqua Valley STEAM Hub's Mobile Unit

## Lending Libraries

Sometimes, equipment or new technology can be too expensive to purchase, especially if only used for a brief period of time. If you'd like to try out new technology with your students, consider connecting with your STEM Hub to see what's in their lending library - from legos to robotics, there are many options available with lesson plans for how to use the technology and equipment!

### UMPQUA VALLEY STEAM HUB LENDING LIBRARY:

The Umpqua Valley STEAM Hub manages a lending library of ready-to-use classroom kits and hands-on resources to engage students in learning. These classroom kits explore concepts in coding, measurements, physics, mathematics, energy and more! The kits are designed to provide everything teachers need to lead exciting STEAM lessons. Learn more here!

# Technology Considerations

## INTEGRATING TECHNOLOGY INTO EDUCATIONAL PRACTICES

When designing an equitable digital learning ecosystem through intentional technology integration, begin with learning targets and pedagogical approaches, as technology serves as an enhancement, as opposed to the center of instructional design. Some examples for technology integration include:

- Technological Pedagogical Content Knowledge (TPACK): This framework integrates content, pedagogy, and technology knowledge to better support technology integration in the classroom. To learn more about this framework, watch this short video from Common Sense Education.
- Substitution, Augmentation, Modification, Redefinition (SAMR): This model supports educators in thinking about the role of technology in education. Common Sense Education shares this short video describing this model.
- Triple E: This framework brings together educational technology research with teaching practice through evaluating tools related to Engagement in, Enhancement of, and Extension of learning goals.
- Passive, Interactive, Creative, Replacement, Amplification, Transformation (PICRAT) Technology Integration Model: This matrix-based model supports educators in reflecting upon their own technology integration practices.

For lesson plans specific to digital literacy, check out Common Sense Education's Digital Literacy & Well-Being Curriculum.

More information about these and other technology integration frameworks can be found in ODE's Digital Learning Instructional Design & Pedagogical Considerations guiding document.

## Accessibility with Technology

Technology used in the classroom should also be accessible to all learners. In 2024, the US Department of Justice created a new rule under Title II of the Americans with Disabilities Act that requires public schools to ensure that any web or app-based content that impacts students' opportunities complies with web content accessibility guidelines and standards by 2026 or 2027, depending on the school size.

Technology can also be used to support students with disabilities and language learners. For more information about assistive technology, contact the Oregon Technology Access Program. Advances in artificial intelligence have created opportunities to support students in ways they may not have had in the past, including advanced real time translation, speech-to-text, and myriad other possibilities.

## Additional Resources

- Makerspace Manual for K-12 Schools
- Youth Makerspace Playbook

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million Federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# FUNDING STEAM PROGRAMS

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# FUNDING STEAM PROGRAMS

This resource provides program, school, and district leaders, and educators resources and examples of how to fund STEAM programs.

## Funding Sources for STEAM Programs

STEAM education is one of the tenants of a well-rounded education, allowing for broad possibilities when it comes to funding. This resource provides some information about how to creatively think about funding STEAM programs and where to start looking for funding opportunities.

One benefit of implementing STEAM programs is that they do not need to be expensive or cost your school any additional funding. For example, getting outside and observing nature is a great free/low cost option. For technology related content, there are free computer science software programs like Scratch that can be implemented.

### ALIGNING FOR STUDENT SUCCESS

One option for funding STEAM programs is to incorporate them into your district's Aligning for Student Success applications. These applications combine reporting requirements for the following funding sources and initiatives, many of which are eligible for funding STEAM Programs:

- Continuous Improvement Planning
- Every Day Matters
- Career Connected Learning
- High School Success
- Student Investment Account
- Early Indicator and Intervention Systems
- Early Literacy Success School District Grants
- Career and Technical Education

### FEDERAL SCHOOL IMPROVEMENT FOR COMPREHENSIVE/TARGETED SUPPORTS

The following resources are available to support districts in their financial stewardship of funding a well-rounded education through these funding sources:

- Aligning for Student Success Section 3: Financial Stewardship
- Implementing with a Budget Shortfall (Supplemental Guidance)

For examples of how districts have funded STEAM programs using the funds above, please visit ODE's Student Success Act page.

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## ELEMENTARY AND SECONDARY EDUCATION ACT FUNDING

The Elementary and Secondary Education Act (ESEA) was signed into law in 1965, with the goal of improving educational equity for students by providing federal funds to school districts serving students experiencing poverty. ESEA is the single largest source of federal spending on elementary and secondary education, and was reauthorized in 2015 as the Every Student Succeeds Act (ESSA). More information about these funding programs can be found at Oregon's Elementary and Secondary Education Act Resources.

## CONNECTING WITH YOUR STEM/STEAM HUB

The Regional STEM Hub network in Oregon provides programming, professional development, mobile maker spaces, curricula, and support for STEAM programs, including funding opportunities. Each regional hub caters its offerings to the area which it serves. Connect with them to learn more.

Some STEM and STEAM hubs have compiled regional and national funding sources for schools and districts across the state. Check out these funding sources curated from their pages for specific projects or contact your STEM hub director for more ideas about local and regional funding opportunities!

- American Chemical Society (ACS)-Hach High School Chemistry Classroom Grant
- Center for Geography Education in Oregon (C-GEO) Grants
- Every Kid Outdoors Free Passes for Fourth Grade Students
- National Marine Sanctuaries Ocean Guardian School Grants
- Oregon Science Teachers Association Diack Ecology Education Program Grants
- Oregon Parks Forever Ticket to Ride Grants
- Oregon Chapter of the American Fisheries Society Grants
- Siletz Tribal Charitable Contribution Fund
- Spirit Mountain Community Fund
- Three Rivers Foundation Grants
- Toshiba America Foundation Grants
- Vernier Science Education Inspiration Grants

## STATEWIDE STEAM EDUCATION ORGANIZATIONS

These statewide educational support organizations provide resources, training, and opportunities to members and may be able to connect members with resources for funding STEAM programs.

- Oregon Computer Science Teachers Association (OCSTA)
- Oregon Science Teachers Association (OSTA)
- Oregon Council of Teachers of Mathematics (OCTM)
- Oregon Arts Education Association (OAEA)
- Oregon Music Education Association (OMEA)
- Oregon Theatre Educators Association (OTEA)
- Oregon Dance Education Organization (ODEO)

## NATIONAL STEAM EDUCATION ORGANIZATIONS

These national educational support organizations provide resources, training, and opportunities to members and may be able to connect members with resources for funding STEAM programs.

- Computer Science Teachers Association (CSTA)
- Educational Theatre Association (EdTA)
- National Science Teaching Association (NSTA)
- National Council of Teachers of Mathematics (NCTM)
- National Arts Education Association (NAEA)
- National Association for Music Education (NAfME)
- National Dance Education Organization (NDEO)

### ARTS INTEGRATION FOCUS: ARTS SPECIFIC FUNDING

Robust arts education is a driver of high-quality STEAM learning—but it requires sustained, intentional investment. From instruments and materials to teaching staff and community partnerships, funding supports the infrastructure that brings creativity to life in every discipline.

ODE's Funding Sources for Arts Programs resource helps schools and districts identify available funding streams to support and expand arts instruction. These sources can also be leveraged or in some cases, braided with additional funding sources, to strengthen interdisciplinary initiatives that place the arts at the center of innovation.

# Braiding Funding

A creative way to expand the use of funds is to consider braiding or blending funding sources to maximize the benefit of these funds for students. However, this process can be challenging. One of the most important elements to braiding funding sources is to consider the Supplement Not Supplant parameters of each funding source.

## SUPPLEMENT NOT SUPPLANT CONSIDERATIONS

- Districts and programs must show that federal funds did not replace state and local funding when administering a program (including summer programs).
- SIA funds are **not** subjected to the SNS rules and considerations.
- Title Funding sources are supplemental and must not supplant local, state or other federal funds. Districts will want to account for SNS provisions that apply to specific Title programs.

Next, consider the following steps when developing programs:

- Conduct a thorough needs assessment
- Identify Funding Streams
- Identify eligible populations and compare requirements
- Build integrated data systems
- Align requirements of funding streams
- Develop shared goals and plan for collaboration
- Build programs using multiple funding streams
- Develop governance structures

## SCENARIO FOR FUNDING A WELL-ROUNDED PROGRAM USING MULTIPLE FUNDING SOURCES

Listed below are some specific examples of STEAM activities that could be implemented in a school and how a school might fund them, given the scenario provided. A check mark ✓ below indicates that funding activities within the designated category may be possible, but further information should be considered. A circle with a line through it ⊘ indicates that the funding source may not be used for the designated category, but exceptions may exist. Please see more specific information about each funding source following the table to determine eligibility of use. For the funding sources listed in the table below, all sources other than SIA have Supplement Not Supplant requirements, and more details may be required to ensure proper use of these funds.

**Scenario: through the needs assessment process, the district heard the community identify a lack of student voice and choice within their education and a desire for richer connections between content learned and real world experiences.**

***The district has decided to implement a new steam-based career technical education (cte) pathway at the high school level, implement a career exploration rotation course at middle school level, and implement career-related experiences at the elementary level.***

### TABLE 2: ALLOWABLE FUNDING SOURCES FOR WELL-ROUNDED SCENARIO

| Activities | I-A[1] | II-A | III | IV-A | IV-B[2] | V-B | IDEA | SIA | HSS[3] | EIIS | Perkins |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Purchase of high-school curriculum approved for CTE STEAM-based Pathway** | ✓ | ⊘ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ✓ |
| **Professional Development for current educators for the high-school pathway content** | ✓ | ✓ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ✓ |

1 Title I-A funds are only allowable in Title I-A buildings, and activities must be aligned to the school-level plan.

2 Title IV-B funds require that all activities take place in the hours when school is not in session and according to the grantees' approved award application.

3 HSS funds may only be used for 8th grade and above and for opportunities that are new since December 8, 2016.

| Activities | I-A[1] | II-A | III | IV-A | IV-B[2] | V-B | IDEA | SIA | HSS[3] | EIIS | Perkins |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Hire an additional teacher for the new course** | ✓ | ⊘ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ⊘ |
| **Purchase or Pay for Translation of course content so that it is accessible for multilingual students and students requiring accommodations** | ⊘ | ⊘ | ✓ | ⊘ | ✓ | ✓ | ✓ | ✓ | ✓ | ⊘ | ⊘ |
| **Purchase classroom materials for new middle school courses** | ✓ | ⊘ | ⊘ | ✓ | ⊘ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ⊘ |
| **Extend middle school career exploration opportunities into the migrant summer learning program** | ⊘ | ⊘ | ✓[4] | ⊘ | ✓ | ⊘ | ⊘ | ✓ | ✓ | ⊘ | ✓ |
| **Purchase online supplemental curriculum for middle school courses** | ✓ | ⊘ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ⊘ |
| **Pay for transportation costs for a job site visit, as part of the middle school career exploration program** | ✓ | ⊘ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ✓ | ⊘ | ⊘ |
| **Contract with and pay for services for a job professional to come into the elementary classroom weekly** | ✓ | ⊘ | ⊘ | ✓ | ✓ | ✓ | ⊘ | ✓ | ⊘ | ⊘ | ✓ |

4 Please follow Title III guidelines for students that are identified English Learners under Title III.

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# SUPPORTING TEACHERS & DEEPENING PARTNERSHIPS

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# SUPPORTING TEACHERS & DEEPENING PARTNERSHIPS

This resource provides program, school, and district leaders, educators, and community members with:

- Strategies to Align Programming for Effective STEAM Learning
- Professional Development Opportunities for educators to Strengthen STEAM Implementation
- Information on how to Partner with Local STEM/STEAM Hubs
- Examples of Partnering with Business/Industry to Incorporate Career Connected Learning

## STEAM Teams: Coordinating Teacher Collaboration across Content Areas

A critical component to STEAM education is cross-content instruction. To allow for this kind of coordination and alignment of standards, it is imperative to create time for educators to collaborate across content areas. Listed below are some scheduling considerations to allow for this time, as well as how to structure/organize this time.

### GRADING AND STAFF DEVELOPMENT DAYS

Using grading days or staff development days is an option for staff to connect and collaborate and is useful for connection/collaboration when content and curriculum has already been aligned and does not require as much time to build or adjust.

- Benefits of this Schedule: Does not require a major shift to the student's or school's schedule; Allows for school-wide collaboration. Eliminates costs of substitutes.
- Structuring Time: Because these days are limited in the calendar year, it is important to structure this time in a way that focuses on the discussions and collaboration required for this synchronous time and then allows for asynchronous connections to occur throughout the school year. Early agreements and buy-in from building administration is supportive in structuring time, to avoid confusion and misunderstandings about these critical intervals and how they are being leveraged.



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## ALIGNING PREP PERIODS

When structuring a STEAM-based system that aligns only two content areas, it is possible to align prep periods for educators so that collaboration can occur during these times.

- Benefits of this Schedule: Does not require a major shift to the student's or school's schedule; Allows schools to start small and practice STEAM education without moving directly into school-wide implementation.
- Structuring Time: Time can be used to develop or revise lesson plans, plan for future connections/collaborations, review aligned standards, and check-in on student learning and understanding of key concepts.

## LEVERAGING TEACHER COLLABORATION TIME

Some schools have time set aside for teacher collaboration. This type of schedule is the most supportive for encouraging school-wide cross-content instruction and alignment.

- Benefits of this Schedule: Regular, recurring and frequent meeting time to align standards and build out curriculum/content; Helpful for school-wide project-based learning.
- Structuring Time: Because this time is regular and recurring, it is helpful to set up a standard, organized structure for this time with recurring, real-time items, such as feedback, problems of practice, and collaborative planning time for upcoming lessons.

## ASSIGNING TOSAS

Some schools may have the opportunity to hire or assign Teachers on Special Assignment (TOSAs) to work together and develop a STEAM-based curriculum or approach to support educators. This method could be paired with any of the scheduling considerations above to better support school-wide STEAM integration.

## PURPOSE DRIVEN THEMES TO INSTRUCTION

Consider engaging a cross-content teacher team or instructional leadership team in developing a scope and sequence of themes for instruction across content areas. This alignment can create natural intersections and opportunities for deeper learning and authentic experiences that are supported by students' content knowledge in multiple disciplines.

## CTE PATHWAY ALIGNMENT

Perkins Professional Development: CTE programs funded by Perkins are required to engage in annual professional development (PD). These opportunities can be facilitated in multiple ways, some of which mirror those listed above. Additionally, pathway meetings, community college alignment meetings, and other PD opportunities can include or be designed to support STEAM concepts being included or reinforced in CTE programs.

Many CTE programs of study benefit from community partnerships. Intentional engagement with regional CTE programs from STEAM Hubs, local industry partners, and community colleges create a community-focused approach to STEAM education. Utilizing regional programs around maker spaces, labs, and workshops helps create valuable resources for students and STEAM-focused initiatives. These resources are often supported through CTE funding but have cross-cutting functionality for STEAM programs and projects.

# Cross-Content Teams and Teacher Collaboration Structures

STEAM Instruction is centered around teaching standards for more than one content area. To achieve this well, it is important for teachers from multiple content areas to collaborate on the curriculum. Listed below are various levels of collaboration and engagement, based on the learning goals and scope of implementation.

## PROJECT-BASED COLLABORATION (SHORT-TERM)

A school may choose to collaborate based on specific projects happening within a school or grade level.

- Planning Time Required: Low
- Instructional Time Required: Minimum
- Primary Goal: Engage students & center student voice & choice

## STANDARDS-BASED COLLABORATION (SHORT/LONG-TERM)

A standards-based collaboration can take many forms and is used to support either a broader range or deeper understanding of specific standards within content areas.

- Planning Time Required: Low - High, depending on how many standards
- Instructional Time Required: Low - High, depending on how many standards
- Primary Goal: Use instructional time efficiently to teach multiple standards from several content areas together and allow for deeper understanding of specific standards that might require more learning time or various approaches to learning

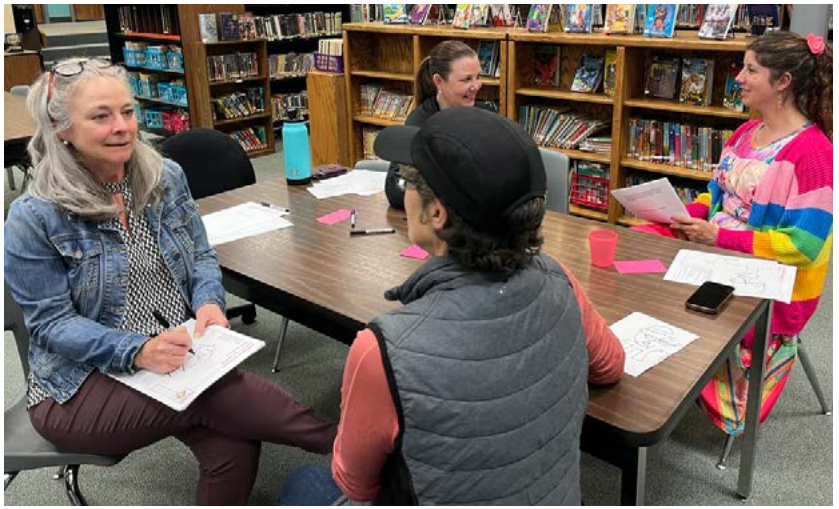
## SCHOOL-WIDE COLLABORATION (LONG-TERM)

A school-wide collaboration is a long-term change in practice that uses both a project- and standards-based approach to deliver STEAM instructional practices throughout the school and schoolyear.

- Planning Time Required: High & Regularly Occurring
- Instructional Time Required: High
- Primary Goal: Effectively teach multiple content areas together to engage students, allowing for student agency, and efficiently using instructional time to teach all required standards

# Planning for Teacher Professional Development

Teaching within a STEAM environment may be new to many educators, and teaching outside of their own content specialty may be intimidating. To support this structure, it is important to allow time for educators to have professional development in cross-content instruction, project-based learning strategies, and performance-based assessment, accompanied by supportive professional development in culturally responsive teaching, linguistically inclusive strategies, and trauma informed practices. Undoubtedly, this is a lot for educators to prioritize, so it is beneficial to create a culture of trust and learning amongst educators and build professional development into the yearly schedule through ongoing learning, rather than one-time trainings. Listed below are some examples of professional development opportunities:



## SYNCHRONOUS LEARNING OPPORTUNITIES

- Rural STEAM Leadership Network: This network is a partnership between seven Oregon STE[A]M Hubs who are interested in learning more about, and also investing deeply into, the rural districts and communities that they serve. Educators can sign up for regular, virtual learning opportunities.

## BLENDED LEARNING OPPORTUNITIES

- Engaging Equity: Equitable Mindsets, Practices, and Systems Training: Although not specific to STEAM, this recently developed training encourages district and school leaders to implement an equity-focused environment through synchronous and asynchronous opportunities.

## OTHER PROFESSIONAL DEVELOPMENT RESOURCES

- Learning Dimensions of Making and Tinkering: A professional development tool for educators: Educators can use this framework to notice, support, document, and design assessments for student learning—and to reflect on how their tinkering environment, activities, and facilitation may have supported or impeded such outcomes.
- Recommendations from the Castek et al. (2019) STEAM Whitepaper:
  - Engage educators in science learning in practice
    - For learning to be local, include community-embedded PD that teaches teachers about local knowledges and practices
  - Cultivate new "ethos" toward learning
    - Values collective intelligence, open and fluid space, and participation-focused production that uses tools for mediating and relating. Successful professional learning in innovative STEAM learning environments often explicitly engages educators in play (Peterson & Scharber, 2017) and collaboration (Frank et al., 2011).

  - Support understandings of teaching as design
    - "The new teacher…(a) is a purposeful learning designer, rather than (just) a curriculum implementer…(b) is comfortable working with learners in new, multimodal, online social media spaces… (c) engages their learners' identities and harnesses lateral knowledge-making energies amongst learners…(d) manages a multifaceted learning environment in which learners may be engaged in a variety of different activities simultaneously… [and] (e) is a practitioner-researcher, building and interpreting the evidence base of pedagogical inputs in relation to learner outcomes…" (Kalantizis & Cope, 2010, p. 205).

# Partnering with STEM & STEAM Hubs

Oregon's Regional STEM/STEAM hubs are an excellent source of information, resources, and support, providing the connecting link between schools, business/industry, community-based partners, and families. If your school would like to incorporate more STEAM opportunities, connecting with your Regional STEM/STEAM hub may be the first step. You can find out more information about which hub coordinates programs in your region and how to contact them by going to the Oregon STEM website.

# Building Connections to Out-of-School Partners and Industry

The Regional STEM/STEAM hubs are a great place to start when connecting with your local out-of-school partners and business/industry. In addition to this, there are many business/industry partners and out-of-school partners who have programming and other opportunities for schools:

## CAREER CONNECTED LEARNING

Career connected learning opportunities can be a synergistic pairing with STEAM learning experiences, providing students with real world experiences and examples of people in their community who are engaging in and applying the skills that they are developing.

- Career Journey Video Series shares stories of young Oregonians and their path to a specific career. Each video has a short and long version and supporting documentation. There is also a guide within the series that identifies core subject alignment and/or pathway areas related to the specific video so that teachers can easily identify which videos would work well in their class.
- Oregon Employability Skills curriculum helps students develop the work related or "soft skills" necessary for success at work. The curriculum is available for multiple ages and in several formats. These skills complement the technical knowledge that students develop within specific courses. Students can also earn badges to demonstrate mastery of the concepts.
- Career Connect Oregon is a one stop resource hub with multiple materials and resources available to assist teachers and learners. Information is arranged by career connected domains of awareness, exploration, preparation and training. There are some great pathway resources in the student section that help learners identify the skills and knowledge necessary in specific career areas. Families and business and industry partners will also find resources on the site to assist them in supporting students.
- The Career Connected Learning Toolkit provides information and resources to support both elementary and secondary students with preparing for future careers.

### WALDPORT HIGH SCHOOL AND OREGON COAST AQUARIUM

Philip Reed, Computer Science and CTE Visual Arts and Communications instructor at Waldport High School partnered with the Oregon Coast Aquarium to help students explore a wide range of careers in operating a coastal aquarium, utilizing various technologies including Adobe Suite, cameras, 3D printing, and laser engraving. Some students created apps for the aquarium, including a map-based animal information app, an online ordering platform for the cafe, and maps that marked areas for special needs and over-stimulated guests.

## INTERNSHIPS/EXTERNSHIPS

Connecting with business and industry allows students to have internship or externship opportunities and potentially earn credit for these options. It can also enrich career connected learning for students. While well placed in high schools, connecting to business and industry is helpful for younger students as well, allowing students to explore career options and broadening their interests. Job shadow and internship programs are implemented by most of the STEM/STEAM Hubs, some of which come with compensation for either time, travel, or both. A few examples of Hub-led programs are:

- Frontier STEM Hub: Malheur Works program
- Mid-Valley STEM-CTE Hub: Educator Externship Program
- Columbia Gorge STEM Hub: Educator-Industry Match Making & Advanced Manufacturing Educator Externship
- Greater Oregon STEM Hub: Externship Opportunities
- Portland Metro STEM Partnership: Teacher Externships
- South Metro-Salem STEM Partnership: Educator Externships

### ARTS INTEGRATION FOCUS: TEACHING ARTIST PARTNERSHIPS

Inviting teaching artists with deep expertise in their arts medium to schools helps support cross-content instruction including the arts, especially when educators do not have content level expertise in certain arts domains or specific techniques.

The Oregon Arts and STEAM Education Organization Lookup Tool provides a list of arts and STEAM organizations across the state of Oregon, categorized by region and subject. These organizations can connect schools with teaching artists to provide access to arts learning, arts residencies, performances and authentic arts experiences as a part of STEAM learning. More information about this option is available in the Arts Access Toolkit, in Supporting Arts Educators, Teaching Artists, and Arts Organizations.

## OUT-OF-SCHOOL (BEFORE/AFTER SCHOOL OR SUMMER) LEARNING

There are many organizations that support out-of-school learning. A good place to start is to connect with Oregon ASK. There is also great opportunity and connection to place-based learning within out-of-school opportunities. More information about summer learning specifically, can be found in the Summer Learning Toolkit.


## COMMUNITY BASED ORGANIZATIONS

Connecting with community-based organizations is an excellent way to promote Project-Based Learning that connects to the needs of your local community. Partnering with community-based organizations also supports culturally responsive educational practices.

# Finding Programs and Organizations

- Oregon Arts and STEAM Education Organization Lookup Tool
- Science Near Me Lookup Tool
- STE/A/M Statewide Partnership Map

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WELL - ROUNDED ACCESS PROGRAM

# STEAM INSTRUCTIONAL PRACTICES

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# STEAM INSTRUCTIONAL PRACTICES

*"...children's minds and experiences are not compartmentalized by subject matter, like elementary school schedules often are"*

-from Rise and Thrive with Science: Teaching PK-5 Science and Engineering

This resource provides educators with recommendations and promising or best practices in STEAM pedagogy and instruction.

## Effective STEAM Teaching

Teaching STEAM integrates standards from multiple areas, allowing students to explore concepts in a connected, meaningful way. Through hands-on projects and authentic problem-solving, students see how multiple subjects intersect, gaining a deeper understanding and developing critical thinking, creativity, and collaboration skills — all essential for tackling complex challenges they'll encounter in life.

Science and Engineering in Preschool Through Elementary Grades: The Brilliance of Children and the Strengths of Educators (2022) describes this concept well:

*"Children use both language and literacy and mathematics (and other content areas) as they engage in science and engineering. They talk, sketch, draw, and write as they observe, design, and communicate their thinking. Additionally, they draw on texts (including diagrams, television shows, and simulations) constructed by others as they ask questions and develop explanations."*

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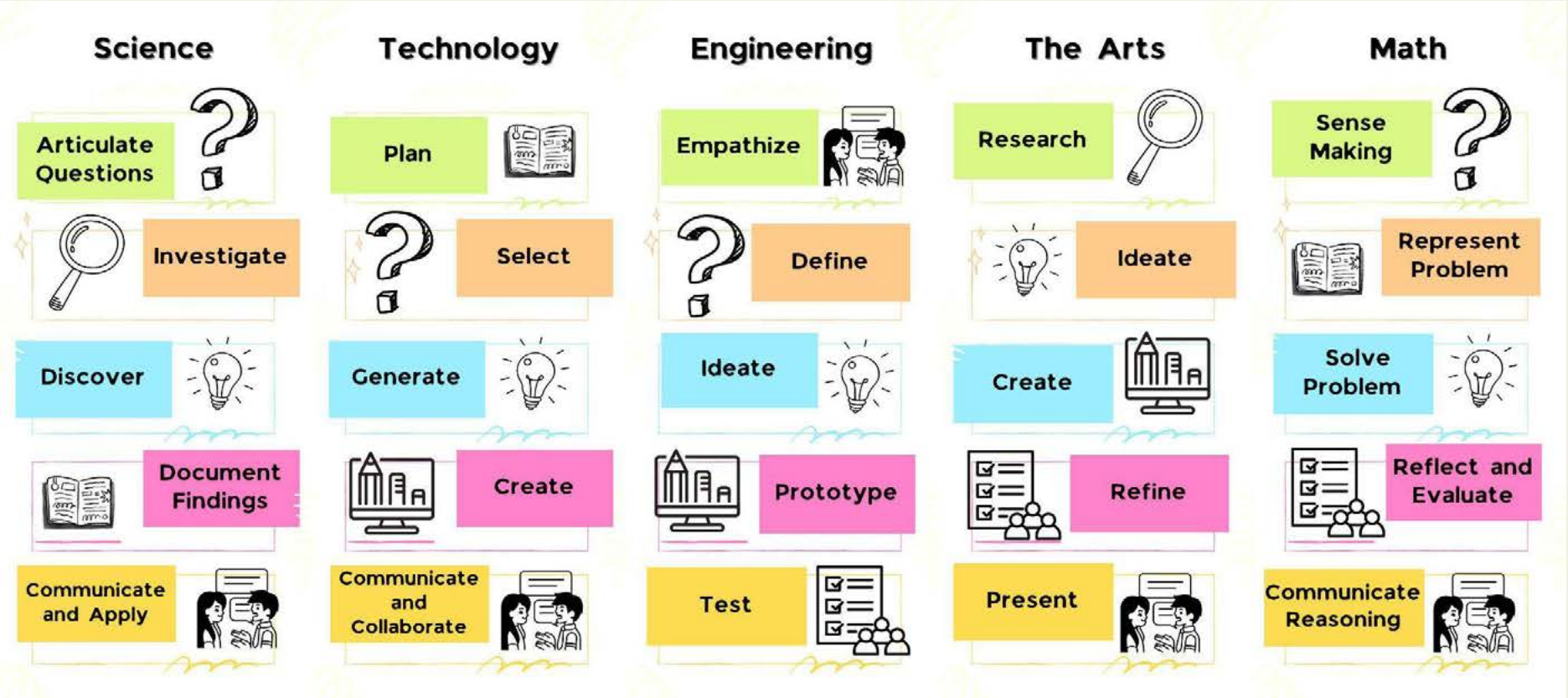
Science, Technology, Engineering, the Arts, and Math all have processes in common that lead to the development of effective solutions to complex problems. These processes may occur in a different sequence, but generally follow a similar pattern, as highlighted in Figure 1.

**FIGURE 1: STEAM CONTENT AREA PROCESSES**



Familiarizing students with these processes or practices supports their development of complex thinking and problem-solving skills. For example, the student-facing resource in Figure 2, created by Hillsboro School District educators, offers guiding questions to help students identify mathematical practices when stuck on a problem. Encouraging metacognition helps students build perseverance, understand problem structure, and generate their own prompts and strategies to support creative solutions.

### TABLE 3: STUDENT QUESTIONS TO SUPPORT MATHEMATICAL PRACTICES

| Math Practices | Make sense of problems and persevere in solving them | Reason abstractly and quantitatively | Construct viable arguments and critique the reasoning of others | Model with mathematics |
|---|---|---|---|---|
| **Question Bank** | ▪ What is the problem asking?<br>▪ How will you use that information?<br>▪ What other information do you need?<br>▪ Why did you choose that operation?<br>▪ What is another way to solve that problem?<br>▪ What did you do first? Why?<br>▪ What can you do if you don't know how to solve a problem?<br>▪ Have you solved a similar problem?<br>▪ Describe what you already tried. What might you change?<br>▪ How do you know your answer makes sense?<br>▪ How else might you organize…represent… show…? | ▪ What other operation or property could you have used to represent this situation?<br>▪ What properties did you use to find the answer?<br>▪ How do you know your answer is reasonable?<br>▪ What do the numbers or variables used in this problem represent?<br>▪ What is a situation that could be represented by this equation? How is ____ related to ____?<br>▪ What is the relationship between ____ and ____?<br>▪ What does____ mean to you? | ▪ Will that method always work?<br>▪ How do you know your answer is correct?<br>▪ What do you think about what they said?<br>▪ Who can tell us about a different method?<br>▪ What do you think will happen if ____?<br>▪ When would that not be true?<br>▪ Why do you agree/disagree with what they said?<br>▪ How does that drawing support your work?<br>▪ What mathematical evidence would support your solution?<br>▪ How could you prove that ___?<br>▪ What were you considering when___?<br>▪ Did you try a method that did not work? Why didn't it work?<br>▪ If I told you I think the answer should be (offer a wrong answer), how would you explain to me why I'm wrong? | ▪ Why is that a good model for this problem?<br>▪ How can you use a simpler problem to help you find the answer?<br>▪ What conclusions can you make from your model?<br>▪ How would you change your model if___?<br>▪ What are some ways to visually represent the problem situation,<br>▪ e.g., picture, numbers, diagrams, graphs, tables?<br>▪ What is an equation or expression that matches the diagram, number line, chart, table, etc…?<br>▪ How would it help to create a diagram, graph, table, etc…?<br>▪ What are some ways to visually represent ___? |

# Planning for Effective Content Integration in Instruction

*"Effective integration involves more than making superficial connections between subjects or tacking on an incidental task from another content area. It goes beyond having students read books or passages about science topics during circle time or creating graphs during science investigations. Effective integration leverages the connections between subjects to energize learning in both areas while also attending to children's learning in each subject."*

(Kober et al., 2023, p. 183)

Recognizing the relationship between subject areas presents one instructional challenge, while effectively integrating and teaching multiple subjects within a classroom setting presents another. The challenges involved differ by grade level, content area, and the focus of a particular unit or project; however, there are some principles that bridge different contexts in education that can be applied to any opportunity for content integration in the classroom.

For example, the Scarborough Reading Rope highlights the interconnected components of skilled reading, such as background knowledge, vocabulary, and verbal reasoning. These literacy skills are deeply intertwined with STEAM (Science, Technology, Engineering, Arts, and Math) disciplines, as both reinforce each other in the following ways:

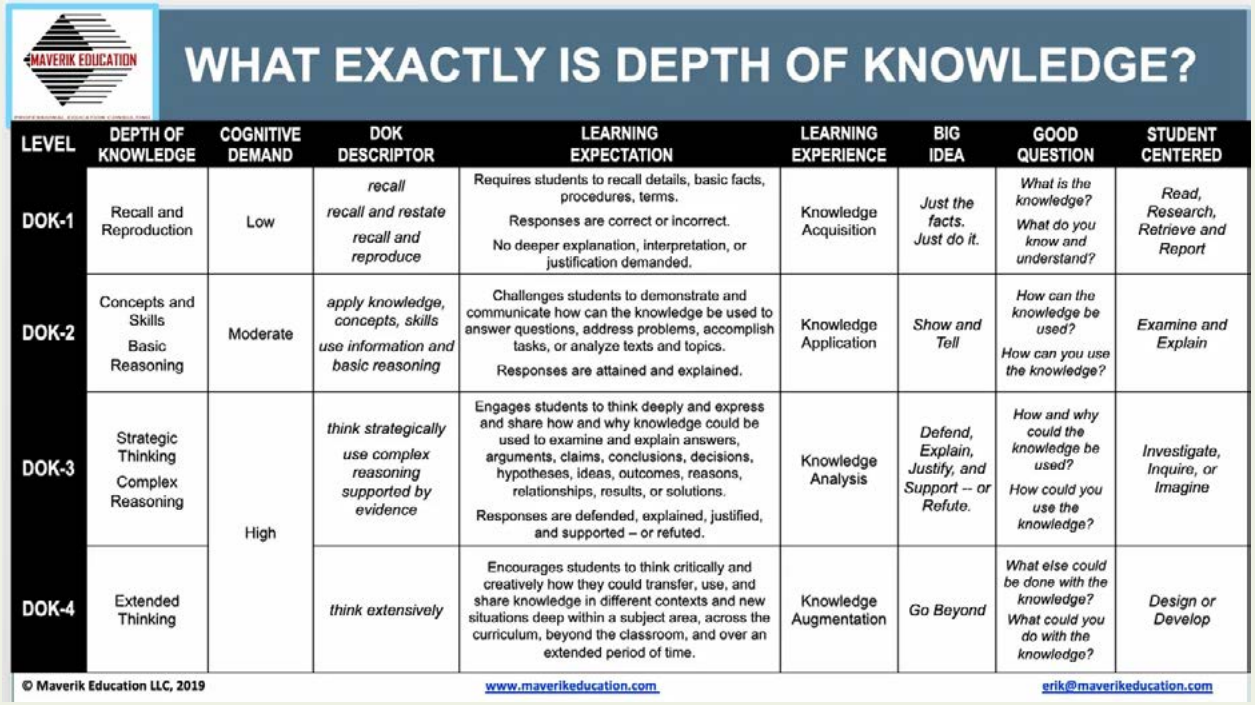
- **Science:** Students analyze data, read and interpret informational texts, and write detailed explanations of scientific processes, enhancing vocabulary and comprehension.
- **Technology:** Using digital tools to gather, organize, and present information strengthens technical literacy while encouraging students to engage with and understand complex text and communicate their ideas in multiple ways.
- **Engineering**: Designing and building models demands the ability to read technical diagrams, follow instructions, and write or present findings clearly.
- **Arts:** Creative projects, such as designing infographics or communicating the results or conclusions of a project through an artistic medium, integrate artistic expression with written and verbal reasoning to communicate ideas effectively.
- **Math:** Applying mathematical reasoning to solve real-world problems requires precise reading of word problems, writing solutions, and verbalizing thought processes.

By connecting STEAM pedagogy to existing models and frameworks that are already used in their educational setting, educators can help students see how foundational skills are essential for success in every discipline, fostering a well-rounded and practical approach to learning.

## PRINCIPLES FOR EFFECTIVE CONTENT INTEGRATION[1]

- Engage children in **investigation and design** experiences that draw on multiple subjects.
- Make **integration explicit** when designing classroom resources and teaching strategies - so students have an understanding of how their learning experience is integrated.
- **Continue to support children's knowledge in individual subjects.** Each individual content area has its own skills, core ideas, and practices that need to be developed in a systematic way.
- Recognize that **more integration is not necessarily better.** Integrate with purpose and intention - single discipline, multi-disciplinary, interdisciplinary, and transdisciplinary approaches each work best in different instructional situations. Avoid adding additional subject standards into a lesson if they will not be fully taught with the depth needed for students to truly grasp the skill at hand.

**FIGURE 3:** Webb's Depth of Knowledge (DOK)




| LEVEL | DEPTH OF KNOWLEDGE | COGNITIVE DEMAND | DOK DESCRIPTOR | LEARNING EXPECTATION | LEARNING EXPERIENCE | BIG IDEA | GOOD QUESTION | STUDENT CENTERED |
|---|---|---|---|---|---|---|---|---|
| DOK-1 | Recall and Reproduction | Low | *recall*<br>*recall and restate*<br>*recall and reproduce* | Requires students to recall details, basic facts, procedures, terms.<br>Responses are correct or incorrect.<br>No deeper explanation, interpretation, or justification demanded. | Knowledge Acquisition | *Just the facts. Just do it.* | *What is the knowledge?*<br>*What do you know and understand?* | *Read, Research, Retrieve and Report* |
| DOK-2 | Concepts and Skills<br>Basic Reasoning | Moderate | *apply knowledge, concepts, skills*<br>*use information and basic reasoning* | Challenges students to demonstrate and communicate how can the knowledge be used to answer questions, address problems, accomplish tasks, or analyze texts and topics.<br>Responses are attained and explained. | Knowledge Application | *Show and Tell* | *How can the knowledge be used?*<br>*How can you use the knowledge?* | *Examine and Explain* |
| DOK-3 | Strategic Thinking<br>Complex Reasoning | High | *think strategically*<br>*use complex reasoning supported by evidence* | Engages students to think deeply and express and share how and why knowledge could be used to examine and explain answers, arguments, claims, conclusions, decisions, hypotheses, ideas, outcomes, reasons, relationships, results, or solutions.<br>Responses are defended, explained, justified, and supported – or refuted. | Knowledge Analysis | *Defend, Explain, Justify, and Support -- or Refute.* | *How and why could the knowledge be used?*<br>*How could you use the knowledge?* | *Investigate, Inquire, or Imagine* |
| DOK-4 | Extended Thinking | | *think extensively* | Encourages students to think critically and creatively how they could transfer, use, and share knowledge in different contexts and new situations deep within a subject area, across the curriculum, beyond the classroom, and over an extended period of time. | Knowledge Augmentation | *Go Beyond* | *What else could be done with the knowledge?*<br>*What could you do with the knowledge?* | *Design or Develop* |

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- **Provide appropriate levels of questioning and engagement for all students.** Move beyond the goals of recall, basic application, and completion to strategic and extensive thinking, by including questions that engage a varied depth of knowledge (DOK) (see Webb's Depth of Knowledge in Figure 3).
- **Design using multiple means of engagement, representation, action, and expression.** Designing instruction with the Universal Design for Learning Guidelines in mind helps ensure the content is accessible for all students.

1 Modified from Kober, N., Carlone, H., Davis, E.A., Dominguez, X., Manz, E., & Zembal-Saul, C. (2023). Rise and Thrive with Science: Teaching PK-5 Science and Engineering. p 183. Washington, DC: The National Academies Press. https://doi.org/10.17226/26853

## Setting Learning Targets that Address Complexity

When setting learning targets for STEAM learning opportunities, it's important to distinguish between tasks that simply require effort and those that engage students in meaningful thought and problem-solving. One way to ensure that your students have the opportunity to apply thought effort to a task is to use a structure that encourages complexity when setting targets: Create a ____ that ____ and _____. (Stambaugh, Fecht & Mofield, 2015)

For example, asking students to "draw a modern building" involves effort, but a more rigorous target would challenge them to "create a modern building that includes a worm's-eye-view and bird's-eye-view and incorporates details to create atmospheric perspective." Similarly, rather than simply building a Rube Goldberg machine, students could be asked to "design and build a Rube Goldberg machine that transfers energy using six simple machines and two examples of innovation." Learning targets that require thought effort push students to apply higher-order thinking skills, integrate multiple concepts, and demonstrate deeper understanding—all of which are essential for developing college- and career-ready learners.

### ANALYZING AND ALIGNING STANDARDS ACROSS CONTENT AREAS

Aligning standards across multiple content areas can be a complex process, and it may be helpful to review some integrated lessons before designing your own. The following example illustrates the activities in a STEAM-based instrument design unit and lists the integrated standards. Noting the depth of knowledge requirements across aligned standards can ensure that students are deeply engaging with and developing their skills equally across multiple standards areas, a hallmark of effective STEAM instruction.

## CURRICULUM EXAMPLE: STEAM INSTRUMENT DESIGN UNIT OVERVIEW

- Middle school students study the physics of sound waves by using musical instruments to analyze and interpret the work of musicians who have created and utilized different instruments across various cultures and historical periods. They highlight the contrasting sounds of different instrumental combinations and scales and provide reasoning behind such differences based on historical and cultural context.
- Students analyze the physical properties that lead to the difference in sound between various instruments. Students engage in design thinking and prototype various possible designs for a new instrument.
- Builds towards the following standards:

### MUSIC

- Standard: MU.5.RE1.8
  - 2. Compare how the elements of music and expressive qualities relate to the structure within programs of music.
  - 3. Identify and compare the context of programs of music from a variety of genres, cultures, and historical periods.
- Standard: MU.8.RE2.8
  - 1. Support personal interpretation of contrasting programs of music and explain how creators' or performers' apply the elements of music and expressive qualities, within genres, cultures, and historical periods to convey expressive intent.

### OREGON SOCIAL SCIENCE STANDARDS (2024)

- Standard: 8.27
  - Determine and explain the importance and contributions (products, events, actions, and ideas) of key people, cultures, and ethnic groups, religious groups, and other historically underrepresented groups in Oregon, the United States, and the world.
- Standard: 8.36
  - Construct explanations using reasoning, correct sequence, examples, and details with relevant information and data while acknowledging the strengths and weaknesses of the explanations.

### SCIENCE

- Standard: MS.ETS1.1
  - Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- Standard: MS.ETS1.2
  - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- Standard: MS.ETS1.3
  - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Standard: MS.ETS1.4
  - Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- Standard: MS-PS4-1
  - Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- Standard: MS-PS4-2
  - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

OpenSciED offers this STEAM lesson about Sound Waves as a place to start! Take a look at the lesson and think through how you would align standards from different areas into the learning opportunity. In "additional unit information," the "cross-cutting concepts" section can help provide some ideas of where to begin.

## LITERACY AND STEAM

Incorporating STEAM practices into literacy instructional design can support strong literacy instruction. This Literacy and STEAM resource provides more information related to literacy and transdisciplinary instructional practices. In addition, Oregon's Adolescent Literacy Framework emphasizes the importance of purposeful reading, writing, speaking, and listening across all content areas. Embedding literacy strategies in STEAM instruction ensures that students can access, process, and communicate complex ideas—skills essential for both STEAM success and lifelong learning. Educators are encouraged to integrate literacy goals into their STEAM planning to deepen comprehension, support language development, and foster student voice through multiple modes of expression.

- Oregon's Early Literacy Framework
- Oregon's Adolescent Literacy Framework
- Adolescent Literacy Framework Resources

STEAM instruction is complex, and the learning that follows is deep and rewarding. Taking the extra time to align standards with intention can lead to meaningful learning experiences for students and is well worth the effort and time. It often takes a team of teachers and other education professionals to develop complex STEAM units. For more information about support for instructional design, see the Supporting Teachers and Deepening Partnerships resource.

Additional resources to support integrated instruction:

- ODE's Arts and Social Sciences Standards Crosswalk
- ODE's English Language Proficiency Relationships and Convergences
- Mathematical Modeling and Reasoning, included as part of the Oregon Math Project
- ODE's Tribal History/Shared History Lesson Plans include multiple lessons that center indigenous knowledge and integrate standards from various content areas, such as this fourth grade lesson "Salmon and the River"

## ARTS INTEGRATION FOCUS: EXPANDING THE "A"

Texts in today's world are more than books, articles, and the written word. Contemporary media both demands a deep understanding of multiple literacies and expands literacies beyond traditional texts. Connecting to and interpreting visual artworks, film, music, or digital media as text can provide natural points for integrating the arts, technology, and humanities subjects into STEAM learning.

These resources provide additional information and resources around integrating multiple literacies into STEAM instruction:

- Literacy in Visual Art Education: Art as Text from the Arts Education Partnership
- Art as Text from Achieve the Core
- Art as Text: Bridging Literacy and the Arts from Edutopia
- The Oregon Arts Group includes many resources that expand connections to multiple literacies, such as this High School Lesson, Bomba: Género de música

# The Dynamic STEAM Classroom

Imagine stepping into a dynamic STEAM classroom, where curiosity sparks innovation and learning feels alive with possibility. The teacher serves as a facilitator, guiding inquiry, encouraging exploration, and prompting students to think critically and creatively. Instruction is purposeful and responsive — posing thoughtful questions, scaffolding complex concepts, and creating space for students to iterate, reflect, and grow.

What does it sound like? What does it look like? Noise, mess, and complexity are a part of exploration, iteration and innovation - and both teacher and students know that it's not about getting it right the first time, and that the process might get a bit messy. This environment fosters a culture of discovery, where students are empowered to take risks, embrace challenges, and connect their learning to the world beyond the classroom. What universal life skills does this environment teach students? How can students be provided with the most opportunities to develop their navigational skills for real world problems and careers?

## SUPPORTING ALL STUDENTS IN STEAM INSTRUCTION

To ensure that all students have access to high quality STEAM learning experiences, provide access points, supports, challenges, and topics of interest that engage a wide range of unique learners. The Universal Design for Learning resources provide some examples and ideas for what this may look like. Designing using multiple means of engagement, representation, action, and expression is a helpful place to start. For example, collaborating on classroom norms, setting up stations for learning, and applying total physical response opportunities are all instructional moves that can open up the world of STEAM for learners.

Oregon's Transformative SEL Framework & Standards emphasize understanding oneself within the community and society, aiming to build skills for addressing inequities and fostering positive change. Center in these standards and practices to create inclusive STEAM learning environments where students and adults feel affirmed, develop agency, and collaborate to improve society.

Consider using the Zero Barriers in STEM Education Accessibility & Inclusion Workbook from the Smithsonian Science Education Center for more examples of research-based instructional moves to ensure access to STEAM learning for all students.

## STEAM, 21ST CENTURY SKILLS, AND ESSENTIAL SKILLS

This dynamic STEAM environment fosters the development of 21st century skills such as critical thinking, creativity, collaboration, and communication. In alignment with these goals, Oregon has identified a set of Essential Skills that closely relate to 21st century competencies and can be seamlessly integrated into STEAM learning experiences. These Essential Skills serve as valuable process tools that prepare students to achieve their postsecondary goals. Because they span academic disciplines and are embedded within content standards, they naturally support interdisciplinary learning. The following recommendations highlight opportunities within STEAM environments to intentionally cultivate these essential skills.

## RECOMMENDATIONS FOR 21ST CENTURY SKILLS OR ESSENTIAL SKILLS DEVELOPMENT

- **Start small** - collaborative projects are complex. Consider piloting lessons or collaborative activities with just one class or a shorter activity, to test out what supports are needed for students to engage fully.
- **Set clear priorities and expectations with students** about the results of collaborative projects. While students may have different roles in a project, ensure they all have opportunities to engage deeply with the content at all levels of knowledge, so they all experience valued contribution.
- **Utilize organizational structures** to help streamline collaborative work within the classroom. For instance, students may keep and return to a journal at the beginning and end of each lesson or have another way to track their progress in whatever role they take in their work or project.
- **Track student questions** as you learn together, to provide natural opportunities for inquiry and exploration.
- Consider framing your STEAM learning time with a process that students can track - for example, the engineering design process or artistic design process.
- You may choose a few common discussion protocols to return to, so students can have some guided practice to support their collaborative work.
- **Demonstrate collaboration** by connecting with local, national, and global partnerships or opportunities. Schedule in collaborative opportunities throughout the year and consider regular check-ins with other educators, experts in the community, industry, and teaching artists.
- **Reflect with your students** about how your STEAM learning went. What worked well for students? What could you do differently to improve and iterate for the next opportunity?

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million Federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# STEAM ASSESSMENT AND GRADING PRACTICES

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# STEAM ASSESSMENT AND GRADING PRACTICES

This resource provides program, school, and district leaders and educators with recommendations and resources for assessment and grading practices within STEAM education.

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## STEAM Assessment Practices

Within STEAM instruction, assessing student learning occurs at multiple levels. While summative tests are critical to increasing equity and excellence at the state, district, and school levels, they cannot answer all educational questions at every level within the educational system (student-classroom-school-district-state). Nor can they inform minute-to-minute, day-to-day, and week-to-week instructional decisions. A world-class educational system needs to effectively incorporate **assessment for learning**, such as formative assessment practices and appropriate uses of interim assessment tools, rather than overemphasizing **assessment of learning**, such as statewide summative tests (Oregon Department of Education, 2019).

Only a balanced approach to assessment can meet the differing informational needs of students, families, teachers, district and state administrators, and others. For a full explanation of a balanced assessment system, please review the Right Assessment for the Right Purpose Guidance Document.

## FORMATIVE ASSESSMENT PRACTICES

Formative assessment is a planned, ongoing process used by all students and educators during learning and teaching to elicit and use evidence of student learning to improve student understanding of intended disciplinary learning outcomes and support students to become self-directed learners. Effective use of the formative assessment process requires students and educators to integrate and embed the following practices in a collaborative and respectful classroom environment:

- Dimension 1: Clarify Learning Goals and Criteria for Success
- Dimension 2: Elicit evidence of Student Learning
- Dimension 3: Interpret Evidence to Determine Next Steps
- Dimension 4: Act by Providing Feedback and Adjusting Instruction

Formative assessment practices are woven into instructional time to ensure students are learning standards across multiple content areas. Educators can gather meaningful evidence of student understanding through a variety of tasks and activities, including open-ended or differentiated activities. Well-designed tasks aligned with learning goals provide opportunities to assess student thinking individually, collaboratively, or in small groups (Wylie & Lyon, 2022). Examples of tasks that elicit evidence of learning for formative purposes include:

- **Journaling**, to help students make connections and track daily learning;
- **Small Group Discussions**, where small groups compare and reach consensus on predictions after observing phenomena.

These practices not only enhance the learning experience but also provide actionable insights. To support these efforts, ODE has developed several guidance documents and tools to help educators integrate Formative Assessment practices effectively.

# Interim Tests

In addition to formative assessment practices, educators can also use interim assessments. Interim tests are periodic standards-based assessments that target specific units of content that provide a view of how students are progressing toward understanding Oregon's content standards. When used in a formative way, interim assessment tools connect student performance to instruction, outlining not just where student learning is needed, but providing classroom educators with instructional examples of what to work on next. Interim assessments help educators address instructional questions such as: "Did my students understand that concept?" and "What aspects do I probably need to revisit and reframe to support their learning?". Effective interim use also connects student performance to instruction, outlining not just where student learning is needed, but providing classroom educators with instructional examples of what to work on next (Oregon Department of Education, 2019).

**ODE provides free interim tests in Science, Math, and ELA through the OSAS portal. Designed to work together with formative practices, these assessments allow educators to gather evidence of student learning aligned with Oregon's state standards. In addition, interim tests can also fulfill state requirements, such as Local Performance Assessments (LPAs). In ELA and Math, any Interim Assessment Block (IAB) designated as a "Performance Task" meets the LPA criteria. In Science, IABs designated as "cluster tasks" fulfill the LPA definition.** When used thoughtfully alongside formative practices, interim tests can become powerful tools to support learning and instructional planning, rather than simply measuring achievement.

Recommendations for STEAM Assessment Practices[1]:

- Support formative assessment practices that equip learners to share and gain from their peer's expertise and feedback during learning
- Design assessment opportunities situated in and informed by local cultures, languages, and values, and that centralize learners' perspectives and voices
- Prioritize tasks that capture complexities and provide multiple means of engagement and expression for learners over time
    - Varied examples:
        - Narrative inquiry
        - In-the moment observations curated over time
        - Video recordings/analyses
        - Documented cycles of peer reflection
        - Journaling
        - Think-aloud interviews
        - Reflections on new understandings while presenting their products or creations

Learn more about assessment best practices with these resources:

- Oregon Department of Education Assessment Resources
    - The Right Assessment for the Right Purpose (RARP)
    - Local Performance Assessment Practice Brief
    - ODE Interim Assessments webpage
    - On-Demand Course: Implementing the OSAS Interim Assessments
    - The Oregon Open Learning Hub is Oregon's K-12 open educational resource (OER) repository where educators can find high quality science open education resources including performance tasks and supplemental lessons.

## ARTS INTEGRATION FOCUS: AUTHENTIC PERFORMANCE ASSESSMENTS

Authentic assessment is essential for capturing the depth of student learning, creativity, and growth—especially in the arts. More than summative tests of knowledge, high quality arts assessments emphasize process, reflection, and real-world application.

The **NCAS Model Cornerstone Assessments in Dance, Media Arts, Music, Theatre, and Visual Arts** provide nationally developed, discipline-specific tools for assessing student performance in arts domains. These resources help educators measure not just what students know, but how they think, create, and communicate through the arts—supporting rigorous, standards-based instruction.

1 Adapted from Castek, J., Schira Hagerman, M., and Woodard, R. (Eds). (2019). *Principles for Equity-centered design of STEAM learning-through-making*. Tucson: University of Arizona. https://circlcenter.org/wp-content/uploads/2019/10/Castek-STEAM-Learning-Making-Whitepaper.pdf

# Equitable Grading Practices

Consider equitable grading practices when providing cross-content instruction by starting with the following questions to explore the foundations of equitable grading.

- What relationship did I have with grades as a learner?
- How has my experience with grading as an educator been influenced by my experience as a learner?
- To what extent do my students know the purpose of grades and grading?
- What biases do I carry into my practice as an educator, and how might these impact my grading practices?

Consider these resources to support equitable grading practices:

- Oregon Department of Education Equitable Grading Practices PLC
- Oregon Department of Education Equitable Grading Resources
- Patterns Science Unit 2 student rubrics for formative assessment and equitable grading:
  - Example 3D Rubric for Explaining Energy Flows
  - Example 3D Rubric for Using Computer Simulation
  - Example 3D Rubric for Engineering Portfolio

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# STEAM INSTRUCTIONAL MATERIALS RESOURCES

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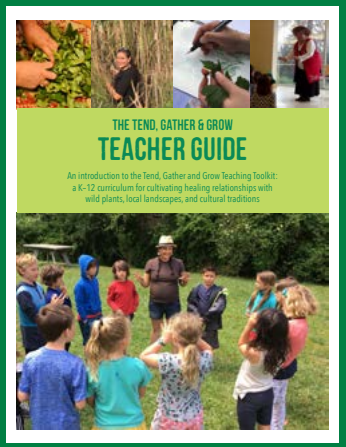
# STEAM INSTRUCTIONAL MATERIALS RESOURCES

This resource provides educators with instructional materials and resources to apply in STEAM courses and learning opportunities. Many openly licensed curriculum resources and tools are available to help evaluate an effective STEAM curriculum and instructional materials. High quality instructional materials that have been evaluated per content area can be found at ODE's High Quality Instructional Materials page.

## Leveraging STEAM Instructional Materials for Equitable Access to Meaningful Learning

Learners are each grounded in their individual experiences and connections to making, tinkering, and experimentation. These practices can vary widely from community to community, and at the same time, have common connections and underlying processes that all students can grasp and make connections to. STEAM learning involves more than computing or digital technology. Integrated, transdisciplinary learning is a practice in many learning traditions. It is important to provide students with examples of innovation, genius and technological developments from many traditions to illustrate these connections across time, identities, and cultures.

Tend, Gather and Grow Curriculum: These curricula include five educational toolkits that explore native and naturalized plants and foods of the Pacific Northwest region. Developed with an emphasis on serving Native communities, they include Indigenous knowledge, stories, and traditions. The curricula is applicable for non-native educators and can be used as a model for other regions.

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Multilingual Learner Resources:

- Oregon Open Learning Multilingual Learner Collection: With the passage of HB 3499 in 2015, the Oregon Legislature directed the Oregon Department of Education (ODE) to create an online resource bank for sharing evidence-based, culturally responsive best and promising practices for serving multilingual/EL students and engaging their families.

Give me a hand! Bioengineering for Prosthetic Limbs Lesson: This lesson plan was developed for emergent bilingual students who are intermediate or advanced in their English language development skills. Students extend their knowledge of the skeletal system to biomedical engineering design, specifically the concept of artificial limbs and joints. Students relate the skeleton as a structural system, focusing on the hand as structural necessity. They learn about the design considerations involved in the creation of artificial limbs, including materials.

## Evaluating Lesson Plans

When evaluating lesson plans for high-quality STEAM-focused content, consider using the following resources to determine the quality and appropriate application of STEAM instructional materials resources.

- STEAM Open Education Resources Quality Framework
- Culturally Responsive Curriculum STEAM Scorecard

For more information on principles of effective content integration to support the use and review of STEAM instructional materials, see the STEAM Education Instructional Practices Resource.

## Examples of Supplemental Lesson Plans

These resources are designed to enrich the learning experience by incorporating diverse perspectives and real-world applications, ensuring that every student sees themselves represented in STEAM learning experiences. Integrating these materials into your instruction fosters a more inclusive and engaging educational environment.

- Oregon Open Learning: Oregon Regional STEM Hubs and STEM Resources Group & Project Based Learning Group: These resources are the result of a collaboration of educational leaders and the Oregon Department of Education to promote inclusive education. They are created by and for education leaders - including instructional approaches, and other useful links to support K-12 education.
- STEM Bites: Oregon's regional STEM Hubs have collaborated to bring engaging, hands-on science and engineering learning ideas to educators across the state. Hands on science can be challenging to do, and STEM Bites are designed to help. Each "Bite" can be done at home, in a classroom, or in a program space. Bites primarily use simple materials that classrooms and families already have or can readily acquire. The STEM Bites are organized by grade band (K-2, 3-4, and 5-6). The collection includes explorations of our environment, engineering challenges, science investigations, observations and more! Try one Bite with your learners or try them all!
- STEM Teaching Tools: A large repository of equity-based, open-sourced materials including phenomena, curricula, essays on STEM and STEAM pedagogy and equity in STEM, PD modules, climate change, and more.
- Indigenous STEAM: The Indigenous STEAM Collaborative co-designs, implements, and shares land based educational materials developed in collaboration with families, communities, educators, and research.
- Learning in Places Lessons: These lessons were developed by a collaborative network of educators, families, and community partners working to cultivate equitable, culturally thriving, socio-ecological systems learning and ethical decision-making using field-based science education in outdoor places, including gardens, for children in pre-kindergarten to 5th grade (and beyond) and their families.
- Teach Engineering: Engage with a large bank of innovative lessons integrating engineering with all STEAM subjects, including mobile art, musical art, and electronic wearables!
- Protecting Whales and Protegiendo a las ballenas: Science and ISTE CS Standards
- Food! How De We Ensure Good Nutrition for All? and ¡Food! ¿Cómo podemos garantizar una buena nutrición para todos?: Based on the UN Sustainable Development Goals
- Teaching Preschool Partners' resource collection on Playful Inquiry: Provides guidance and sparks for inquiry and play-based learning with young students
- The Oregon Transformative Social Emotional Learning (TSEL) Teacher Guides: Offers practical recommendations for integrating TSEL into various content areas. These guides feature ready-to-use "lesson sparks" that inspire meaningful connections between social-emotional learning and academic instruction.

Exploring Computer Science is a year-long, research-based, high school intro-level computer science curriculum and teacher professional development program that focuses on broadening participation in computing. The Oregon Department of Education has partnered with CS for Oregon through the Well-Rounded Access Program to expand access to equitable computer science programs, such as Exploring Computer Science, broadening access for students to this critical content. For more information or to learn about professional development available for educators, visit csfororegon.org.

# Well-Rounded Access Program Courses

Extending the promise of a well-rounded education is one of the commitments that serve as a pillar of Oregon's Consolidated State Plan under the Every Student Succeeds Act. In October 2020, the U.S. Department of Education awarded the Oregon Department of Education (ODE) a 5-Year, $9.8 Million competitive grant known as the Expanding Access to Well-Rounded Courses (Course Access) grant. To carry out the requirements of this grant, ODE formed the Well-Rounded Access Program (WRAP). Between October 2020 and September 2025, the WRAP expanded professional development opportunities for the following courses:

- Exploring Computer Science: This is a year-long, research-based, high school intro-level computer science curriculum and teacher professional development program that focuses on broadening participation in computing.
- Patterns Science: The Patterns High School Science Sequence is a three-year course pathway and curriculum (physics, biology, chemistry) aligned to the Next Generation Science Standards (NGSS), developed by Oregon teachers and freely available to use.

In addition, the WRAP developed content for the following courses:

- Arts, Care, & Connection: A collection of free K-5 lessons that integrate directly with the Oregon Art Standards and the Transformative SEL Framework & Standards, centering ideas of identity, agency, collaborative problem solving, and belonging.
- Native Arts: Tribal specific K-12 arts lessons and Intertribal contemporary K-12 music lessons.
    - Speak Sing Native: Speak/Sing Native™ is an original, multidisciplinary K-12 music education lesson series for the general student. It aligns with Oregon state standards and complements the Oregon Department of Education's Tribal History/Shared History initiative.
    - These arts integration lessons are part of a broader Native Arts initiative designed to support educators and students in deepening their understanding of the rich cultural and artistic traditions of Oregon's Tribes. Rooted in collaboration, respect, and authenticity, this work highlights both historical and contemporary practices of local Indigenous communities.
    - Coquille Indian Tribe: K-12 Lessons
    - Burns Paiute Tribe: K-12 Lessons
    - Confederated Tribes of Coos, Lower Umpqua, and Siuslaw: K-12 Lessons

## ARTS INTEGRATION FOCUS: ARTS INTEGRATION IN CURRICULUM

**Arts Impact**

Arts integration strengthens STEAM learning by making academic content more engaging, meaningful, and accessible, and it can also be complex to design from scratch.

**Arts Impact** offers a rich library of **free, standards-based arts integration instructional materials** across visual arts, dance, music, and theater for K-8 grade levels. Lessons are thoughtfully aligned with social studies, math, reading, writing, and social-emotional learning.

**Patterns Science**

Through funding provided by the Well-Rounded Access Program, Patterns Science has incorporated Arts-Integrated content within its instructional materials. This background document provides more information to teachers about how to integrate arts into the high school science classroom experience.

## Additional Resources

- OpenSciEd: This openly licensed K-12 material uses a storyline approach– a logical sequence of lessons that are motivated by students' questions that arise from students' interactions with phenomena.
- Scratch & Scratch Educator Guide: Scratch is the world's largest coding community for children and a coding language with a simple visual interface that allows young people to create digital stories, games, and animations. Scratch is designed, developed, and moderated by the Scratch Foundation, a nonprofit organization. Scratch promotes computational thinking and problem-solving skills; creative teaching and learning; self-expression and collaboration; and equity in computing. Scratch is always free and is available in more than 70 languages.
- Art Biology Lab: The artworks featured in The Art+Biology Methods Virtual Exhibition are the result of a month-long collaboration between Art and Design students studying BioAesthetics and BioArt, the BioMedia Lab, and the Art±Bio Collaborative for the 2021 Cambridge Science Festival.
- SMSP STEM Attributes: These attributes were determined by the experience of South Metro-Salem STEM Partnerships' (SMSP) regional professional educators and confirmed by research literature as critical for successful STEM learning.
- PhET: Online simulations for STEAM Learning
- Mathematics, Engineering, Science, Achievement (MESA): The MESA Schools Program (MSP) is a pre-college program for students grades 5-12th. It's an academic enrichment program that is offered to underrepresented middle and high school students in select schools in Oregon.
- Connecting Arts to Academic Subjects: Resources from the Georgia Department of Education
- Oregon's Integrating Transformative SEL Standards in the Arts and CTE Arts Programs of Study: Guide offers educators resources, standards crosswalks, and model practices to weave the state's Transformative Social-Emotional Learning (TSEL) standards into arts and STEAM instruction.

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million Federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# COMMUNICATING THE BENEFITS OF STEAM EDUCATION

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# COMMUNICATING THE BENEFITS OF STEAM EDUCATION

This resource provides programs, school, and district leaders, educators, and community members:

- Information about the benefits of STEAM education
- Data and research around STEAM learning
- Examples of the ties between STEAM programs and educational equity, and
- Communication tools to assist in effective communications and engagement around STEAM education in Oregon

Building a shared understanding of the benefits of STEAM education across Oregon communities is key to expanding access to STEAM learning for students. By sharing up-to-date research and data, advancing equity through STEAM programs, and using effective communication strategies, educators can foster greater awareness and stronger support for STEAM initiatives across the state.

## Shining a Light on STEAM Programs in Oregon

Educators and students in STEAM programs know firsthand the many benefits of providing students with authentic learning opportunities. However, families, school staff, and community members may have different levels of awareness and perspectives on STEAM education's value. For these programs to truly thrive, practice cultivating a shared understanding of their impact and actively leverage available resources to expand access and support for STEAM learning.

Oregon has a rich landscape of existing STEAM schoold and programs. The Oregon Department of Education's (ODE) 2022 Well-Rounded Access Program Needs Assessment points to a key finding that numerous funding sources and STEAM-related programs are available to Oregon students; however, "knowledge and awareness of these opportunities may not be widespread among educators, students, or families" (Oregon Department of Education, 2022). A key recommendation from the WRAP Needs Assessment is to bolster communication and messaging around the value of STEAM education and resources available to support the expansion of STEAM and STEAM education in Oregon.

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# STEAM Learning Benefits and Opportunities

Education in STEAM is closely tied to Oregon's Accountability Framework:

**HIGH-QUALITY LEARNING EXPERIENCES FOR ALL STUDENTS**

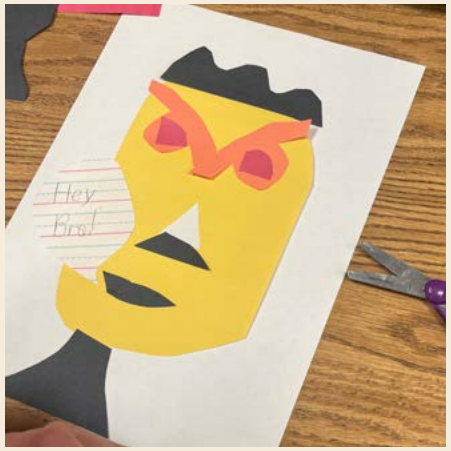
**ALIGNED AND FOCUSED EDUCATIONAL SYSTEMS**

**ENGAGED PARTNERS AND COMMUNITIES**

**SAFE AND INCLUSIVE SCHOOLS**

**COMMITTED AND SUPPORTED STAFF**

Research supports the benefits of access to STEAM learning in schools. Some of these benefits include:


- Emphasizing the natural interconnectedness of learning in all subjects - leading to students' positive self-reported knowledge construction, intrinsic motivation, satisfaction and interest in STEM fields (Nguyen et al., 2020), self-efficacy, and interdisciplinary knowledge acquisition (Jia Y, et al., 2021).
- Creating equitable educational opportunities by providing project based learning experiences - leading to greater academic growth for disadvantaged students (Duke et al., 2021) and potentially a particular benefit for students with disabilities, by increased math scores, graduation rates, and post-secondary school enrollment (Plasman & Gottfried, 2018).
- Providing project-based learning opportunities that enhance autonomy, competence, and engagement in STEM learning for secondary students (Vennix et al, 2017).
- Creating opportunities for STEM service-learning experiences that can increase student engagement, self-efficacy with science, interest in STEM careers, and aid in developing communication and collaboration skills (Collins et al., 2019), (Hamerlink, 2013), (Baumann, 2013).
- Giving schools and their communities opportunities to partner with local industry and institutions of higher education, leading to increasing STEM academic performance and interest in continuing STEM learning (Lopez et al., 2016).

## STEAM Programs as Engines for Educational Equity

STEAM education can be a powerful equity strategy, with the potential to address gaps in access for underrepresented and underserved students in STEM and STEAM fields. The Education Commission of the States (2023) outlines these strategies to utilize STEAM learning in P-5 education for the pursuit of equitable educational outcomes:

- Create the classroom learning conditions for engagement, including fostering a sense of belonging, identity and self-discovery.
- Use instructional approaches and curricula that are developmentally appropriate and play based.
- Elevate equity by focusing on culturally responsive and inclusive practices.
- Integrate science education into pre-K to address opportunity gaps early.
- Focus on foundational skill development, such as cognitive and interpersonal skills.
- Leverage children's rapid brain development and their natural curiosities to explore, observe, experiment, and solve problems through play.

*"One thing I wish we had more of, was more art classes."*

-Student Response,
Oregon Department of Education 2022 SEED Survey

*"I enjoy the way they teach science here, I like the hands-on and experimental aspect of the class. It never feels boring or repetitive because we're always learning something new. I also like how it directly connects to things that we can use when we become adults and are looking for a job."*

-8th Grade Student Response,
Oregon Department of Education 2023-24 SEED Survey

*"[I would like to see] more hands-on courses where you get to interact and experience more things. That would be fun."*

-8th Grade Student Response,
Oregon Department of Education 2023-24 SEED Survey

A STEAM program can support equity initiatives in myriad ways. This work benefits from careful alignment with school or district equity initiatives to ensure equitable access for all students, including each school and district's focal student populations.

While many schools and districts currently offer or are working toward offering comprehensive STEAM programs, there remains a journey to provide access to all students across Oregon. To learn more about strengths and needs found for STEAM access across the State of Oregon, explore the Well-Rounded Access Program's Needs Assessment, released in 2022.

# Communication Resources

Schools and districts can use STEAM programs as a beacon, inspiring engagement and showcasing the transformative impact of STEAM education. Explore creative ways to share these success stories widely and empower students and families to be champions in spreading awareness of the value STEAM brings to education and the future.

## FAMILY LETTER

Utilize ODE's STEAM Learning Family Letter Template to communicate to families and reinforce learning around STEAM learning experiences happening in the classroom.

STEAM Learning Family Letter Template

STEAM Learning Family Letter Template Instructions:

Utilize a copy of this template to communicate to families about STEAM learning experiences in the classroom. This template can be filled out by educators and shared or completed with students as a reflection activity to share with their families. It can be shared electronically or printed off for students to fill out in class.

If possible, share an artifact, photo, or performance from the process attached to the document, on a classroom website, or in a classroom newsletter to supplement this communication tool. Before sharing with families, we recommend that the classroom letter is translated into the home languages of students in the classroom.

**Communicating the Benefits of STEAM Education** provides additional information about the benefits of STEAM education and communications strategies and tools for STEAM programs.

## ADDITIONAL RESOURCES FOR COMMUNICATING THE BENEFITS OF STEAM PROGRAMS

These organizations provide research and resources to share with families and community members around the benefits of STEAM learning[1].

- Oregon STEM
- Chief Science Officers
- Oregon ASK

The Oregon STEM newsfeed provides updates around STEAM education news and research. At the site, sign up for their monthly newsletter to receive notifications about STEAM resources, research, and opportunities.

1 *Note: These resources have not been endorsed by ODE, but are being shared as relevant resources for STEAM education professionals to consider.*

This work is funded by the Expanding Access to Well-Rounded Courses Grant, a 5-year, $9.8 million Federal grant that ODE received from the US Department of Education in 2020. The STEAM Toolkit is a portion of the work of the Well-Rounded Access Program, along with developing and expanding STEAM and Arts courses. If districts or schools have additional resources, examples or success stories to contribute, please email them to ode.stem@ode.oregon.gov.

# GLOSSARY AND KEY TERMS

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# GLOSSARY AND KEY TERMS

**CONVERGENCE EDUCATION:** An approach that best equips students to tackle the world's most pressing challenges and opportunities of the 21st century, which are inherently transdisciplinary. (Convergence Education, A Guide to Transdisciplinary STEM Learning and Teaching)

**DESIGN THINKING:** The design thinking process is used in many fields, including engineering and the arts, to design creative solutions. This process generally incorporates five stages: Empathize, Define, Ideate, Prototype, and Test.

**OPEN EDUCATIONAL RESOURCE (OER):** Educational instructional materials that have had an open license applied to them. This means they are free to use and can be reused, remixed, revised, retained, and redistributed. (The Council of Chief State School Officers: What is OER)

**STEAM:** The acronym STEAM (Science, Technology, Engineering, Arts, Math) has many different definitions across educational spaces and means different things to different people. For the purposes of creating a common language in the Oregon education network, in this toolkit, "STEAM" represents the concept of "STEAM Pedagogy", or as the National Science and Technology Council defines it, "Convergence Education" (see specific definitions within this resource). Although STEM and STEAM are used interchangeably within this toolkit, the term "STEAM" is used intentionally to better emphasize the importance of including the Arts in this practice.

**STEAM ECOSYSTEM:** STEM Ecosystems are community-based collaborations that transform how students learn and connect to future opportunities. They bring together cross-sector partners—schools, afterschool programs, colleges, businesses, community organizations, and government agencies—to create powerful STEM and STEAM learning experiences. (STEM Ecosystems)

**STEM/ STEAM HUB:** The Oregon Regional STEM Hub Network is comprised of 13 STEM and STEAM hubs, central to implementing innovation, scaling best practices, and addressing workforce needs across Oregon. Their aim is to improve student outcomes in STEM education, increase participation in STEM and CTE majors, and increase the number of Oregon youth who enter high-wage, high-demand STEM and CTE professions.

**STEAM IDENTITY:** The sense of belonging and seeing oneself as a "part of" or "good at" STEAM. One example might be a student seeing themselves as a scientist or an artist.

**STEAM INSTRUCTIONAL APPROACHES:** See the STEAM Program Approaches and Models resource for specific definitions for these approaches, including: Applied Learning; Career Connected Learning; Choice-Based/Free Choice/Tinkering/Play-Based; Inquiry-Based; Invention Education; Place-Based Learning; Problem-Based/Phenomenon-Based Learning; Project-Based Learning; Service Learning.

**STEAM PEDAGOGY:** The method and practice of teaching multiple content areas (most specifically but not limited to Science, Technology, Engineering, Arts, and Math) together, to better integrate standards across content areas and teach skills like problem solving and critical thinking.

**STEAM SCHOOL:** STEAM schools, in general, are schools that focus education priorities and systems around STEAM education. For the purpose of this toolkit, STEAM School generally refers to schools working with a STEM Hub through specific transformational practices, as outlined in Portland-Metro STEM Partnership's STEAM School Rubric.

**STUDENT VOICE:** Refers to the values, opinions, beliefs, perspectives, and cultural backgrounds of individual students and groups of students in a school, and to instructional approaches and techniques that are based on student choices, interests, passions, and ambitions. (Glossary of Education Reform)

**TRANSDISCIPLINARY EDUCATION:** Learners identify complex problems and work together to create a shared conceptual framework and draw together theories, concepts, and practices that transcend individual disciplinary boundaries. Focus is on broad, real-world constructs drawn from an increasingly interconnected world, societal relevance, and student interest. Transdisciplinary (including applied interdisciplinary approaches) is distinct from multi- or interdisciplinary in that subjects are blended in a transformative manner that provides important gateways for student-centric, student-defined problems or topics that lead to authentic and meaningful learning experiences and student-driven innovations. (Convergence Education, A Guide to Transdisciplinary STEM Learning and Teaching)

**WELL-ROUNDED ACCESS PROGRAM:** Extending the promise of a well-rounded education is one of the commitments that serve as a pillar of Oregon's Consolidated State Plan under the Every Student Succeeds Act. In October 2020, the U.S. Department of Education awarded the Oregon Department of Education (ODE) a 5-Year, $9.8 Million competitive grant known as the Expanding Access to Well-Rounded Courses (Course Access) grant. Oregon's proposal for the grant funding focused on expanding access to arts-specific and STEAM-related courses. To carry out the requirements of this grant, ODE formed the Well-Rounded Access Program (WRAP).

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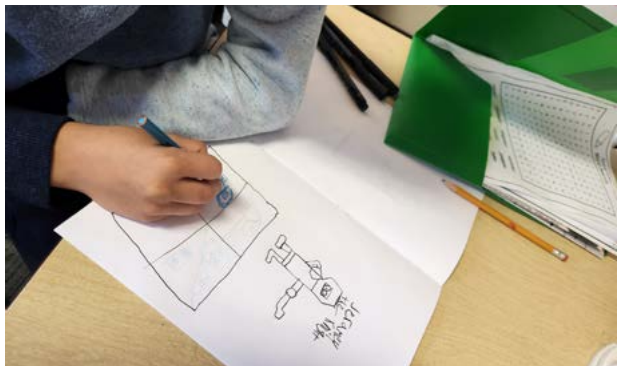

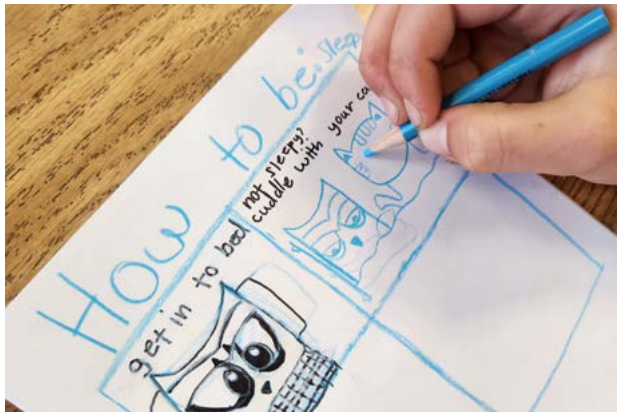


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