

**The Case for the Continued Importance of Spherical Geometry with
Emphasis on Spherical Trigonometry
Selected References
Griffin Dodd**

- 1906
- A History of the Teaching of Elementary Geometry
- Alva Walker Stamper
- Columbia University Press
- <http://books.google.com/books?id=E2XQAAAAMAAJ&printsec=frontcover#v=onepage&q=&f=false>

Stamper's doctoral thesis for Columbia University, a history of geometry education before Euclid until 1906, focuses primarily on European and American educational practices. He divides his work using three historical dividers: Euclid, the rise of the Christian schools, and the year 1525. Stamper's study of French geometry education describes Charles Meray's "fusion" method in which plane and solid geometry are taught simultaneously. The current (1906) research on this method provides evidence that it, "saves time, appeals to intelligence more than memory, and accustoms the student to think for themselves." Stamper notes that this method is not used in the lycees (high schools that prepare students for university) and conjectures that the problem of preparing students for higher examinations prohibits teachers from trying a new method. A similar method used in German high schools is discussed. Summarizing the most recent developments in the teaching of geometry, Stamper notes that in the U.S. and England, individual disciplines are becoming more isolated. This is not the case in France and Germany. His conclusion recommends that: practical experimental work gives rise to proper incentives for logical investigation, the class hour should be dedicated to investigation rather than hearing lessons, and that mathematical subjects should not be taught in isolation.

- 1924
- The Teaching of Geometry in Schools. Report of 1923
- H. F. Baker, E. M. Langley, W. C. Fletcher, M. J. M. Hill, W. J. Dobbs
- The Mathematical Gazette, Vol. 12, No. 170 (May, 1924), pp. 73-136

This article is comprised of four responses to the 1923 report, "The teaching of geometry on schools." Baker, an astronomy and geometry professor at Cambridge, disagrees with what he sees as the report's support for rote learning of abstractions; especially the concept of a plane. He goes on to argue that students should be taught to deduce propositions of plane geometry from

those of solid geometry rather than the converse. This will lead to much more enjoyment of the subject as it becomes an education by discovery

- 1941
- On Education for Service
- William L. Hart
- The American Mathematical Monthly, Vol. 48, No. 6 (Jun. – Jul., 1941), pp. 351–418

This is a reproduction of a report submitted to the chairman of the war preparedness committee by a subcommittee chaired by Hart, a professor of mathematics at the Univ. of Minnesota. It breaks down the Army and Navy into branches (i.e. Artillery) and describes what math should be required. Suggestions are made as to how to encourage high schools to structure their curriculum. Stress is placed on giving more prominence to solid geometry in high school. Learning solid geometry is called a patriotic duty. The need for a solid grasp of spherical geometry is stressed for those wanting to become pilots, navigators, gunners, and officers.

- 1943
- Spherical Trigonometry–An Emergency Course
- R. B. McClenon
- National Mathematics Magazine, Vol. 18, No. 1 (Oct., 1943), pp. 1–48

McClenon, of Grinnell College, begins by expressing that the return of spherical geometry to school curricula brought on by the war (WWII) is a positive change. He hopes that it is one that will last; providing several reasons why spherical geometry is good for mathematical development. He then compares theorems in plane geometry with those in spherical; concluding with a list of spherical geometry's applications and a statement that spherical trigonometry should be taught in schools solely on its merits and not because it is needed in wartime emergency.

- 1944
- Next Steps in Education and in the Teaching of Mathematics
- William Betz
- National Mathematics Magazine, Vol. 18, No. 4 (Jan., 1944), pp. 145–180

The author, borrowing from an address he gave to the Teacher's College at Columbia University, declares the war (WWII) illuminates a dire need for mathematics curriculum reform in all years of primary and secondary education. The current practice of one year courses in algebra and geometry is dangerously inadequate. When courses are taught in continuing geometry, it is crowded into a time frame that is too narrow for understanding and mastery. The sudden demand for mastery has given rise to "emergency" courses. One

course of this type provides for 17 hours of algebra, 17 of geometry, and 19 of spherical geometry. This causes Betz to ask, "How much real mastery and understanding can be achieved under such a plan?"

- 1998
- Perspectives on the Teaching of Geometry for the 21st Century
- Carmelo Mammana & Vinicio Villani
- Kluwer Academic Publishers
- <http://books.google.com/books?id=8fRQHBa7L9sC&printsec=frontcover#v=onepage&q=&f=false>

This compilation of works by over twenty authors is a study commissioned by The International Commission on Mathematical Instruction. These works encompass a myriad of topics including: reasoning in geometry, assessment, current teacher qualifications, and changing trends in geometry curricula. Computer technology allows for a resurgence of 3-D geometry exploration. One author describes spherical geometry as culturally important, but can not name countries where it is still taught in secondary schools. Several articles pick up where Stamper's A History of the Teaching of Elementary Geometry leaves off. These articles describe the evolution of geometry education since the end of the nineteenth century. According to one author, areas of geometry that cease to be taught in the universities are not taught at earlier levels of the education system. This statement applies to spherical geometry.

- (1999)
- The Decline and Rise of Geometry in 20th Century North America
- Walter Whiteley
- <http://www.math.yorku.ca/~whiteley/cmmsg.pdf>

Whiteley, of York University, enumerates current problems associated with the marginalization of geometry in North American secondary education curricula. He declares that geometry continues to be a vital area of mathematics. Alarming, few students are exposed to geometry in high school and college. There is a dearth of available teachers to prepare future geometers. Whiteley details the emerging availability of computer software that aids geometry education from primary school on. He then suggests how geometry is learned and should be taught. He suggests that 3-D geometry should be learned before 2-D geometry. Geometry should be taught "down the hierarchy—from topology, through projections, and finally to Euclidean geometry." Euclid's postulates should reinforce what students have already discovered.

- 2000
- Rice University Spherical Geometry Applet Page
- John C. Polking
- <http://math.rice.edu/~pcmi/sphere/index.html#toc>

Polking's website provides explanations and exercises as a general overview of spherical geometry. Spherical diagrams can be rotated to facilitate visualization and understanding of the material. Specifically, Girard's Theorem (a formula for the sum of the angles in a spherical triangle) and Euler's Theorem (relating the sides, faces, and edges of a convex, 3-D polygon) are explored.

- 2003
- A Panoramic View of Riemannian Geometry
- Marcel Berger
- Springer Publishing
- http://books.google.com/books?id=d_SsagQckaQC&pg=PP1&dq=a+panoramic+view+of+riemannian+geometry&ei=71P8StiNFKe8zgTFiJndDg#v=onepage&q=&f=false

Berger's extensive exploration of Riemannian geometry details "living" topics in geometry. These topics, undiscovered one hundred and fifty years ago, continue to yield new discoveries. Spherical geometry continues to be a vital topic in mathematics research. Berger refers to spherical geometry over one hundred times when he explains different areas of current research.

- 2009
- KryssTal: Spherical Trigonometry
- Author Unkown
- <http://www.krysstal.com/sphertrig.html>

The website, inspired by a UK politician who claimed that Arab civilization had contributed nothing of note to the world, introduces the origins of spherical geometry. The author states that spherical geometry arose as a method of finding Mecca. The website then uses applications of spherical trigonometry to find distances and direction between cities, declination of celestial bodies, geographic positions of sunrise, and correct sundial readings.

- 2009 (Date of authorship unknown)
- San Jose State University: Spherical Geometry and Trigonometry Website
- Thayer Watkins
- <http://www.sjsu.edu/faculty/watkins/sphere.htm>

Watkins, of San Jose State University, describes how computers simplified the spherical trigonometric computations necessary for accurate navigation. This simplification eliminated the need to understand formulas or their derivations. A lack of new textbooks led to the current, near extinct state of spherical trigonometry. Watkins finds this puzzling; ease of computation should lead to an emphasis on theory. He warns that spherical geometry textbooks in

existence might be discarded by libraries as they age. His site presents derivations of important results from spherical geometry and trigonometry.