

Teaching Mathematics with a Biblical Worldview and a Historical Perspective
by
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Introduction

The mission of Belhaven College to “prepare students academically and spiritually to serve Christ Jesus in their careers, in human relationships, and in the world of ideas” applies to every academic discipline. Many people, including Christians and even Christian mathematicians, might ask how that could possibly be done in mathematics. How can God have anything to do with solving a quadratic equation or finding the area of a triangle? At Belhaven we guide our students through a process of learning what a worldview is, describing a biblical worldview, and articulating their own worldview. We teach our students that their worldview applies to every aspect of their lives, including the study of mathematics.

Teaching mathematics from a Christian perspective does not mean just adding a few Bible verses to the day’s lesson. In order for students to learn mathematics within the framework of a biblical worldview, they need to be familiar with the current philosophical and methodological presuppositions in mathematics, both secular and biblical, and how these views developed throughout history.

Philosophical Presuppositions of Current Scholarship in Mathematics

The main philosophical presupposition in the current secular scholarship in mathematics is that mathematics is religiously neutral. That is, mathematics

exists apart from God. However, there are differing views of the origins of mathematics and mathematical thought. One opinion is that man discovers pre-existing mathematical truths, while another is that all mathematics is invented by man.

The dominant philosophy in mathematics originated with Plato in the fourth century B.C. His belief that mathematical objects have an existence of their own outside of the human mind and are therefore discovered by man has been embraced by mathematicians for centuries. Another view of mathematics is based on Aristotle's opinion that mathematical knowledge is obtained from experimentation and observation. This viewpoint sees mathematics as a creation of humans by pure reason. In either case, developments in mathematics are seen as triumphs by man and his intellect. According to Calvin Jongsma of Dordt College, if anything is deified by the modern mathematical scholar, it is mathematics itself (6).

In the early 1900s, at a time when mathematicians and philosophers were moving away from Platonism and searching for a way to describe the foundation of mathematics, three alternative philosophies of mathematics emerged: logicism, formalism, and intuitionism. Mathematician and author James Nickel notes that each of these schools of thought was based on the power of human reason. Logicism, whose main contributors were Bertrand Russell and Gottlob Frege, says that mathematics can be reduced to logic. David Hilbert, one of the greatest mathematicians of the nineteenth and twentieth centuries and founder

of formalism, believed that mathematics was merely a game where mathematical symbols are manipulated. Intuitionism, introduced by mathematician L.E.J. Brouwer, is characterized by the belief that meaningful mathematics can only be based on the natural numbers using a finite number of steps (186-189). These very brief descriptions of differing views of the nature of mathematics demonstrate that current secular mathematicians may not agree on all philosophical presuppositions, but they do agree on the presupposition of the autonomy of man.

The authors of "Mathematics as Poesis" describe naturalism, another philosophical school of thought that is "gaining favor among mathematicians" (Stueckle, et al. 64). To the naturalist, evolution explains how humans are able to learn and use mathematics. As the human mind developed through the process of natural selection, it had the ability to construct mathematics that is consistent with the physical world (65).

Methodological Presuppositions of Current Scholarship in Mathematics

The methodology of mathematical activity includes models, statistics, abstraction, proof, and, most recently, technology. Nickels states that secular scholars consider mathematics to be a tool used by man to create order from chaos. Their endeavors have no value system and no acknowledgement that God is in control (203).

In order to prove any conjecture, all mathematicians must accept chosen axioms by faith without proof. They also have faith that by working within the

framework of mathematics, using logical methods of proof, a conclusion will be reached. The types of reasoning in mathematics include induction, reasoning by analogy, and deduction. Often the mathematician uses induction first to observe patterns and predict results. He must use deductive reasoning to verify the results. There are two types of proof in mathematics. The direct proof involves applying the rules of logic to given axioms, definitions, and other proven theorems. In an indirect proof, or proof by contradiction, the conclusion to be proved is assumed false and then the techniques of logic are applied. If this leads to a contradiction of given definitions or properties, then the conclusion must be true.

Appropriate and Relevant Biblical Presuppositions in Mathematics

A biblical view of mathematics is based upon the fact that God in Christ created all things and that “He is before all things, and in Him all things hold together” (Colossians 1.17). God is the source of all knowledge, and He is the One who gives meaning to all of creation. We recognize that in Christ “are hidden all the treasures of wisdom and knowledge” (Colossians 2.3). Because man is created in God's image, man has been given the gift of knowledge, though finite and limited. It is with this gift that we explore and gain a framework through which we understand God’s creation.

Scripture makes it clear that the foundation of our knowledge is an awesome reverence of God: “The fear of the Lord is the beginning of wisdom, and knowledge of the Holy One is understanding” (Proverbs 9.10). Therefore, a

Christian worldview of mathematics presupposes that God is the ultimate source of mathematical knowledge, and humans discover mathematical realities using their God-given intellectual gifts. Man is under the authority of God, and “ultimate foundations and ultimate meaning in any area of life, including mathematics, can only be found in the revelation of the infinite, personal God of the Scripture” (Nickel 9). One point may need to be clarified in the biblical view that humans discover mathematics instead of inventing it. God designed an orderly universe that is governed by laws which can be described through the language of mathematics. The mathematical realities behind these laws exist whether man is aware of them or not. However, as man discovers these principles, he must invent symbols and notation to describe notions and properties.

God made man in His image and gave him dominion over the earth. Brian J. Walsh and J. Richard Middleton assert that “the twofold original human task is to *develop* and *preserve* our creational environment” (54). Mathematics provides us with the means to carry out this mandate and take care of our world. As stewards of both creation and our mathematical abilities, our research in mathematics explores that creation and seeks applications for the good of others. In the book *Mathematics in a Postmodern Age* the authors state, “We are creatures of the Lord, meant to exercise our analytical and quantitative abilities in the service of other people and the rest of creation, not to further our own ends or challenge God’s sovereignty. As Christians, we must take responsibility for what

mathematics we develop and how it is applied in the world around us" (Howell and Bradley 192). This responsibility requires godly discernment for ethical issues that Christian mathematicians may face in the application of their research.

As bearers of God's image, we have been given the ability to think rationally and logically. We use logic to prove theorems and rational thinking to interpret observations. Our creativity allows us to make conjectures, craft symbols, and model natural phenomena. This aspect of our biblical worldview explains how we, as mere humans, can grasp mathematical truths and make applications. Nickel answers the question of how we know and understand mathematics in this way:

For the Christian, God's unchanging character guarantees $2 + 2 = 4$. The entire universe reflects His faithfulness. The Biblical God is the creator of the human mind with its mathematical capabilities and the physical world with its mathematical properties. Biblical faith unites *a priori* and *a posteriori* under the umbrella of the biblical God as the true source of knowledge and revelation. The workings of man's mind and the laws of the physical world cohere because of a common Creator. The *a priori* capabilities of the human mind correspond to the *a posteriori* properties of the external world by *prearranged design*. (232)

Although our minds are finite and can never grasp the infinite knowledge of our Creator, they do reflect the order, imagination and inventiveness that His creation demonstrates.

Mathematics is used to describe the beauty and order of creation as well as the attributes of God. It reveals God's power, wisdom and infinite nature. These attributes of God's character are proclaimed throughout the Bible; here are a few examples:

The heavens declare the glory of God; the skies proclaim the work of his hands (Psalm 19.1).

But God made the earth by his power; he founded the world by his wisdom and stretched out the heavens by his understanding (Jeremiah 10.12).

For since the creation of the world God's invisible qualities – his eternal power and divine nature – have been clearly seen, being understood from what has been made, so that men are without excuse (Romans 1.20).

How many are your works, O Lord! In wisdom you made them all; the earth is full of your creatures (Psalm 104.24).

Great is the Lord and mighty in power; his understanding has no limit (Psalm 147.5).

God is purposeful. "Many are the plans in a man's heart, but it is the Lord's purpose that prevails" (Proverbs 19.21). According to W. James Bradley, even when the Christian mathematical community does not understand God's purposes for mathematics, we believe that it is "one of the fundamental tools that God has given us to carry out his purpose" (6). Christian mathematicians,

especially those in academia, have the responsibility of conveying these tools to the next generation of mathematicians so that they can serve God and fulfill His purposes.

Comparisons and Contrasts

A biblical view of mathematics is basically a platonic one with its eternal truths existing in the mind of God. However, for the secular mathematical community, as mathematician Bonnie Gold writes,

the traditional philosophical difficulties with this [the Platonic] view are (1) it requires a belief in some abstract, non-physical, non-psychological realm, which might have been fine when God was central to our world-view, but which is unattractive to modern intellectuals, and (2) even if such a realm exists, how do we, physical beings, have any contact with or knowledge of, this realm? (376)

Each of the secular philosophical views which replaced the platonic view attributes the creation and discovery of mathematics to humans. The autonomy of man is recognized, not the autonomy of God. As these schools of thought gained popularity, “instead of being a monument to God the Creator, mathematics became the magnum opus of the inventiveness of man” (Nickel 162). Mathematics was no longer a tool for describing the universe and revealing God’s wisdom, power, and a pre-established harmony but merely a tool of science invented by man himself.

The secular thought is that things happen by chance, not by design. As George Lakoff and Rafael Núñez claim, the secular scholar believes that “mathematics is a natural part of being human. It arises from our bodies, our brains, and our everyday experiences in the world” (377), whereas the Christian mathematician believes, according to Reformed theologian and educator Rousas J. Rushdoony, that “mathematics is not the means of denying the idea of God’s pre-established world in order to play god and create our own cosmos, but rather is a means whereby we can think God’s thoughts after Him” (qtd. in Nickel 204). This view has God at the center of mathematical thought. Rushdoony continues to assert that the purpose of mathematics is not to celebrate mankind’s work, but “it is a means towards furthering our knowledge of God’s creation and towards establishing our dominion over it under God. The issue in mathematics today is root and branch a religious one” (qtd. in Nickel 204).

All mathematicians use the same mathematical language, symbols, and notation in their study of patterns and structures. There are universally accepted axioms which form the basis of all mathematical research. Nickel notes that through the centuries God, with common grace, has allowed both believers and nonbelievers to make discoveries in mathematics. The paradox is that secular scholars must use a biblical faith to make assumptions, thereby contradicting their own worldview (218). Paul Erdős, outstanding twentieth-century mathematician, says “God has a book containing the most elegant proofs of all

mathematical theorems. You don't have to believe in God, but you must believe in the book" (qtd. in Steuckle et al. 65). According to Albert Einstein, "Without the belief that it is possible to grasp the reality with our theoretical constructions, without the belief in the inner harmony of our world, there could be no science" (312). In the words of Rushdoony:

The unbeliever is thus able to think and work only on the basis of practical reason which presupposes the Christian frame of things. On his own premises, he can know nothing; on borrowed premises, he is able to think and work, but for all his results, he remains in the paradoxical position of the cattle rustler. . . . He has no knowledge on the basis of his own principles, he has valid knowledge only as the thief possesses stolen goods (61-62).

The pursuit of scientific truths requires a form of faith in the inevitability of an underlying order. Secular scientists who consistently rely on that faith in order to do their work are using principles which are contrary to their beliefs.

There are differences in the way mathematicians explain the fact that creation is governed by laws of physics and nature, which can be expressed mathematically. From a biblical perspective, this is true because God is the Sovereign Creator of everything. Nickels notes that secular scholars, who see mathematics as a creation of the human mind, must use words such as "mysterious" and "incredible" to describe the way that mathematical truths exist

and model the universe. Eugene Wigner, winner of the 1963 Nobel Prize in physics, has used the phrase “unreasonable effectiveness” to express his perplexity. He states that there is no rational explanation for the enormous usefulness of mathematics in the natural sciences (207).

Mathematicians have historically been concerned with the rigor and depth of their discipline. Most mathematicians see a beauty in the way mathematics works and how it exhibits connections between very different aspects of the physical world. There is general agreement in the need for the mathematics community to do research that can be applied in many fields of science, such as materials science, biomedical statistics, computational genomics, and aerospace engineering. However, without an underlying value system, secular mathematicians may misuse results and technological advances in their field. Moreover, all the glory for these advances is attributed to man. The goal of the biblical Christian scholar in any discipline should be to glorify God in his endeavors.

Reading, Thinking and Research

Throughout each era in history the discoveries in mathematics have been filtered through the prevalent worldviews at the time. In my discussion of the secular philosophy and methodology in mathematics, I have left gaps between Plato and the twentieth-century mathematicians. There is a wealth of information and history about the developments in mathematics and the philosophy of mathematics during those years. Knowledge of these topics is

needed to gain an understanding of how the presuppositions have changed over the centuries.

My reading and research for this paper have been both enlightening and humbling. There is so much to learn about the development of mathematics over the last twenty-five hundred years. My future reading will lead to a better understanding of the developments in mathematics during different periods in history and of the philosophical views of mathematics. This research will fall into three categories.

First, I plan to read an objective history of mathematics to get a complete overview of the people, discoveries, and philosophies in the order in which they appeared. The reading I have done in this area so far has made me keenly aware of the need to construct a timeline in my mind that includes important cultural, historical, scientific, and mathematical events or discoveries.

After gaining a better knowledge of history, my next task is to improve my general understanding of postmodern thought in order to assimilate ideas in readings on current philosophical views in mathematics. One such view is humanism, and I plan to read *What Is Mathematics, Really?* by Rueben Hersh, a proponent of postmodern thinking. In a review of this book, Ed Dubinsky reports that Hersh argues for a humanistic philosophy of mathematics. He does, however, devote the second half of his book to a complete and objective review of the history of mathematical philosophy (1066).

Later I will read some works written from a biblical perspective. One book that looks intriguing is *The Divine Challenge: On Matter, Mind, Math & Meaning* by John Byl, professor of mathematics at Trinity Western University. In this book Byl critiques naturalism and postmodernism and argues that “only a Christian worldview, based on the Bible, can supply us with the necessary foundation for logic, mathematics, science and morality, while giving life coherence, meaning, purpose and hope” (“Divine Challenge”).

Another important book is *Mathematics in a Postmodern Age: A Christian Perspective* edited by Russell Howell and W. James Bradley. This book will add to my insight into the nature of mathematics and the influences that postmodern thinking has had on it.

After adding more depth to my own knowledge of the historical development of mathematics, I will be able to describe the secular and biblical views that were prevalent during the era in which the topics we are studying were discovered. For the general liberal arts student, some of whom admit a dislike for mathematics, these ideas may stimulate a new appreciation for the subject. These students may have never thought of the relationship between mathematical thought and worldview perspectives. For example, when the Pythagorean Theorem is taught in a college algebra class, a discussion of Pythagoras and his philosophy may prove surprising to the students. According to Nickel, he considered numbers to be divine and eventually founded a mathematical cult which attracted many student followers. Pythagoreans

believed that the entire universe and ultimate reality could be explained by relations between whole numbers. They worshiped the creation rather than the One who created it (22). I hope that some students will be reminded of Paul's words in Romans 1:27, "They exchanged the truth of God for a lie, and worshiped and served created things rather than the Creator – who is forever praised."

For the mathematics majors, who have an appreciation for the subject, I plan to use my reading and research to develop a course that weaves the philosophical and methodological aspects throughout a study of the history of mathematics. This course, *History and Philosophy of Mathematics*, will expose the students to both the secular and biblical views of mathematics and how they affected progress and stagnation in the discipline. Students will answer the familiar questions (What is a worldview? What is a biblical worldview?) which have been posed in their *Worldview Curriculum* and other classes, but now they will work these out in the context of mathematics.

This course could be offered as one of our *Special Topics in Mathematics* (MAT 399) and the content would include not only history and philosophy but also topics requiring a mathematical maturity level of junior or senior mathematics majors and minors. In addition to learning the secular and biblical presuppositions in mathematics described earlier in this paper, students will explore topics that will illustrate them.

A brief look at the lives and writings of great mathematicians, whether believers or unbelievers, can help summarize the prevailing philosophies of their eras. Sir Isaac Newton was one of the greatest mathematicians and physicists of all time. His accomplishments in optics, mechanics, gravitation, and motion are unparalleled. His best known published work is *Mathematical Principles of Natural Philosophy*, or *The Principia*. As Angela Hare points out, Newton was also an extremely devout Christian and student of the Bible. He wrote extensive theological works and exegeses of the Scriptures. Among these was *Observations upon the Prophecies of Daniel and the Apocalypse of St. John*, published after his death. He saw all of his discoveries as evidence of the God-given orderly structure of the world (5). Johannes Kepler, German mathematician and astronomer best known for his laws of planetary motions, gave praise and thanksgiving to God for the privilege of using his keen mind to help glorify God. Kepler had such a deep personal faith in God that it permeated all of his scientific research and often included prayers and psalms of praise in his writings (Nickel 114). He said, "The chief aim of all investigations of the external world should be to discover the rational order and harmony which has been imposed on it by God and which He revealed to us in the language of mathematics" (qtd. in Percy and Thaxton 126). In contrast to these two men, constructionist mathematician Errett Bishop writes, "Mathematics belongs to man, not to God. We are not interested in properties of the positive integers that have no descriptive meaning for finite man. When a man proves a positive integer to exist,

he should show how to find it. If God has mathematics of his own that needs to be done, let him do it himself" (qtd. in Byl).

In the history of mathematics there are a multitude of examples of mathematical discoveries which seemed to be so abstract that there could be no possible application to the physical world, yet years or centuries later, scientists used those discoveries to prove important theories. One such example is the work of English mathematician Godfrey Hardy (1877-1947). According to Nickel, Hardy proclaimed to be an atheist and prided himself in the fact that his work in analysis and number theory was purely abstract and had no practical application. After his death, one of his conclusions was applied to genetics and became known as Hardy's Law (220). Another example is Georg Riemann's non-Euclidean geometry that he discovered in the 1850s. This new geometry provided the tools for Einstein's theory of relativity (Nickel 179). These and other similar examples will provide material for class discussions on whether mathematics is discovered or invented.

No study of the history of mathematics would be complete without considering chaos theory. Within this new branch of science is the work of Benoit Mandelbrot called fractal geometry. James Gleick describes Mandelbrot's research and discoveries in his book *Chaos: Making a New Science*. In the 1960s Mandelbrot was searching for a way to explain the connections between various types of irregularities. He was studying data on cotton commodity prices, intermittent noise on telephone lines transmitting information between computers, and the variation of heights of the Nile River. All of these quite different occurrences

displayed similar random patterns that also had a surprising “regular irregularity” (98). Mandelbrot also discovered self-similarity within smaller sections of the data. In other words, a graph depicting the data over a period of years with the Nile River heights or over a period of hours with the telephone noise, when scrutinized over shorter and shorter periods of time, had a recursion of the same pattern inside of pattern (103).

Mandelbrot used the abstract Cantor set, named for nineteenth century mathematician Georg Cantor, as a basis for his work and research. Here we see another example of a mathematical concept that is found to have applications in science and even economics many years after it was formulated. With the Cantor set as a model and the aid of modern computer technology, Mandelbrot envisioned using fractional dimensions to measure the irregularities in an object which cannot be measured using Euclidean geometry (Gleick 102). In the following two decades, fractal structures were found throughout the human body in blood vessels, lungs, and urinary collection system. At approximately the same time scientists were applying the same principles to the study of polymer science (Gleick 108-110). How could these amazing “coincidences” be explained in any other way than a Sovereign Creator God?

The primary way to evaluate students’ understanding of differences and similarities in secular and biblical presuppositions in mathematics is through writing assignments. In each of their mathematics courses, our students write an essay, a reflective paper, or a short research paper on a topic that relates to

mathematics and a Christian worldview. Many of these papers demonstrate spiritual maturity and a belief that God cannot be separated from a study of mathematics. After I incorporate what I will learn over the next few years into all of my courses and specifically The History and Philosophy of Mathematics, I hope to see evidence of a deeper understanding of how the current views in mathematics have developed.

In addition, there is little discussion of the current philosophical presuppositions among my colleagues at our regional Mathematical Association of America meetings. There are sessions on pedagogy, technology, and pure mathematics. This meeting also includes sessions in which undergraduate and graduate students present the results of their research. This would be a good forum for both me and our mathematics majors to present talks and spark much-needed debates. I am eager to suggest a panel discussion on the value of teaching the history and philosophy of mathematics in an undergraduate program. Several colleges in our Louisiana/Mississippi Section of the MAA have such courses in their curricula. Participating on a panel would give me an opportunity to share our biblical perspective in a history of mathematics course. The student competition would be a valuable experience for our mathematics students. Their talks on the results of research projects in mathematical history and philosophy would provide a refreshing biblical perspective in this secular setting. Their presuppositions and methodology that are influenced by a distinct Christian worldview may be

challenged by a secular audience, but engaging in such a debate will increase everyone's awareness of these worldview differences.

Conclusion

The mathematics we use and teach today is built upon discoveries that took place over hundreds and hundreds of years. As man's mathematical knowledge increased, philosophical and methodological presuppositions developed. These presuppositions have always depended upon the worldview in which the mathematician does his work and research.

My goal as a mathematics professor at Belhaven College is to provide instruction that is both rigorous and meaningful within a biblical worldview. By incorporating what I have learned about the historical and current presuppositions, both secular and biblical, into my courses, I hope to give students a foundation that will equip them to apply a biblical worldview not only to their use of mathematics, but to every aspect of their lives.

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