

THE OVERLOOKED DIMENSION OF DROP-OUTS

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Vexation

Each state has their unique way of documenting drop-outs. This has been a long term problem of the American education system. Historically, compulsory education has been the domain of states. Some states have grade levels, others have ages. The issue of drop-outs became a greater national issue with the passage of No Child Left Behind legislation (NCLB, 2002). States had an additional reason to have a low percentage. Society has a strong need for having each K-12 student reach their education potential- high school graduation. Previously, the high school diploma was the ticket to a successful adulthood. In 1950, typically only 50% of the students received a high school diploma. At that time, science was considered predominantly for college bound students, especially in chemistry and physics. The launch of Sputnik I in 1957 resulted in changing of science and mathematic courses with a focus upon the structure of the disciplines.

In April 1983, the U.S. Department of Education released a small report that influenced high school science requirements. The *Nation at Risk* report recommended all high school graduates must have two credits in science. This report did not identify which science topics/courses. They left this decision to states. The last decade of the twentieth century had a focus on identifying what science concepts were necessary for an individual to be scientifically literate for the 21st century. Two policy documents *Science for All Americans (SFAA)*, [American Association for the Advancement of Science (AAAS), 1989] and *National Science Education Standards (NSES)* [National Research Council (NRC), 1996] provided guidance to states in their development of state science curriculum. The AAAS published *Benchmarks for Scientific Literacy* (1993) that put *SFAA* in a K-2, 3-5, 6-8, and 9-12 format. These documents were used by states as they personalized their K-12 science curriculum. Even though there is 90% content agreement between *SFAA* and *NSES*, the states proceeded to develop their own science formatted curriculum. In addition, National Assessment for Educational Progress (NAEP) has long term documented student performance in science. However, NAEP does not align with *SFAA* and *NSES*.

Historically, drop-outs were a concern because these individuals were not the most productive members of society. Drop-outs are individuals who did not earn a high school diploma. Beginning in 2012-13 school year, the U.S. Department of Education standardized that all students who enter high school that do not graduate will be identified as drop-outs. This method had been recommended by the National Governors Association in 2005.

Who are these overlooked drop-outs? They are the individuals who completed only the minimum number of fewer science classes. If a scientific literate society is essential, the science education community needs to reach consensus about what science concepts are most appropriate for all students. There needs to be a consensus of what students need to know. This requires a redesign of a national curriculum. The mathematics community updated their standards in 2001, but science education has not addressed this need.

Students need to be able to utilize concepts from physics, chemistry, biology and earth science throughout their lives. It is not the number of science courses needed for graduation, but the concepts that students need to understand. State science tests are driving the school day. If it isn't tested, teachers don't emphasize those concepts. If the test is at the end of March, do students care about the rest of the year?

The purpose of K-12 science is to prepare students for life not a career as a scientist. The science concepts must relate to students' future. For example, we are having an almost epidemic-like increase in Type II diabetes, associated with obesity. Biology classes need to focus upon this endocrine related topic rather than goiter. The development of an agreed upon science curriculum needs to cross state boundaries. This will result in reduced size of science textbooks that are addressing these state variations in science curriculum. This agreement needs to be coordinated by a group who doesn't have a vested interest. *Taking Science to School* (NRC, 2007) recommends the reduction without identifying specific science concepts.

Venture

We need to reduce the number of science drop-outs, individuals who only complete the minimum number of credits. Science courses should not be a prerequisite for the next course. Surface coverage of topics fails to develop understanding of science concepts and processes. The educational system needs to examine carefully why our students' performance on TIMSS and PISA are inferior to other developed countries.

The state of Missouri recently implemented a requirement of three science courses for high school graduation without recommending the essential concepts. Some Missouri schools have implemented Physics First as a required ninth grade course. Some schools have selected biology and chemistry as the next two courses. Unfortunately, some are teaching biology at tenth grade and other schools at ninth grade. Starting in 2009, there will be an end of course examination for biology to meet NCLB legislation. Will this be fair to students who have chemistry before biology? As a result, the same biology examination will be completed by ninth (non-Physics First students), tenth, or eleventh grade students. Biology concepts need to be built upon prerequisite concepts rather than biology only concepts. I don't consider Missouri unique in its approach for establishing science curriculum and its assessment. We need to focus on students having quality science opportunities K-8 so they do not drop out of the science pipeline for being able to utilize what they have studied for their entire life not just their K-12 years.

It is not my recommendation to develop a series of science courses for dropouts. This would be a form of tracking and what would be the requirements for admission to this drop-out track? To bring this situation forward, I would send a letter to our state STEM committee noting they have ignored a large group of students with their college science concept expectations. There are an increasing number of Missourian individuals who are enrolling at community colleges without a strong science background. With their associate's degree, they have completed their science requirements for life. However, are they prepared for a changing life in the twenty-first century that is based upon expanding science and technology knowledge? As I continue to work with the K-12 rewrite of Missouri GLE's, I will continue to bring this ignored population to the committee's attention.

As we continue to examine K-12 science curriculum, we need to implement suggestions from TIMSS (2003), reduce the curriculum topics while teaching at great depth and improve the way science is taught. NCLB has established that science is to be assessed three times in K-12. Within Missouri, this is occurring at grades 5, 8 and biology. Science is not part of academically yearly progress reports; science is customarily ignored prior to grade 5. The greatest stress upon science instruction must be grades 5-9. Middle school science has the highest number of non-certified teachers (Weiss, 2003). Therefore, I recommend that Teacher Quality grants should be only for teachers in this grade span. This focus should be on science concepts that are addressing use of science as an adult rather than only the high school curriculum. A science/technology/society orientation would provide a relevance model. I am not recommending ignoring the science interested/oriented individuals, but acknowledging that not all individuals are of this type. We must be interested in offering science courses for all students.

My future research agenda will involve two studies which also relates to this vexation. First, conduct a study to see whether high school biology performance differs between grades 9, 10, and 11. Second, conduct a study to see whether Physics First with chemistry and without chemistry influences biology performance. The results of these studies will be shared with state stakeholders, Science Teachers of Missouri members, and state school board members.