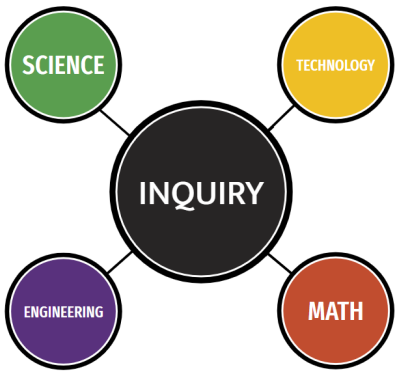
INTRODUCTION

This handout is a companion to the video, Wee Engineers, created in collaboration with the Idaho STEM Action Center and the Boise State University College of Education. Using the preschool engineering curriculum from the Museum of Science, Boston's EiE Program®[5] as our starting point, this information complements the four key aspects of integrating the engineering design process (EDP) within an inclusive preschool classroom:

- Introduce the EDP in developmentally appropriate ways
- Provide time and support for children to work together and share ideas
- Anchor engineering challenges to literacy rich activities
- Use the accommodations that promote participation in the EDP for children with disabilities

EARLY STEM



STEM in early childhood is defined as an approach to learning that is fueled by the questions young children ask as they pursue their interests and sense of wonder.[1] For children with disabilities, research suggests that engagement in STEM can be a vehicle for addressing multiple areas of development, including motor, communication, and social skills.[2,3] However, children with disabilities often do not have access to STEM in early childhood and this gap in opportunity persists throughout high school.[4]

So how do you introduce the EDP to all young learners?

1: McClure, E.R., Guernsey, L., Clements, D.H., Bales, S., Nichols, J., Kendall-Taylor, N., & Levine M.H. (2017) *STEM starts early: Grounding science, technology, engineering, and math education in early childhood.* New York: The Joan Ganz Cooney Center at Sesame Workshop.

2: Huskens, B., Palmen, A., Van der Werff, M., Lourens, T., & Barakova, E. (2015). Improving collaborative play between children with autism spectrum disorders and their siblings: The effectiveness of a robot-mediated intervention based Lego therapy. *Journal of Autism and Developmental Disorders, 45,*3746-3755. doi: 10.1007/s10803-014-2326-0

3: Blank, J. & Lynch, S. (2018). Growing in STEM: The design process: Engineering practices in preschool. *Young Children (73),*

4:. Basham, J. D., & Marino, M. T. (2013). Understanding STEM Education and Supporting Students Through Universal Design for Learning. Teaching Exceptional Children, 45(4), 8–15. https://doi-org.libproxy.boisestate.edu/10.1177/004005991304500401

INTRODUCE THE EDP IN DEVELOPMENTALLY APPROPRIATE WAYS

The EDP consists of at least 8 different steps.[5] However, it can be simplified for our youngest learners while still keeping the integrity of the process, as pictured here.

By using the steps "Explore, Create, and Improve" from Wee Engineer®,[6] teachers can provide rich experiences that allow young children with disabilities to also explore their curiosity and begin to build problem solving and collaborative skills.

One of the surprising discoveries from our research at Boise State University was that over time, while engaging in the EDP, all of our students, both with and without disabilities, approached failures as a natural process of solving problems.[7] As a result, students demonstrated more perseverance and emotional regulation as they improved their creations and engaged in trial and error.

PROVIDE THE TIME AND SPACE FOR CHILDREN TO ENGAGE IN THE EDP

- Choose a time during the day that children can meet as a group to share ideas before and after the engineering challenge.
- Work in small groups when engaging in the steps of "Explore, Create, and Improve". For us, our Center time worked best, but you could offer a more open ended time by inviting children to explore materials in different areas of the classroom.
- This is a great time for special education teachers and specialists to promote peer interactions and engage in peer-mediated interventions for children with disabilities.
- For children with disabilities, create visual or tactile choice or communication boards that are specific to the engineering challenges. This could be done with icons, photos, or the materials to explore in the challenge.
- Offer a variety of open-ended materials and tools that are both age appropriate and address the fine motor development of all young learners.

ANCHOR THE EDP WITH LITERACY RICH ACTIVITIES

- Partner with your school or community librarian to find both fiction and Nonfiction books that interest the children.
- Create word walls that display content related language such as compare, experiment, problem solving. Highlight the "juicy words"[8] that children are Using during the engineering challenges.
- Provide notebooks, clipboards and writing materials for children to explore and create designs or reflect on the designs they created.

USE THE ACCOMMODATIONS THAT PROMOTE PARTICIPATION IN THE EDP FOR CHILDREN WITH DISABILITIES

- For each challenge, create a visual and/or tactile communication board for children to express their ideas about materials. You can take pictures of the different items they will explore or make a tactile board with the actual items.
- Evidence-based strategies such as peer-mediated supports or visual modeling can be used to help children collaborate with each other and share their ideas to solve the problem presented in a given challenge.
- Designate a space in the classroom, perhaps on top of the cubbies, to store creations that are not yet finished. Children will vary in the time they spend creating their solutions, so you want to honor their need to go back if time is limited within the classroom schedule.

5. Retrieved from https://www.naeyc.org/resources/pubs/yc/sep2018/design-process-engineering-preschool
6: https://www.eie.org/stem-curricula/engineering-grades-prek-8/wee-engineer and https://blog.eie.org/creating-an-engineering-design-process-for-the-preschool-classroom
7: Mere-Cook, Y.& Ramanathan, G. (in press). We are engineers! Using the engineering design process to promote social emotional, language, and literacy development for preschool-aged children with and without disabilities. *Young Children*.
8: Bardige, B. (2013). Language develops through play. Boston Children's Museum. Retrieved from: https://www.youtube.com/watch?v=fZwbK0-kVwQ