Prior to the 1920s, physics and chemistry were the two dominant science courses in U.S. high schools. They were “precollege” requirements, needed before acceptance to schools such as Harvard University. Every high school wanted its students to be admissible to the top colleges, so they offered courses in physics and chemistry. Dozens of other courses in the public school curricula – including health, hygiene, nutrition, agriculture, manual training, physical exercise, nature studies, cell theory, and human anatomy – were ultimately combined in the category of “Biology.” By the 1980s, biology had become the third science course in most high schools.

Since World War II, U.S. schools have typically included biology as a 10th-grade class, along with physics and chemistry for 11th- and 12th-graders. As the 20th century concluded, biology was often the only science course required for graduation from high school. Students were interested in biology and nature studies, but biology was taught, too often, in a teacher-centered fashion. Students were frequently asked to remember the content of textbooks, laboratory manuals, and lectures without any opportunity to focus on personal explorations and explanations of nature. This was done in spite of the continual plea that we must encourage more student experiences in the actual “doing” of science and focus less on remembering what has been done. After all, biology is a subject that even preschool children have explored on their own through interactions with the natural world. Students typically “do” biology even before they enter formal classrooms.

**National Science Education Standards**

In 1996 we saw the first major nationally focused reform of science education with the release of the National Science Education Standards (NSES), which provided major emphasis on how teaching should change in our schools. One of the crucial elements of the NSES was their definition of inquiry, or the “doing” of science. Science was not merely information provided by scientists and included in textbooks for students to remember. It was a place where scientists even found their own mistakes.

There were nine features included in biology courses that were designed to encourage students to be “doers” and not just “onlookers,” including a focus on student understanding and use of information, core ideas, and inquiry-based learning. These meant having students engaged in “active and extended inquiries as well as opportunities for discussion and debate among students” and “the sharing of responsibility for learning with students,” all of which indicate hallmarks of inquiry instruction.

**The World of STEM**

Science educators now live in a world of STEM (Science, Technology, Engineering, and Mathematics). This STEM perspective is especially noteworthy because of the major funding initiatives, along with political and even public interest and support for it. While STEM has varying definitions, some suggest that STEM should be the vehicle that ignores the boundaries separating the four science disciplines and gives students increased opportunities to engage in the actual “Doing of Science” – encouraging student-centeredness. This means less attention on teacher-centeredness, as long as understanding of the individual disciplines do not get lost along the way.

Biology has enjoyed a relatively brief history as one science discipline. It has provided closer ties to the new STEM reform efforts of 2015. It is amazing to see “STEM” as having more meaning personally while also illustrating research that is labeled “Biology.”

**Next Generation Science Standards**

The Next Generation Science Standards (NGSS) have been proposed by a consortium of states to be adopted widely, across state lines, to replace the NSES. In spite of the promises of the NGSS, there are some problems. First, the 41 individuals responsible for preparing the NGSS were well qualified in terms of their general credentials, but the team included only five experienced science-education researchers. Probably only a few on the writing team knew of the NSTA’s “What Research Says to the Science Teacher” publications. Second, the developers seemed unconcerned about teaching; instead, they spent time adding interesting, but ultimately not particularly useful, elements such as “Crosscutting Science Concepts and Core Ideas Also Regarding Technology and Engineering.” Even the Core Concepts are offered without any focus on how to teach. These new standards do not relate to anything in the daily lives of students. The NGSS do not include student explorations, nor do they address societal issues. Still another problem with the NGSS is that they do not encourage student-centered learning. The focus of the NGSS has no relationship with actually “doing” science and including that goal as a major purpose for science education. This stands in direct opposition to the strong inquiry focus