

# Wonderful World of STEAM

**Foundations for STEM / STEAM Learning  
Across Diverse Student Populations**



*A thin book that introduces concepts, inspirations, and strategies to promote Science, Technology, Engineering, Arts, and Mathematics learning across student populations with a wide diversity of interests, learning styles, and ability levels.*

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## Dedication

*We dedicate this book to the amazing children who explored the incredible world of STEAM with us in a deeply enriching and loving environment that was filled with excitement, curiosity, sharing, and fun. As a team, we collectively launched, exploded, designed, created, played, calculated, estimated, and shared our passions for Science, Technology, Engineering, Arts, and Math.*

*The amazing part is how children with significant disabilities showed us how to show up and fully engage. They did not seem to care or even notice when their hands, hearts, legs, or minds could not keep up with the demands of the curriculum. Instead, they demonstrated a spirit of CAN DO that reinforced for each of us the belief that all things are possible with a little patience and an open heart.*

*We lovingly share some of our experiences and insights as child interventionists, educators, parents, and grandmothers who have embraced the many children who come into our space. Whether we responded in the role of educator, counselor, interventionist, or friend ... we always learned something new from each experience ... and hope to pass on the torch of fully engaging students of all ability levels – without regard for disability or disorder – in the wonderful world of STEAM.*

*The most important thing if all ... as you look at these pictures and read about our foundations for promoting STEAM across a mixed ability population ... is that you will NEVER know which child belongs to which category, diagnosis, or ability group. Because, in the end, all children are brilliant. They all take turns leading. They all take turns expressing genius. And they all sometimes need a little love and guidance.*

*From our hearts to yours,*

*Cheryl & Darleen*

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*Changes in ability levels and characteristics of student populations demand a new approach to keep up with the ever changing fields of science, technology, engineering, and mathematics.*

## **Introduction**

The world is changing while everybody is holding on for dear life.

Advances in technology, information processing, and science have led to transportation and communication systems that seemed like something out of a sci-fi novel from the 1900s. School-age students are responsible for learning more history, science, technology, mathematics, and sociocultural rules than ever before. At the same time, new challenges to human learning, growth, and development are emerging, causing considerable challenge and upset to the quickly accelerating educational system.

Growing numbers of children with neurodevelopmental, attentional, and sensory processing disorders fill special education classrooms while other countries are outpacing the United States in the number and educational level of scientists, engineers, mathematicians, and inventors produced around the globe. The United States educational system struggled with monolithic yet impractical movements like No Child Left Behind and the Common Core.

While nations like India, China, and Japan produce armies of highly trained and effective professionals across the fields of science, technology, engineering, and mathematics, schools in the United States are still struggling with basic concepts like Free Access to Public Education, Least Restrictive Environment, and Exceptional Student or Special Education. The growing number of children diagnosed with an Autism Spectrum Disorder, or are identified as being neuro-atypical, rises so do the numbers of children impacted by pre-term birth, exposure to substances during gestation, emotional and behavioral disorder, depression and self-harming, anxiety, and trauma.

Many classrooms come to a grinding halt while attempting to respond to the educational and developmental demands of fragile children who exhibit poor self-regulation, unruly or dangerous behavior, and unstable cognition. All the while, advances in all areas of **Science, Technology, Engineering, and Mathematics [STEM]** continue at a frenetic pace as a result of the information age and the world wide web.

For a while, many schools in the United States attempted to phase out non-core classes like music, art, and physical fitness, thinking that the resources previously allocated to those special classes could bridge the serious gaps in the core academic classrooms. Common sense, supported by cutting edge research, prevailed and the arts were once again valued as a critical curricular endeavor that promoted broad learning, growth, and development of students and enhanced performance in STEM fields. So the Arts were infused into STEM - and STEAM was born.

**STEM + *Arts* = STEAM**

This thin book is an introduction to a spectrum of insights, philosophies, and strategies that focus on promoting STEAM learning and success of diverse student populations. STEAM learning is not just for high ability or logical students. Instead, an engaging and innovative approach to teaching and instruction of Science, Technology, Engineering, Arts, and Mathematics can promote the STEAM competency and awareness of all learners, no matter their ability level or personality type.

This book introduces the unexpected ways that STEAM learning can be promoted for all students, including those with learning problems and disabilities. The ways to promote STEAM are often unexpected, oblique, and surprising. Yet, when educators, parents, and the community embrace these evidence-based strategies and concepts, the results are astonishing: Children of all ability levels and walks of life become competent and effective STEAM-empowered citizens who can solve their own problems and contribute to creating a better world in which to live.



*The growing number of students with learning problems, emotional or behavioral disorders, and neuro-atypicality demands careful attention to special education concepts like FAPE, LRE, and Inclusion.*

### **FAPE, LRE, and Inclusion**

In order to promote student emersion in STEAM, educators and administrators who approach diverse STEAM learning populations must be prepared to evolve some basic concepts about education, disability, and accessibility. Students require exposure to environments that are rich with Science, Technology, Engineering, Arts, and Math through conversation, media, art, activities, resources, and curriculum. Learners additionally benefit from access to extra-curricular exposures that include field trips as well as after-school clubs, group activities, and STEAM-related events and activities (Roberts, 2010).

FAPE, the mandated free access to public education, is a concept that opens the door to making learning accessible to all children. Yet, some learners are inherently resistant to aspects of the STEAM domains, with some students holding

highly charged and negative attitudes about Science, Technology, Engineering, the Arts, and/or Mathematics. Education professionals must recognize the historic negativity related to some of these subjects while making space to introduce the curriculum in a new and more accessible format. A more progressive interpretation of FAPE may incorporate new attitudes of educators and administrators as part of the required elements to promote student confidence and engagement as necessary to truly achieve parity of access by diverse learners.

LRE, or Least Restrictive Environment, is another concept that can be self-limiting when considering STEAM curriculum and learning. The challenges associated with a disability may confound learning for some students. Again, a reconceptualization of LRE may incorporate more streamlined and naturalistic incorporation of STEAM learning across the student's learning environment. Students can access and engage with STEAM learning as part of the everyday experience, increasing a sense of familiarity and comfort with the topics.

The LRE for traditional learning may be a resource room, co-teaching classroom, or small group setting; whereas LRE for STEAM may be a playground that is furnished with signs, equipment, posters, and activity areas that are conducive to STEAM learning and exploration. In some cases, a student's LRE depends upon the ability for assistive technology to connect with outside media and technology sources that can provide access to STEAM information and resources (Caves, Shane, & DeRuyter, 2010).

Inclusion is a component of LRE and is a necessary component for students to access STEAM learning and instruction. Examples, ideas, and inspirations for Science, Technology, Engineering, Arts, and Mathematics can be

presented across all educational settings. Each student area, from the small resource room and mainstream classroom to the cafeteria and playground can present ideas, information, and access to critical STEAM curriculum.

The lunchroom table may display a bowl with real apples and oranges; a jar filled with a number of jelly beans that the students must estimate; and herbs and lettuces can be grown under grow lights in the cafeteria to promote a deeper understanding of concepts of nutrition, photosynthesis, and plant respiration. Meanwhile, students grouped at lunchroom tables can discuss the arts as part of the required social and emotional interactions required during mealtime.

In most cases, even students with challenging disabilities can participate in field trips and hands-on activities with accommodation and modification. Students who are physically restricted from field trips can still engage in virtual exploration of STEAM encounters. The educators who stay behind with the students who are unable to attend field trips and outings can simulate aspects of the event by way of discussion, media, personal exploration of the literature, hands-on activities, and personal reflections on the deeper meaning behind the trip, activity, or destination.



*STEAM learning success often depends upon factors that are completely unrelated to science, technology, engineering, art, or mathematics – but rather linked to developmental capacities of the child.*

## **Behavior Management and Self-Regulation as Keys**

Emotional intelligence explains the human capacities for self-regulation, emotional processing, prosocial behaviors, and intrinsic motivation. Disruption or deficiency in any of the board areas of emotional intelligence can frustrate a child’s learning and engagement (Petrides, Frederickson, & Furnham, 2004). This may be especially true for learning across the STEAM domains, which can be learning-intensive.

Behavior inhibition systems may be off-line in children with a history of intense neglect, which is typical for some children who were adopted, have a

trauma history, or were caught up in the child welfare system. These children may be challenged to control their own bodies and minds when in the learning environment, making intense exploration and learning a challenge.

Specific classroom, trauma-informed, and developmentally supportive strategies can help these children learn to self-calm, self-soothe, remain self-aware and self-regulate. STEAM learning can only really thrive when emotionally fragile and attention-challenged learners are supported to calm down, focus, act kindly to others, and pay attention.

Behavior management must be more intentional and developmentally targeted for mixed ability populations and support the emotional intelligence and broad development of children. To this end, the STEAM curriculum can be supercharged with Social, Emotional, and Self-Regulatory knowledge, skills, and competencies.

Examples of supportive competencies include mindfulness, self-awareness, and metacognition as strategies to promote student self-regulation. Additional behavioral management strategies include academic and behavioral contracting with students; promoting student intrinsic motivation and sense of accomplishment; and peer/friendship connections.

**This is a professional courtesy  
Sample version of the complete thin  
book including references.**

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[OrchardHumanServices.org](https://OrchardHumanServices.org)  
website or go to [Amazon.com](https://Amazon.com)  
to purchase a full copy of the book.**

**Orchard Human Services, Inc.  
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*Children thrive in the positive expectancy and attention of adults who care about them. The encouraging attitudes and beliefs of an educator, parent, or therapist can dramatically impact a child's confidence and performance in incredible ways.*

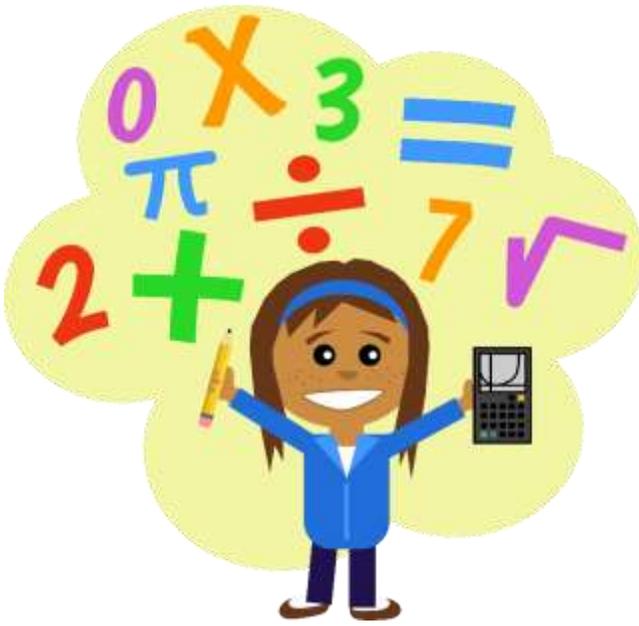
### **Rosenthal and Pygmalion Effects**

The positive expectation of parents, educators, and administrators can positively impact student learning and success across STEAM curriculum (Weinstein, 2018). This notion was first introduced through mythology about Pygmalion and repeated in modern theater. Eliza Doolittle of the musical *My Fair Lady* transformed her speech, manners, and humanity under the positive guidance of Professor Higgins. More recently, research into the phenomenon has been conducted under the category of Rosenthal Effect.

As the educational and psychology communities move farther into the new millennium, the research about the neuroplastic potential of the brain abounds. So do strategies to promote STEAM learning across diverse populations. The current culture still holds remnants of antiquated ideas about math not being for girls or boys not being good at the arts.

Meanwhile, exploration of strategies to promote neuroplastic growth and development of the brain is in its infancy. Research is unfolding right now that explains ways to improve learning, cognition, focus, attention, and memory through such diverse strategies as nutrition, genetic and epigenetic interventions (Flitton et al., 2019), transcranial magnetic brain stimulation (Kaur et al., 2019), neurofeedback (Yu, Kang, & Jung, 2012), ketogenic nutrition that promotes serum levels of Beta-Hydroxybutyrate (Murray et al., 2016; Stubbs et al., 2017), colored lenses for vision (Kim, Seo, Ha, & Kim, 2015), and so much more.

What would happen if parents, educators, administrators, and psychologists simply assumed that each child has the in-born potential to be a STEAM genius? The research indicates that holding a positive expectation of successful academic learning and mastery of the curriculum is a strong indicator of future student performance. So each adult reading this text is hereby challenged to adopt a new attitude toward STEAM learning . . . one that recognizes the true potential for greatness that resides in the hearts and minds of each and every child.



## Conclusion

STEM, or science, technology, engineering, and mathematics, learning and success is critical for today's students to take over the work force of tomorrow. The arts make a meaningful contribution to the individual learning and development of students, helping them achieve greater success in the remaining domains. And thus, STEAM was born.

This thin book introduced a spectrum of concepts, strategies, and paradigms that promote successful STEAM learning and achievement for students with diverse ability levels. Some of the most powerful ways to promote STEAM success come from outside the curricular STEAM fields. Socialization, neuro-hacking, and Universal Design for Learning represent just a few of the many ways that educators, parents, and administrators can promote the effective STEAM learning and success of all students.

## References

- Basham, J. D., Israel, M., & Maynard, K. (2010). An ecological model of STEM education: Operationalizing STEM for all. *Journal of Special Education Technology, 25*(3), 9. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=edb&AN=55602838&site=eds-live&scope=site>
- Buchhalter, J.R., D'Alfanzo, S., Connolly, M., Fung, E., Michoulas, A., Sinasac, D., . . . Rho, J.M. (2017). The relationship between d-beta-hydroxybutyrate blood concentrations and seizure control in children treated with the ketogenic diet for medically intractable epilepsy. *Epilepsia Open, 2*(3), 317-321. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/29588960>
- Caves, K., Shane, H.C., DeRuyter, F. (2010) Connecting AAC devices to the world of information technology. *Assistive Technology, 24*(1), 81-89. Retrieved from <https://doi.org/10.1080/10400435.2002.10132057>
- Cramer, S.C., et al. (2011). Harnessing neuroplasticity for clinical applications. *Brain, 134*(6), 1591-1609.
- Efland, A.D. (1995). The spiral and the lattice: Changes in cognitive learning theory with implications for art education. *Studies in Art Education, 36*(3), 134-153.
- Flitton, M., et al. (2019). Interaction of nutrition and genetics via DNMT3L-mediated DNA methylation determines cognitive decline. *Neurobiology of Aging, 78*, 64-73.

- Garg, M.K., Sharma, P., & Kirmani, M.N. (2016). Neuroplasticity of the brain: Neurophysiological perspective. *The International Journal of Indian Psychology*, 3(4), 2349-3429.
- Gibbons, P. (2015). *Scaffolding language, scaffolding learning*. Portsmouth, NH: Heinemann.
- Hwang, G., & Chen, C. (2017). Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving. *British Journal of Educational Technology*, 48(4), 950. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=edb&AN=123348778&site=eds-live&scope=site>
- Izzo, M.V. & Bauer, W.M. (2015). Universal design for learning: Enhancing achievement and employment of STEM students with disabilities. *Universal Access in the Information Society*, 14(1), 17-27. Retrieved from <https://doi.org/10.1007/s10209-013-0332-1>
- Kaur, M., et al. (2019). Sleep-wake, cognitive and clinical correlates of treatment outcomes with repetitive transcranial magnetic stimulation for young adults with depression. *Psychiatry Research*, 271, 335-342.
- Kim, J.H., Seo, H., Ha, S., & Kim, S. (2015). Functional magnetic resonance imaging findings in Meares-Irlen Syndrome: A pilot study. *Korean Journal of Ophthalmology*, 29(2), 121-125.
- Murray, A.J., et al. (2016). Novel ketone diet enhances physical and cognitive performance. *The FASEB Journal*, 30(12), 4021-4032.

- Noble, T., & McGrath, H. (2015). PROSPER: A new framework for positive education. *Psychology of Well-Being Theory, Research and Practice*, 5(2), 1-17. Retrieved from <https://doi.org/10.1186/s13612-015-0030-2>
- Petrides, K.V., Frederickson, N., & Furnham, A. (2004). The role of trait emotional intelligence in academic performance and deviant behavior at school. *Personality and Individual Differences*, 36(2), 277-293. Retrieved from [https://doi.org/10.1016/S0191-8869\(03\)00084-9](https://doi.org/10.1016/S0191-8869(03)00084-9)
- Quintana C., Reiser B.J., Davis E.A., Krajcik J., Fretz E., & Duncan R.G. (2009). A scaffolding design framework for software to support science inquiry. *Journal of the learning sciences*, 3, 337-386. Retrieved from [https://doi.org/10.1207/s15327809jls1303\\_4](https://doi.org/10.1207/s15327809jls1303_4)
- Renner, J. (1976). Significant physics content and intellectual development – cognitive development as a result of interacting with physics content. *American Journal of Physics*, 44, 218.
- Roberts, J.L. (2010). Talent Development in STEM disciplines: Sparking innovators. *NCSSMST Journal*, 15(2), 7-9. Retrieved from <https://files.eric.ed.gov/fulltext/EJ893657.pdf>
- Sherrill, R. (2005). Effects of hemoencephalographic (HEG) training at three prefrontal locations upon EEG ratios at Cz. *Journal of Neurotherapy*, 8(3), 63-76. doi:10.1300/J184v08n03\_05
- Siry, C. & Kremer, I. (2011). Children explain the rainbow: Using young children's ideas to guide science curricula. *Journal of Science Education and Technology*, 20, 643-643. Retrieved from <https://doi.org/10.1007/s10956-011-9320-5>

Stubbs, B.J., et al. (2017). On the metabolism of exogenous ketones in humans.

*Frontiers in Physiology*, 8, 848.

Weinstein, R.S. (2018). Pygmalion at 50: Harnessing its power and application in

schooling. *Educational Research and Evaluation*, 24(3-5), 346-365.

Yu, J., Kang, H., & Jung, J. (2012). Effects of neurofeedback on brain waves and

cognitive functions of children with cerebral palsy: A randomized control

trial. *Journal of Physical Therapy Science*, 24, 809-812.

Zeneli, M. (2015). *Developing, testing and interpreting a cross age peer tutoring*

*intervention for mathematics: Social interdependence, systematic reviews*

*and an empirical study* (Doctoral thesis). Durham, NC: Durham

University. Retrieved from <http://etheses.dur.ac.uk/11367/>

## About the Authors

### Cheryl Safford, Educator, Director, Artist & Community Outreach



Mrs. Cheryl Safford is artist and the Founder and Director of Kinder Kollege Christian School, College Park, Ga. She also serves on the board for Orchard Human Services, Inc.

A credentialed early childhood director and educator, she is active in the community, promoting learning, development, and wholeness of the children at her center and in her community. Ms. Safford has won many awards for her significant contributions and her passion for service is infinite.

A visit to Kinder Kollege reveals Ms. Safford's inner passion for the arts, science, and literacy. Her center contains a plethora of science manipulatives, an extensive library, and an art center that is out-of-this-world. A hallmark of her many decades of providing high quality early childhood care and education is her commitment to serving children with disabilities. One of her outstanding contributions is her fishing ministry, through which she teaches connection to nature, science, patience, and inner peace to children in her community. She can be reached at 404-768-5037 or through Kinder Kollege's facebook page:

[facebook.com/Kinder-Kollege-Christian-School-186050804742341/](https://facebook.com/Kinder-Kollege-Christian-School-186050804742341/)

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Dr. Darleen Claire Wodzinski is a Clinical Mental Health Counselor, Non-Clinical Psychoneuroeducational Psychologist, Developmental Interventionist, and Special Education Consultant.

Author and national presenter, she is founder of the nonprofit Orchard Human Services, where she provides direct services to fragile populations and training for educators, parents, and professionals who serve fragile children.

Dr. Darleen specializes in promoting attachment, social, and emotional development, learning, and recovery of children with a history of adoption, complex trauma, developmental trauma, or some form of attachment disorder, including Reactive Attachment Disorder [RAD] and DSED [Disinhibited Social Engagement Disorder]. Other areas of focus include socialization and behavioral training for children with an Autism Spectrum Disorder or who are diagnosed with Neuro-Atypicality or learning problem.

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## More About the Authors



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Dr. Darleen Claire Wodzinski

Since meeting at a GAEYC education conference, Ms. Safford and Dr. Darleen have collaborated to provide high quality education, intervention, and therapeutic services to children with complex and co-occurring disorders of development, learning, cognition, behavior, neurodevelopment, and attachment.

One of their shared projects is a summer and after-school program that promotes STEAM learning for children with exceptionalities within an inclusion setting.

They also share a deep commitment to family and community. Each of them has hosted many children from other families in their homes over the years. Their work with children and families reflects this deeper knowing about how to support children and families with challenges.

Perhaps the most precious thing about their relationship is a common love of tea. All throughout the year, you will see Ms. Safford and Dr. Darleen sharing a delicious home-brewed tea. Ms. Safford makes a special fresh organic ginger tea while Dr. Darleen loves mixing herbal and fruit teas to create new flavors.



*Other books, white papers, and publications available at  
Orchard Human Services, Inc. and Amazon.com are:*



- Marmalade Jam Series –
  - Marmalade Jam
  - Juno's Butter Knife
  - Marmalade Jam Companion Coloring Book
- Developmental Justice
- What Children Need to Know
- Develop-MEANT Series
- Methylene Tetrahydrofolate Reductase Deficiency: Practical Implications for Pediatric Medical and Dental Practice
- Autism Insights – A New Hope *series*
- Self-Care Guide

[Marmalade Jam](#)

Part I of Therapeutic Children's Series

Juno's Butter Knife [to be released soon]

Part II of Therapeutic Children's Series

[Dead Children Can't Read](#)

Classrooms of Compassion

[Raising Social Children](#)

A Guide for Parents Who Suspect Their Child May Have A Delay in  
Social Development

[Self-Harm Guide](#)

A Guide for Youth, Families, Educators, Human Services Workers