STEM Education and Kinesiology

By Penny McCullagh, Ph.D., KT Editor

“The Committee on STEM Education (CoSTEM) was established pursuant to the requirements of Section 101 of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. §6621). In accordance with the Act, the Committee reviews science, technology, engineering, and mathematics (STEM) education programs, investments, and activities, and the respective assessments of each, in Federal agencies.”

STEM refers to Science, Technology, Engineering and Math. One idea however is that STEM education does not just focus on these four disciplines and in recent years there has been an emphasis on expanding to other disciplines and to looking at the interaction between disciplines as opposed to focusing on a single discipline. The U.S. Department of Education announced in November 2020 that during Fiscal Year (FY) 2020, it invested $578 million to support high-quality STEM education. https://www.ed.gov/stem#background

Another example of Kinesiology links with STEM emanates from work by Dr. Cathy Ennis. Readers are referred to a special issue of Kinesiology Review that highlights many of her contributions (Kinesiology Review, 2018 -Volume 3 – The Legacy of Catherine D. Ennis). Ang Chen, a professor at the University of North Carolina at Greensboro (UNCG) worked with Ennis for years, and continues to work on teaching kinesiology science in physical education. Their group has been successful in securing NIH funding by intertwining STEM concepts into their curricula.

Ang explained, “Our curriculum interventions are about teaching and improving elementary to high school students’ knowledge about kinesiology as related to national science and physical education learning standards as associated with physical activity and healthy lifestyles. My everyday lives and thus may stimulate science engagement” which is a goal of STEM. While the research did not provide strong evidence for the idea, it did provide some ideas how kinesiology can be linked to STEM. https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1209&context=nwite

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current project is a five-year physical education intervention study in high schools. The study targets Next Generation Science Standards such as ‘Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions’ and satisfies national physical education standards. The curriculum integrates technology use (e.g. an APP) for students to calculate caloric balance to understand nutrition science and exercise physiology on energy pathways. Our work has shown students’ knowledge growth in kinesiology science (Sun et al., 2012, https://doi.org/10.1086/667405) as well as confusions without the knowledge (Zhang et al., 2021, https://doi.org/10.1080/00220671.2021.1901066) in these areas."

The project’s website is under development and is being migrated to a different platform. Ang can be reached at a.chen@uncg.edu. Here is a link to the pedagogy research lab at UNCG: https://kin.uncg.edu/research/labs/pk-lab/.

Considering that there is a lot of grant funding available for STEM education, it would seem important that kinesiology departments be active in integrating with STEM programs on their campuses if learning about kinesiology-related topics can help improve the education of students in the schools.

Dr. Chris Rhea is an Associate Professor in one of our member departments at the University of North Carolina at Greensboro (UNCG). He is also the Director of the UNCG Research and Instruction in STEM Education (RISE) Network. https://rise.uncg.edu/ I wanted to learn a little more about his role and his department’s role in STEM on their campus in the hopes that other departments might value this information.

**How did your department and you specifically get involved in STEM on your campus? Can you provide us a brief history?**

Our department has a long history of interdisciplinary collaboration. I suspect that is the case for many kinesiology departments, as that is the nature of our discipline. Our department’s interdisciplinary connections have led to many formal and informal STEM touch points on campus. For example, our RISE Network started over a decade ago as an organic group of faculty members broadly interested in STEM education. Cathy Ennis was on our faculty when I started and she was part of the RISE Network, as her and Ang Chen’s work focused on creative ways to embed STEM concepts in K-12 physical education curriculum. Cathy encouraged me to get involved in RISE’s events during my early faculty years. RISE’s signature event is the Science Everywhere festival, which is a community-focused event where faculty and students on campus open their labs and put on science demonstrations for 5,000-plus community members who visit campus on a Saturday in April. To participate in this STEM initiative, I provided tours of my virtual reality lab for many years as a part of the Science Everywhere event. I also encouraged my kinesiology colleagues to participate and in 2019 (our last face-to-face version of the event), our kinesiology department had the most demonstrations from any department across campus. It is a wonderful way for kinesiology to highlight our STEM work with the public. We had to cancel the 2020 Science Everywhere event due to COVID and we pivoted to a virtual event this year, but we hope to be back face-to-face in 2022.

It is my understanding that STEM does not need to be linked to one discipline but is more related to a way of learning? Do only the science sub-disciplines in kinesiology (e.g exercise physiology, biomechanics and motor control) need to be linked to STEM, or can our entire discipline? Can you elaborate on that?

Conceptually, yes. STEM is broad and encompasses all aspects of science, technology, engineering, and mathematics.
Given kinesiology’s interdisciplinary nature, STEM is interwoven in our subdisciplines. The most obvious connections may be the ones you mentioned (e.g., biomechanics, exercise physiology), but I would argue STEM concepts are connected to most of our subdisciplines. I already talked about how Cathy Ennis and Ang Chen connected STEM to physical education pedagogy, for which they were successful in winning grants from NIH and the Department of Education. Motor behavior is well-connected to STEM though its systematic and scientific exploration of how humans control, learn, and develop their movements. The study of sport and exercise psychology also borrows from STEM concepts, especially with the integration of neuroscience in these areas. And the list goes on and on. Thus, STEM can be found throughout kinesiology.

One thing to be aware of is that the definition of STEM varies by agency. For example, the National Science Foundation (NSF) does not typically consider kinesiology as a STEM discipline since we are commonly more aligned with NIH priorities. However, many of our subdisciplines are well-aligned with STEM work, so access to funding mechanisms may depend on your home department. For instance, some sport/exercise psychology and motor behavior faculty are housed in psychology departments, which do qualify for STEM funding from NSF.

**Do you think kinesiology programs should take an active role in getting connected with STEM on their campuses and can you suggest some strategies about how they might do so?**

Yes, absolutely. I see connecting with STEM initiatives across campus as an opportunity to broaden our kinesiology footprint in a reciprocal fashion. It helps by enlightening those who may not be familiar with kinesiology about what we do, but it also brings in research and teaching techniques from their disciplines that might not be widely adopted in kinesiology. Participating in STEM community-focused events also helps ensure that kinesiology is part of the lexicon used by the general public. I viewed accepting the Director position in RISE as a way to continue pushing kinesiology forward into a broader space on campus and connecting unit leaders who may not have a good understanding of what we do. This was also a growth opportunity for me to learn more about STEM in a variety of spaces. If you are interested in the portfolio of event’s that we put on to support RISE’s mission, I invite you to look at our [2019-2020 Annual Report](https://www.americankinesiology.org).


Here are some current funding calls for projects: