HOW TO GUIDE ON TIPS & STRATEGIES FOR IMPLEMENTING STEM RESOURCES AND PROGRAMS INTO YOUR PHYSICAL EDUCATION PROGRAM

INTRODUCTION

Science, Technology, Engineering and Math (STEM) Education is an approach to learning and skill development that integrates each of those four areas of study as they are intricately connected. It involves collaborative work on authentic activities, where individuals ask questions, make sense of information, and use their knowledge and skills to plan, create, test, and improve solutions to challenges. STEM benefits students and educators, especially in the case of physical education programs, where students with disabilities often feel excluded or left out. Through STEM, educators can create lessons that connect physical education standards with other subject standards and develop skills to design and adapt equipment and resources to ensure that all students can actively take part. As Jean Judes, the executive director of Beit Issie Shapiro, stated in 2016, "Technology not only makes things easier for people without disabilities but also makes things possible for people with disabilities."

Our Journey

So, we started thinking "We know adapted physical education, and other educators we met know technology - How can we work together to support students?" It grew into a vision of physical education teachers and students collaborating with STEM teachers and students to meet the needs of all in the physical education classroom! Through our journey with teammates of inclusion specialists from the National Center on Health, Physical Activity and Disability (NCHPAD) and state and local physical education and STEM educators, we have worked through the design process to research available products and learn from online communities designing their own resources, imaged possibilities, built prototypes using common materials and/or technology resources such as Scratch and Makey Makeys to make switches and Tinkercad to design/adapt 3D designs to be printed and used.

Physical education is a course used to educate all children on the importance of movement, exercise, collaboration, skill building, creativity, perseverance, and nutrition. STEM fosters creativity, teamwork, problem-solving skills, experimentation, adaptation, technology integration, and more. Physical education and STEM both model "learning by doing," and there are several benefits that create the need for STEM in physical education.

1. STEM and physical education encourage students to be creative. The creativity that each student possesses will help students be healthy, active adults. Students will have to find creative ways to exercise when there is no outdoor space or gym nearby or may have to design their own equipment or space if they want to be physically active.
2. STEM and physical education concentrate heavily on teamwork. Students with and without disabilities work together to solve a problem and/or complete a task. While completing the task, students learn problem-solving skills by thinking critically, respecting others' opinions, and learning to communicate.
3. STEM and physical education use real-world applications. Activities are usually accompanied by a goal. Students create a plan, either mentally, or physically, on how they will carry out the goal.
4. STEM and physical education encourage students to use their skills to accomplish the activity's goal. Students are more motivated because they can "see" the skills they are using are translating to solving a "real-world" problem.

STEM and physical education motivate students to learn and adapt to activities, so they are successful in the completion of the activity or project. Students use the processes taught by the teacher to adapt/modify activities and projects so all students can be successful, life-long learners.[1]

[1] https://www.theedadvocate.org/7-benefits-of-stem-education/

STEM is becoming a popular activity that students can use in the physical education classroom. For example, have students create their own game, equipment, or field/court design. When students are in the planning phase of this unit, remind students to design and create games, activities, equipment, and space that will be accessible to all students. During this unit, the teacher can facilitate team discussions to include adaptation strategies so all students will be successful. For example, students with limited dexterity could utilize a simple machine such as a pulley to release or launch a ball or use a tablet with visuals as support when learning or mastering a physical education skill. The possibilities are endless, and many teachers are implementing STEM ideas into their programs and benefiting many students with disabilities.

There are multiple benefits to utilizing STEM Resources in your physical education program, whether it be related to creating equipment to meet your student's needs or implementing cross-curricular concepts in your gym. The list below demonstrates the benefits your students, staff, and community will have related to working together:

- Promotes whole-child learning.
- Provides opportunities for children to participate who are often excluded.
- Provides all students an opportunity to build confidence.
- Promotes Physical Literacy.
- Allows teachers to add problem-solving, collaboration, and creativity into their Physical Education classrooms.
- Promotes collaboration, decision-making, and strategy.
- Allow students to design equipment used in their classrooms to help ease the burden of costly equipment.
- Addresses different standards in one unit.
- Builds teamwork and collaboration across all departments.
- Fosters a unique learning environment.

GETTING STARTED

Want to test pilot a project or potentially build your own equipment yet have no idea where to get started? This is the hardest part of STEM in physical education. To make it easy, we created a simple list of steps that will get you started with building out an amazing future for your students, staff, and community and a wonderful program that meets the needs of every student.

1. Identify potential needs in your classroom.
2. Connect with your teammates.
3. Discuss potential collaboration.
4. Partner to teach cross-curricular programs.
5. Meet with the Administration to discuss your projects and how you will be working together.
6. Promote the benefits and successes.

We will go into more details on the planning, designing, implementing, and testing areas later in the document.

WHO ARE MY TEAMMATES?

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Have you ever thought about doing something within your school, but you just weren't sure who to reach out to within the technological world? Below is a list of potential individuals* to connect with and share your ideas for collaboration:

- STEM Teacher
  - ✓ Develops lesson plans.
  - ✓ Collaborates with other content areas on how to incorporate STEM activities.
  - ✓ Assists with STEM activity needs and resources.
- Technology / Computer Science Teacher
  - ✓ Supply instruction on how to code and write programs.
  - ✓ Collaborates with other content areas on Computer Science integration.
- School Library Media Specialist
  - ✓ Supplies instruction and guidance on technology integration.
  - ✓ Aid with technology needs.
  - ✓ Develops STEM activities that can be implemented by other content areas.
- Paraprofessional
  - ✓ Aid the teacher with equipment and materials for STEM integration.
  - ✓ Assist the teacher with the implementation of students' goals and objectives.
  - ✓ Model how to use/adapt the equipment in STEM activities.
  - ✓ Assist the teacher in collecting data and monitoring student progress.
- Physical Education Teacher
  - ✓ Collaborates with STEM teacher and Library Media teacher on ways to integrate STEM lessons.
- Special Education Teacher
  - ✓ Collaborates to share knowledge of individual student needs, strategies, resources, and tools.
- District-Level Teammates
  - ✓ They are important to have as they can offer additional support and help connect the team with people, resources, and funding opportunities. Teammates may include Technology leaders, Technology Coaches, Special Education leaders, Physical Education/Curriculum leaders, and Student Services leaders.

* You do not need to have every person on this list to be successful.

Social Media allows us to follow and/or like pages belonging to national organizations, teachers sharing their programs, STEM programs, adapted physical education programs and spaces where individuals share what they have created. Below is a list of individuals/ organizations that promote STEM programs and adapted physical education:

Adapted Physical Education Teachers:

Account	Who	Location
@DigitTheAPE	Matt Barker	VA
@Musser_APE	Danielle Musser	CO
@LongviewAPE	Jeff Watkins	MD
@NMcCoy_APE	Nicole McCoy	PA
@KizzyKara25	Coach Kara	CA
@amcintyre401	Ashley McIntyre	OH

Other STEM Accounts/People to Follow:

- @equipmeOT
- @techowlpa
- @SAMlabs
- @Btactile
- @tinkercad
- @makeymakey
- @neal_at
- @dailystem

PHYSICAL EDUCATION STANDARDS THAT ADDRESS STEM

Did you know that the National Standards for Physical Education match up to the standards for STEM? Understanding the standards that directly correlate with STEM is a wonderful way to approach your administration if they are struggling to see the benefit. The concepts of STEM have been taught in physical education classes for a long time and continue to be taught to this day; moreover, some individuals do not even know that some of the simplest activities they do in their programs are STEM activities. The standards also allow you to expand resources and build out equipment that can help every child succeed in the skills you are teaching. The standards for physical education that are STEM are listed below:

Combine locomotor movement patterns and dance steps to create and perform an original dance.	Demonstrate competency in a form of dance. Examples: line dance, square dance, ballroom, cultural and social occasions, or lyrical dance
Research and design a comprehensive personal fitness program to enhance a healthy, active lifestyle to develop lifelong healthy habits based on the components of health.	Transfer weight in movement patterns by combining actions and balances to create a sequence with a partner, with or without equipment.
Determine the benefits of using available technology during physical activity. Examples: active videos, active gaming systems, heart rate monitors, health apps	Design and apply a warm-up and cool-down routine for physical activity.
Combine traveling with balance and weight transfers to create a sequence with or without equipment.	Create a movement sequence to music as an individual or in a group to display command of rhythm and timing.

Physical Education Standards on Data Collection that Complement STEM

Record participation in physical activities outside physical education class.	Create a visual product or written essay about the enjoyment and/or challenge of participating in a favorite physical activity. Examples: poster, drawing, comic strip, creative dance, skit, media presentation	Create a plan for physical activity outside class, based on options available in the community.

If you are working with a limited budget or funding, know that there are ways to create equipment inexpensively. The following steps are designed to help you easily get started with building out equipment for your program and connecting with the technology leads in your school to develop the prototype and final product:

1. Ask Questions and Research
   a. Assess your program and write down what you need to create in your program. Be as detailed as possible, including the lesson used within your class and what skill the students will complete during this unit. Consider asking questions like,
      i. "Do my students need assistance holding multiple items together?
      ii. Is there something I can create to support students?"
   b. Identify the materials you will need. Examples?
2. Collaborate and Feedback
   a. Share the questions and research with your teammate.
3. Develop the Plan and Build
   a. Work together to develop a prototype to see if the vision and plan work together and accomplish the tasks the students need to complete with your unit.
   b. Once you have finalized your final product, make it!
4. Test and Redesign
   a. Test pilot the product by walking through the lesson and completing the skills and tasks yourself with the newly designed equipment.
   b. Ask for feedback from the students using the equipment.
   c. Redesign as needed and improve the product.
5. Implement
   a. Add this new piece of equipment or resource to your lessons (see example below).

Example: Suspended Ball to Practice the Kill of Striking with and Implement

Multiple sizes of tennis balls with an eye hook.
Large tennis ball with zip tie forming an eye hook suspended on a cord.

A person striking a suspended tennis ball with a racket.

Interactive Sit and Reach Board Design Process

Ask Questions and Research

- A team of three met to generate a list of questions about students meeting the flexibility standard, equipment, and challenges. Questions included:
  - ✓ Can all students utilize the standard sit-and-reach board as it is currently designed?
  - ✓ Are students actively engaged/interested in meeting the standard?
- The team researched the existing equipment, standard, and discussed observations of learners participating in the sit and reach activity.

Collaborate and Feedback

- The team shared the questions with others (peers and experts) to generate additional questions and share knowledge.

Develop the Plan and Build

- The team developed a plan to address the questions using no technology and/or technology tools.
- To increase active engagement, the team decided to enhance the current sit and reach board with technology by using interactive touch points connected with conductive wires/tape to a Makey Makey board which is also connected to a Chromebook/laptop. An online game, Help Me Fly, was created using the free coding program Scratch so that when the touch points for each inch were touched by both hands the circuit would close and make the hero fly closer to the tallest building. The challenge of the game was to get the hero to fly to the tallest building which would represent the learner demonstrating their flexibility of 8 inches (the standard). Sounds and light flashed on the screen were programmed to increase interest and support learners with visual impairments. High-contrast colors were used along with braille labels.

- The board was also designed separately from the box to enable the board to be connected to a box, table, or other space so that students in wheelchairs or with other needs could also use it.

An educator brainstorms the design: a technology specialist uses cables, tape, and cardboard along with a program on the laptop on the table to brainstorm the design.
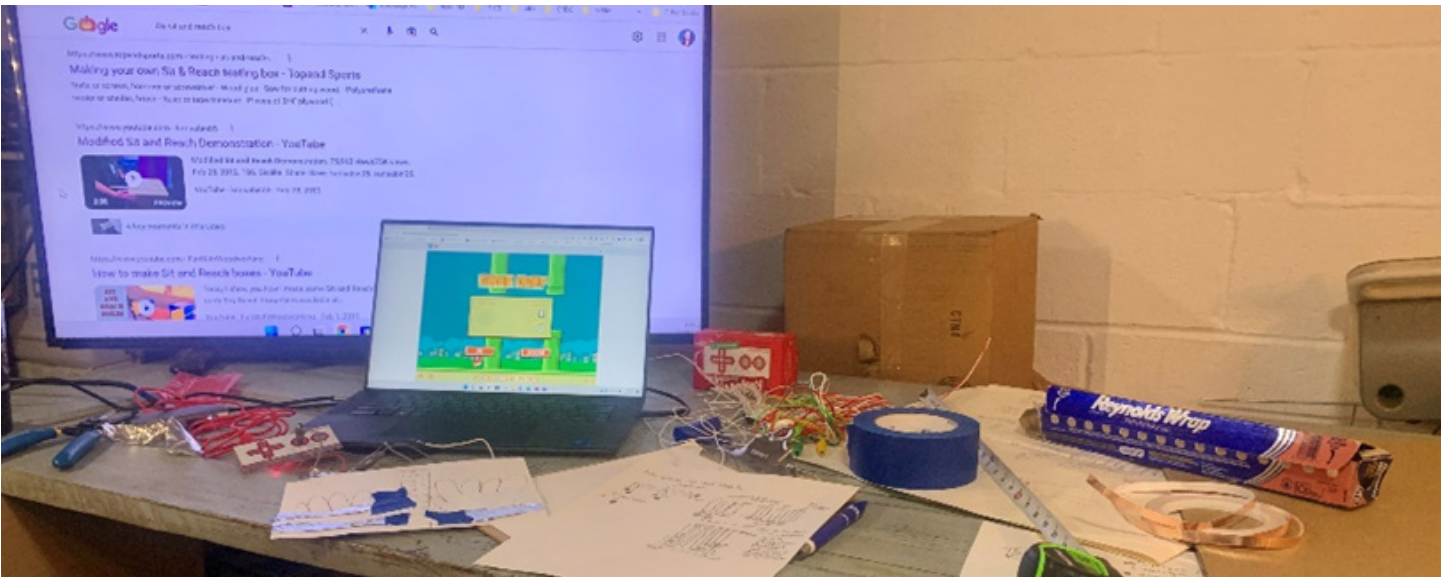

Building a prototype: materials such as tape, aluminum foil, copper tape, tape measure, Makey Makey, laptop and design drawings on paper are on a table.

Prototype of interactive sit and reach board: a Chromebook displaying a game sits on top of a black board with copper brads and braille which is connected to a box that is upside down. The Chromebook is connected to a Makey Makey and the board.

Test and Redesign

- The original design used vertical conductive copper tape connected to alligator clips to close each circuit at each one-inch mark. To decrease the amount of copper tape needed, the board was redesigned using speaker wires connected to copper brads along the back of the board. Each design was tested, and the team felt the copper tape was more stable.
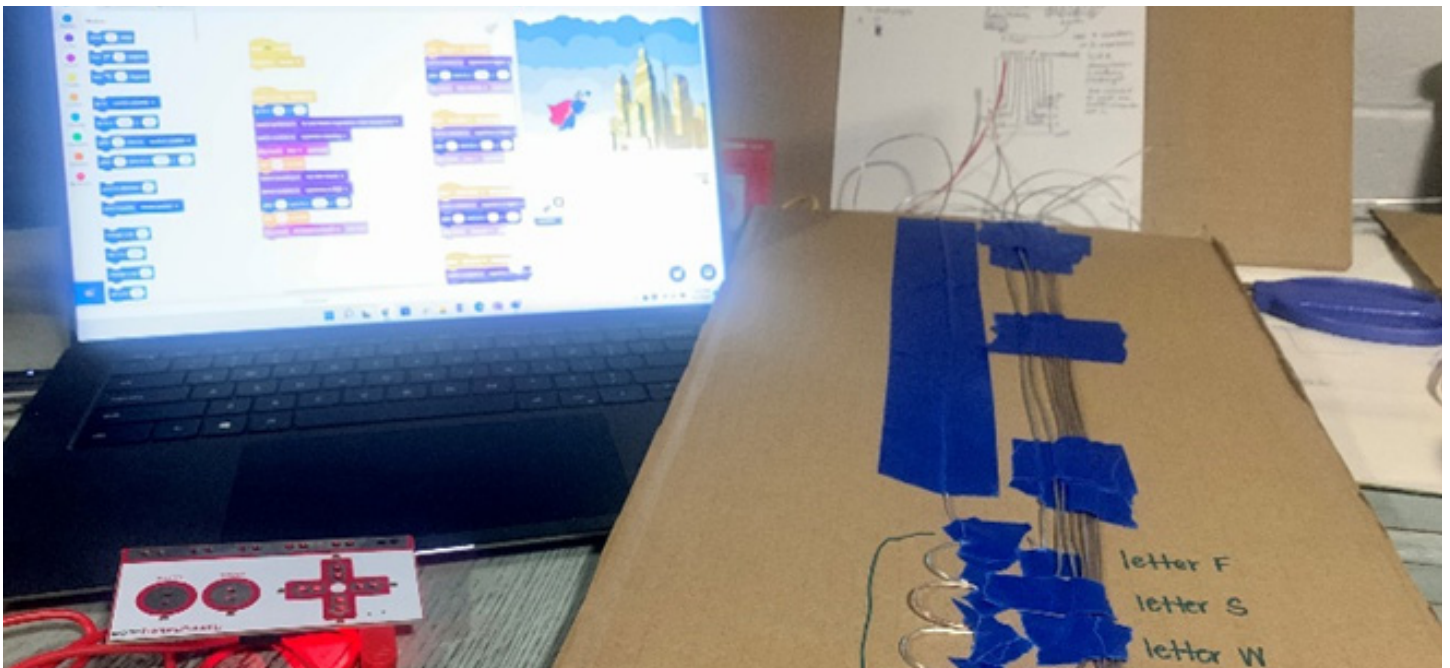
Testing the designed sit and reach board: a prototype sits on a table showing the back of the Sit and Reach board made of cardboard and connected by speaker wires to the Makey Makey that is connected to the laptop where the game program was written.

- A third redesign was created using conductive copper table but in horizontal lines on the back of the board connecting the copper brads together to make the circuits. This design has proved to be the most stable.

An inclusion specialist cuts conductive copper tape with scissors and applies in lines to the back of the Sit and Reach board to create another prototype.

- The team took the redesigned Sit and Reach board to a local conference for other PE educators to test and give their feedback.
- The team at Makey Makey learned about the project and shared another way to write the program in Scratch where you can track how many students reach each marker. A copy of the game was made and redesigned with the new program, Help Me Fly with Scoreboard. They also shared how you could use a Makey Max backpack to make it easier to connect the conductive tape or wires to the Makey Makey.

Testing the prototype: an educator tests the prototype Sit and Reach board by sitting on the floor with his leg touching the bottom of the box and hands are outstretched touching the copper brads to close the circuit and play the game on the Chromebook sitting on top of the sit and reach board

Implement

- The current design is being tested in physical education classrooms for additional feedback from students and educators.

10 GRANT FUNDING

Securing sufficient resources is of paramount importance to guarantee the success and growth of both students and educators. Seeking grant funding for materials, tools, and other resources can be an effective way to supplement school budgets and enhance the learning experience. A variety of funding opportunities exist for schools to explore, including state technology funds, education foundations, and fundraisers. Additionally, district funding, state funding, and federal grants can provide significant financial support for educational initiatives.

Forming community partnerships with local hardware stores and technology companies can further enrich educational resources and opportunities. These collaborations not only ease access to materials and equipment but also help forge connections between schools and local businesses. Actively pursuing these funding sources and partnerships bolsters education quality and demonstrates a commitment to fostering a thriving and well-resourced learning community that extends beyond the school's walls.

[STEM Resources for Adapted Physical Education hub](#) is an ever-evolving site designed to support teams focused on their work. This living site is committed to offering a current collection of resources, empowering users to develop their knowledge, skills, and practices. As the field of adapted physical education continues to expand and progress, the STEM Resources for Adapted Physical Education website will adapt accordingly, ensuring the availability of the most relevant and effective materials for those dedicated to improving the lives of students with diverse needs.

We invite you to contribute to the growth of this resource hub by sharing any materials or resources you are aware of that support the work in adapted physical education. Suggestions can be submitted using the [STEM Resources for Adapted PE form](#). Together, the community can become stronger and inspire others in the journey toward creating more inclusive physical education opportunities for all students.

STEM Resources for Adapted PE

Type of resource: ▾

Supported movement/skill: ▾

Needed technology: ▾

Image:	Title of resource:	Type of resource:	Short description of resource:	Web address for resource:	Needed technology:	Supported movement/skill:
	Training and Technocal Assistance Center's Online Trainings	PD Resource	The mission of the Training & Technical Assistance Center (T/TAC) is to improve educational opportunities and contribute to the success of children and youth with disabilities (birth–22 years). We offer online training in assistive technology and inclusive practices.	http://ttaconline.org/online-trainings	No materials necessary - resource is informational	NA
	Dynamic Learning Maps PD	PD Resource	This site was developed to provide professional development for educators working with students with significant cognitive disabilities. It focuses on teaching and learning in the areas of English language arts, mathematics and science, while also providing important information regarding components of the Dynamic Learning Maps® system.	https://www.dlmpd.com/all-modules-organized-by-claim/	No materials necessary - resource is informational	NA
	Children and Youth Books on Disability and Diversity	Children's Books	NCHPAD staff have curated a list of their favorites books that have disability and diversity representation. We hope you find opportunities to encourage children and youth to read and learn about things that make us different while learning an appreciation for diverse identities.	https://www.nchpad.org/fppics/Story%20Book%20List.pdf	No materials necessary - resource is informational	NA
IRIS	Children's Books - Portrayals of People with Disabilities	Children's Books	This search tool provided by IRIS contains information and synopses of children's and young adult literature about or having to do with people with disabilities. This information includes the name of the author and illustrator, year of publication	https://iris.peabody.vanderbilt.edu/resources/books/	No materials necessary - resource is informational	NA

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Are you enthusiastic about creating inclusive learning environments in physical education and beyond? Do you want to connect with like-minded educators to continue to learn, share ideas and collaborate? If so, we invite you to join the STEM Powered Movement in PE and Beyond online community of learners within the Cognia Learning Community.

To join, create an account at https://home.cognia.org/ and select Communities of Practice on the left-hand navigation. Then, select Browse Other Groups on the right-hand side and search for the STEM Powered Movement in PHYSICAL EDUCATION and Beyond group. Once you find the group, select the group name to open it and then click Join Group.

By joining this group, you will have access to a supportive community of educators who are passionate about creating engaging and inclusive learning environments for all students. You will be able to share your ideas, ask questions, and collaborate with others to develop resources and equipment using no technology and/or technology that motivates your students.

In addition, you will have access to a wealth of resources and tools that can help you enhance your teaching skills and stay up to date on the latest trends and practices in supporting students with disabilities in any learning environment. Whether you are a seasoned veteran or a new educator just starting out, the STEM Powered Movement in PHYSICAL EDUCATION and Beyond group is the perfect place to connect with others and take your teaching to the next level.

Join the STEM Powered Movement in PHYSICAL EDUCATION and Beyond online community of learners today and start connecting with other educators who share your passion for creating inclusive and engaging learning environments for all students.

*This page is not run by the ALSDE (Alabama State Department of Education), NCHPAD, or Lakeshore Foundation.

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Welcome and Introduce Yourself
April Chamberlain   ♡ 0   💬 0
[Trussville , Alabama]   March 22, 2023 at 9:01 PM

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Description
Gather your team or join individually to connect, learn, and collaborate with others to use the engineering design process to adapt or create new equipment, tools, and learning resources for students with disabilities to be actively engaged in PE, STEM/technology, art, music, the classroom, and beyond. Who might be on your team? PE teachers, STEM/technology teachers, Special Education teachers, Paraprofessionals, School Librarians, and /or School/District Leaders. Let's innovate together!

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