

The Relationship and Benefits of Different Sciences in Mathematics

Abstract

Motherhood is the mother of all sciences and learning can affect all walks of life. Failure to meet the educational goals in mathematics will result in weaknesses and an inability to achieve the goals related to the advancement of other sciences and techniques. The evolution of science and technology has made the inevitable evolution of the educational process inevitable. Mathematics and art are very close together. Because nature is the source of life to motivate the artist and the mathematician. Art and mathematics are both in search of perfection and ideal. Biology without mathematics makes no sense. There are many parameters that influence biological factors that we use to solve these parameters using mathematical equations. Mathematics is a branch of science that does not require other sciences to prove its propositions unlike other sciences such as natural sciences, social sciences, and engineering which require further study.

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Introduction

Mathematics is the science of "order" and its subject is to find the description of any understanding of order that is hidden in seemingly complex situations, and the fundamental tools are these concepts that enable us to describe this order. Mathematical science legalizes the natural experiences that we observe in plants and other creatures. Mathematical science categorizes and legalizes these experiences and also develops them.

Mathematics is the greatest heritage of humanity, and its creation and invention, regardless of scientific rules and the use of an intellectual discipline such as literature and music, which is one of the most important human honors in today's society, has a direct or indirect influence on any branch of science. We see, and the least effect that can be had is to create order for people. This branch of science, like education, needs to learn elementary and low concepts. Today, if a science cannot be expressed in mathematical language, it is not a science, and this science is the right of science students from the economic and moral point of view, so it seems that by benefiting from the facilities and using the appropriate teaching methods by the teachers and with a diverse and attractive method, children can be valued. And the importance of this lesson interested and informed.

Whatever science we look at, we will see, directly or indirectly, the traces of mathematics. Mathematics helps us analyze problems and ringtones better and easier. Mathematics is an integral part of life because we will use it for many daily activities. Therefore, it is necessary to examine the mathematical relevance and skills learned in other sciences so that individuals can use this relationship to solve problems in life and other sciences. Mathematics is the science of modeling other sciences. The common language of scientific theories of other sciences is mathematical sciences. Because of the

foregoing, it is necessary to examine the role of mathematics in other sciences, to which we shall refer.

The importance of mathematics

In today's world, there are countless fields of research that depend on mathematical methods. This point is not only true for science and technology, but also for social, business, political and economic decisions. The math provided depends. A person who does not understand much about mathematical tools and concepts is alien to the real world in which he lives and is not able to perform or supervise the duties of a responsible citizen. People's personal lives also become more dependent on mathematics.

For example: in daily life, every person may come across terms, even in reading newspapers, that to understand them requires an understanding of some fields in mathematics.

Scientists' research shows that mastery of mathematics is related to the use of fair standards in the game. They observed that children who are unable to divide cannot fairly distribute the prizes among the winners of the game. Even the management of family finances today is dealing with complex problems that require people to know mathematics. Mathematics has always played a key role in the curriculum, but its practical utility is an important factor for its credibility as a subject. (Zollman, A. (2012)

Reasons for the importance of connection between mathematics and other subjects

Because the usefulness and necessity of mathematical operations are created only by real goals in real conditions, for this reason it is important that students experience mathematics and other related subjects together. Because mathematics is always and everywhere, in practice, it is related to culture and natural phenomena, so it cannot be alien from them. Mathematics should start with sensory understanding and

everyone can learn mathematics, but this learning is done at a different speed. Mathematics, like other subjects, helps people in the real understanding of phenomena, and it is from the point of view that if they are connected with other subjects and placed in the realm of the child's experiences, we will achieve the desired result.(won & et al, 2015)

Mathematics and everyday life

Students increase their mathematical ability and expand their understanding and scope based on their existing knowledge. When students grow older, they continue to store mathematical information outside of school through activities such as shopping and reading bills, and this learning outside of school can be combined with teaching. In this way, students will learn the relationship between mathematics and real life and will be able to transfer the knowledge learned in the classroom to the outside world and use their mathematical knowledge in everyday situations.

The importance of mathematics

The everyday use of this science to calculate and display information through charts is a common practice.

These are elementary aspects of mathematics. Advanced mathematics has many applications that are often ignored.

- Mathematics is used as correcting codes in computers.
- The stunning images of distant planets sent by the Voyager spacecraft could not have had an interesting quality without such mathematics.
- The entry of the ship to the planets was not possible without mathematics and differential equations.
- Whenever it is said that advances are made by supercomputers, there must be a mathematical hypothesis based on which the computer works. Therefore, mathematics allows the computer to increase its speed and accuracy.
- Mathematicians and logicians have a great contribution in the foundation of computer science and its expansion.
- The next generation of software needs the latest methods that we call logical category theory.
- A hypothesis that contains mathematical structures with new images of the foundations of mathematics and logic.
- Various sciences (physics, chemistry, oceanography, astronomy, etc.) need mathematics to develop their hypotheses.
- In environmental science (ecology), when the subject of population change laws are studied, they need mathematics.

- Statistics provides a special hypothesis and method for analyzing wide-ranging differences in information.
- Statistics are also necessary in medicine to analyze data on the causes of diseases and the benefits of new drugs.
- Traveling by plane is not possible without mathematics and control systems.
- Body monitors are the result of smart mathematics that was discovered in the 19th century and made it possible to create an image of the inside of the body by X-ray, so mathematics is often involved in life and death.

Defining Computational Thinking for Mathematics and Science Classrooms

Science and mathematics are becoming computational endeavors. This fact is reflected in the recently released Next Generation Science Standards and the decision to include “computational thinking” as a core scientific practice. With this addition, and the increased presence of computation in mathematics and scientific contexts, a new urgency has come to the challenge of defining computational thinking and providing a theoretical grounding for what form it should take in school science and mathematics classrooms. (Williams & et al, 2004)

About STEM education? A review of literature

the National Academy of Sciences (2014) contributes a reference framework to justify the integration of the four STEM disciplines. As another example, Atkinson and Mayo (2010) emphasize the characteristics of the implementation of STEM education, concluding that there is a current contrasting efforts— one to incorporate science, technology, engineering, and mathematics into the same educational experience, and another that opts to afford protagonism to science and mathematics. Recently, Thibaut et al. (2018) reviewed 23 educational interventions that clearly set out an integrated STEM approach, to determine which learning theories and teaching practices were used therein.

STEM literacy and identity

For the development of this new literacy it is necessary for each of the disciplines involved in STEM to include a series of essential conceptual, procedural, and attitudinal contents in such a way that, although the command of each of these STEM disciplines is necessary, so is the capacity to recognize and appreciate the connections that exist between them. This integration of knowledge areas involves obtaining a final product greater than the sum of its individual parts. Thus, the Washington STEM Study Group (2011) proposes that a

student will be STEM-literate when he or she achieves an understanding of how the world works through these four disciplines and is able to apply this understanding to improving social, economic, and environmental conditions in all social spheres. Zollman (2012) continues with the evolution of this academic approach and to do so introduces a definition for STEM literacy focused on the educational sphere and orientated towards problem-based learning. According to this author, STEM literacy requires the ability to understand and apply content (conceptual, procedural, and attitudinal) from the disciplines that comprise STEM to solve real problems, with particular attention drawn to the need to develop a series of specific affective and procedural STEM skills to consolidate this literacy. STEM literacy is creating the development of “STEM curricula” based on practical skills that aim to eliminate the gap between theory and practice, as well as improve problem-solving skills. The development of these curricula arises from proposals such as that of Dufresne, Gerace, and Leonard (1997) based on problem solving. To achieve it they consider three essential elements: conceptual knowledge (CK), operational or procedural knowledge (PK), and problem-solving knowledge. Practical STEM skills include CK and PK, it having been recognized as a central competency for technological education, defined as the capacity to use engineering skills, techniques, and tools in the field of technology (Barlex, 2007). Furthermore, the praxis of science should promote learning transfer via a cognitive development that allows the realization of abstract concepts, makes the creation of mental structures on the part of students possible via kinesthetic participation and increases their motivation and commitment (Flick, 1993; Klahr, Triona, & Williams, 2007). STEM curricula should also summarize proposals such as those made by Clough and Kaufman (1999) in which students are encouraged to make “connections” between content and skills in a wide variety of contexts to develop their problem-solving skills.

Another aspect to consider within STEM literacy and its curricular development, according to the National Science Foundation (Gonzalez & Kuenzi, 2012), is that it should include a wide range of “STEM subjects” in the fields of chemistry, computers and information technology, engineering, geoscience, life sciences, mathematical sciences, physics and astronomy, psychology, social sciences, educational research, and STEM education.

With this educational approach it is hoped that a “STEM identity” will be reached, in which students feel part of STEM through their interests and skills, regardless of their race, gender or culture (Brickhouse, Lowery, & Schultz, 2000; Carlone & Johnson, 2007; Polman & Miller, 2010). To do so it is necessary for there to be a STEM integration, in which different combinations of the STEM disciplines can be

included, one discipline can be emphasized over others, it can be presented in a formal, neutral, or informal environment and a variety of teaching strategies can be involved (National Academy of Sciences, 2014). To be able to reach this integration, Moore, Miller, Lesh, Stohlmann, and Kim (2013) propose using engineering as a context or catalysing concept for students to develop representations of the real world and thus develop scientific and mathematical concepts in an interdisciplinary manner, via the use of multiple portrayals (specific models, images, language, and symbols) and provide translations between them, supported by technology.

STEM education: Is it equivalent in integrating science, technology, engineering, and mathematics?

The ideas of curricular integration derive from real-world problems in which the disciplines are not isolated. However, we find ourselves confronting an inconsistency, due to the fact that in most traditional educational approaches the disciplines are presented separately, offering little more than a disconnected and inconsistent variety of facts and skills (Beane, 1995; Czerniak, Weber, Sandmann & Ahern, 1999; Jacobs, 1989). The type of learning resulting from this isolated approach to the disciplines fails to present a set unity and, therefore, lack sense when viewed from outside the academic context. It is as if students, when facing a problematic situation, are expected to stop to ask themselves which part they can resolve with science, with mathematics, with art, and so forth (Beane, 1995). In contrast, an interdisciplinary learning approach integrates the disciplines and diffuses their limits, passing through different levels of cognitive ability in pursuit of developing a holistic thought process. In this manner, students can make meaningful connections that allow them to process knowledge to produce an interdisciplinary understanding that is applicable to reality. Boix Mansilla, Miller, and Gardner (2000) define interdisciplinary knowledge as the capacity to integrate knowledge and the modes of thought of two or more disciplines to produce a cognitive development, such as explaining a phenomenon, solving a problem or creating a product in a way that would have been improbable via just one of the disciplines involved. This approach is considered to be a great leap in all of the spheres and is increasingly attracting greater attention (Czerniak et al., 1999). Satchwell and Loepp (2002) mark out an integrated study plan such as that, which assimilates concepts from the perspective of more than one discipline. Notwithstanding, although these new approaches are transferred to curricular proposals or are argued and defended by education researchers, in educational centers there continues to be a development of the “separate topics” or “layer cake” approach for the teaching of knowledge and skills (Furner & Kumar, 2007). This reticence to adopt the integrated approach may be due to its

radical departure from most current teaching practices (Mikser, Reiska, Rohtla & Dahneke, 2008). Unfortunately, failure to adopt the integrated approach keeps students from developing the skills needed to solve real problems because they fail to understand the context in which the problems are situated (Frykholm & Glasson, 2005).

Yet another area of contention is the diverse conceptualizations established for the integration of the disciplines. In this regard, we find concepts such as (a) "Integrated STEM," in which different combinations of the STEM disciplines should be included, one discipline should be emphasized over another, presented in formal or informal contexts and involve a variety of teaching strategies (M. Sanders, 2009); (b) transdisciplinarity, which mentions the lack of correspondence between knowledge and the resolution of social problems (Hoffmann-Riem et al., 2007); (c) interdisciplinarity, which is associated with the capacity to solve problematic situations that require the tools and theories of multitude disciplines, developing student skills (Klein, 1990); (d) supradisciplinarity, which implies involving diverse disciplines to transgress the knowledge of one of them (Balsiger, 2004); and (e) multidisciplinary, which implies involving various academic disciplines, without integrating them, to solve a problem and reach multiple disciplinary objectives (Tress, Tress, & Fry, 2005). Thus, we find ourselves for the third time facing the paradox established by Bybbe (2013), due to the fact that multiple conceptualizations exist, something that speaks to the lack of a consensus between the scientific community.

Mathematical Relationship with Other Sciences

We know that today mathematics plays a fundamental role in our lives. Paying rent, buying equipment, keeping track of days, everyone needs to know and be aware of math. When we look at the history of the sciences, we find that nature and the needs of life are the main factors behind the emergence and growth of sciences throughout history. Mathematics first came into being, influenced by the deep needs of human life, then continued to grow, which is why Alexandrov says that the source of mathematics's vitality is its two concepts and results. This is the most important thing for understanding mathematics' (Brothers 2003). By the way, one of the most important goals of mathematics education is for students to learn to value mathematics and to recognize its effectiveness in life and the development of thinking, reasoning, and analysis. They also have confidence and confidence in their ability to perform math assignments and various problem-solving situations so that their work and effort in mathematics become practical and enjoyable. By studying and studying the natural sciences (mechanics, astronomy, chemistry, and physics) we will find that their laws are usually expressed by

mathematical formulas, and their theories are advanced by the use of mathematics (Walie, 2006). The one who reads mathematics thinks better and the one who thinks better will live better.

1. Calculus

Differential calculus is one of the most important mathematical topics devised to solve problems in physics and astronomy. Examples of differential arithmetic applications include: Calculating Extremes, Mass Centers, Labor, and Hierostatic Force, Calculating Satellite Orbits, and Fluid Descriptions in Other Areas, including Economics, Business, and Life Sciences, and Sports Physical Issues. Economists use calculus to predict general economic trends. Oceanologists use this account to formulate theories about sea currents, and meteorologists use it to describe atmospheric airflow. Biologists predict population size and report the impact of fox-like predatory animals on the population of predatory animals. Medical researchers design X ultrasound and radiation equipment to inspect the internal organs of the body, and space scientists use it to design missiles and discover distant planets. Psychologists use calculus to understand visual illusions, and physicists use it to design bare navigation systems and study the nature of time and the universe. Sporting goods manufacturers use differential calculators to design tennis and baseball rackets and stock market analysts to predict prices and interest rate risk assessments. Pharmaceutical companies need the help of this account to determine the right amount of drug stocks, timber producers need to determine the most appropriate timing.

2. Differential Equations

Sometimes it is necessary for different disciplines of science, engineering, medicine, economics, and so on. To articulate a particular problem, a mathematical model is built. Most of these mathematical models include equations containing an unknown function and derivatives of the function concerning independent variables called such equations as differential equations, one of the most commonly used mathematical topics, one of which is in personal cosmetic surgery. Using mathematical techniques, it is possible to see the results of preoperative facial reconstruction and cosmetic surgery. In this regard, three surgeons from Berlin have been able to accurately determine the results of reconstructive and cosmetic facial surgeries using mathematical techniques. The design predicted by this innovative method was in exact agreement with the results after surgery. In the first step, a three-dimensional computer model of the patient's face is called a virtual patient. Secondly, by creating a virtual lab space, different surgical strategies are tested on the patient and the results of all different types of surgical procedures are compared. In this

mathematical approach, presented at the American Mathematical Society, by solving and modifying partial differential equations that represent the change of physical systems, they choose the best equation for the biomechanical molding of the soft tissue of the face and bone. This procedure yields acceptable results with an error of about 1 to 1.5 mm for soft tissue. This allows the patient to see the postoperative image. In this method, by examining the model quantitatively, the results of the proposed models, and the patient's postoperative image in each surgical model, we can select the best method for the patient's surgery.

3. February analysis

Nowadays, Fourier analysis of important mathematical topics is one of the essential tools of any engineer and applied scientist in the field of linear devices, antennas, mechanical vibrations, optics, environment, various random processes, boundary value problems, and case design. Uses Fourier analysis works on image and signal processing. One of the applications of the Fourier analysis in earthquake engineering is the simulation of artificial mapping acceleration. In this method, non-stationary characteristics of the strong earthquake are considered based on the spatial characteristics and characteristics of the wave propagation path. Fourier analysis can be used to process the accelerometer raw data and filter it. Also, February's spectrum can be obtained to evaluate the effect of higher modes and to examine the type of damage pattern to structures, especially in tall buildings. This spectrum represents the major and dominant frequencies of the structure. Studies in different disciplines of earthquake engineering show the value and importance of the Fourier spectrum in earthquake engineering .

4. Mathematics and Art

Mathematics and art are very close together. Because nature is the source of life to motivate the artist and the mathematician. Art and mathematics are both in search of perfection and ideal. Alberti saw the painter's first need for geometry. In 1435 he wrote the first book on perspective. Painters turned to mathematics to give life to images and to bring 3D to their works. All Renaissance painters were Alberti, Dider, Leonardo, Da Vinci, artist mathematicians, and mathematicians artists. Drazak, himself an artist's architect because of the need for painters to prove theorems known as his own, saw the development of visual geometry, and subsequently more and more mathematical principles were confirmed. Mathematics and art are inseparable. Here are some examples from some of the great speeches about the relationship between mathematics and art. Mathematics and art are alike because there is symmetry, and correspondence (Hamilton, the Irish mathematician), and the work of a

mathematician as a painter and a poet is a beautiful creation (Hardy, an English mathematician), each poet must be a mathematician), Every single thing should be thought of individually, and whenever it is required, linked to mathematics (Hilbert), I'm not a dreamer, Rather than being a mathematician, my sculptures are only good because they are made of mathematical thought (Rodin, the famous French sculptor), when I cleverly come to terms with distant mysteries and when analyzing my observations I got into mathematics, I didn't have any serious training in science, but I guess I had more in common with a mathematician than with an artist (Asher, the famous Dutch painter). We now observe precisely the conscious use of the golden rectangle and the proportion of the golden ratio in ancient Greek art, especially in the work of 'Fidias'. Mathematical concepts such as proportions, parallels, perspectives, symmetric error, geometric shapes, boundaries, and infinitives have complimented their beauty in ancient artworks to this day. The best examples are mosaic images of Muslim artists and the expansion of these geometric shapes by *M.S.Esher* to show moving objects.

5. Mathematics and Biology

Biology without mathematics makes no sense. There are many parameters that influence biological factors that we use to solve these parameters using mathematical equations. For example, to adjust the diet Livestock and poultry have the linear equation by which It is easy to balance dietary components from the supply of biological materials such as amino acids, proteins, and so on. Given that many parameters are involved in most biological systems, we use mathematics to model and optimize these factors. Mathematicians in biology are generally divided into two groups, the first group identifying and applying a series of mathematical models to simulate, and the second group optimizing it with equations (Genetic Algorithm).

6. Mathematics and Medicine References

Gerald C. Hsu was able to help control the metabolic conditions of type 2 diabetes (T2D) patients by using medical math-physics and artificial intelligence technology. The author received an honorary PhD in mathematics and majored in engineering at MIT. He attended different universities over 17 years and studied seven academic disciplines including mathematics, engineering, computer science, and business administration. He has also worked in various industries including defense, nuclear power, computer-aided-design, computer hardware, software engineering, and semiconductor design.

By 2010, his type-2 diabetes (T2D) and its complications became very serious. Although he never received formal training in medicine, in order to save his life, he launched his

own study and research on T2D. First, he studied six metabolic diseases and food nutrition during 2010 - 2013, then conducted research during 2014 - 2018. Thus far, he has spent 20,000 hours on his research and collected, processed, and analyzed ~1.5 million data to examine the relationship between metabolic conditions and lifestyle details. Due to the fact that he has no academic training in biology and chemistry, he could not conduct his research using the traditional “bio-chemical” approach, instead he used a “math-physical medicine” approach which is based on mathematics, physics, engineering modeling, signal processing, computer science, big data analytics, statistics, machine learning, and artificial intelligence. This approach could provide quantitative data proof and precise interpretation of certain biomedical phenomena. His main focus is on preventive medicine for chronic disease control using six prediction tools he developed during the period of 2015 - 2017, i.e. Metabolism, Weight, FPG, PPG, Adjusted Daily Glucose, and Estimated A1C. He believes that the better the prediction, the more control one would have over chronic disease.

Glucose testing is invasive, troublesome, and costly. Most T2D patients are not performing the measurement on a regular basis. There is also an argument on the accuracy of glucose testing methods via either lab-tested A1C or finger piercing and testing strips. Regardless of this argument, he has collected a complete set of FPG and PPG data using both lab-tested A1C and 9,328 finger prick testing strips. The author spent 7.5 years researching and developing an effective way to help himself and other patients with diabetes control by predicting their glucose values, both FPG and PPG, accurately, easily, and instantly based on a math-physical medicine approach and artificial intelligence technology.

This particular paper was prepared to describe his developed metabolism model and glucose prediction tools used to control his metabolic conditions and lower his risk probability of having a heart attack or stroke via an effective daily lifestyle management.

Flow Diagram of T2D Control, the quantitative results from the developed prediction models including metabolism, Weight, FPG, PPG, A1C, reflect the accuracy and applicability for Type-2 diabetes control via a guided lifestyle management. The utilization of math-physical medicine is also proven quite effective for this investigation. Health Data Comparison Between 2010 and 2017, the author’s health condition has been improved significantly due to his own efforts.

This same big data dynamic simulation approach using math-physical medicine could also provide an early warning to patients with chronic disease of having a heart attack or stroke in the future.

The author has not only saved his own life, but also wants to offer his findings, results, methodologies, and tools to other

patients with chronic disease. Hence, they can understand their environment interactions, lifestyle improvements, and disease control with an ultimate goal of improving their well-being. He firmly believes that for chronic diseases, prevention is more important and effective than treatment; therefore, if you can predict your disease condition accurately, then you can control it in a correct and effective manner.(Gerald, 2018)

Conclusion

Various sciences, including chemistry, astronomy and physics, are closely related to mathematics, and students who are unable to understand the basic principles of mathematics will have difficulty reading scientific diagrams and charts.

More complex mathematics, including geometry, algebra, and calculus, help students solve chemistry and physics problems, understand planetary motion, and review scientific papers and studies.

Mathematics is also very important in practical sciences such as engineering and computer science, and students need to solve mathematical equations when writing computer programs and analyzing algorithms.

Some careers, such as nursing, literature, or social studies, may seem separate from math, but nurses must use math in many ways, including interpreting blood pressure and determining the exact dosage of medications.

Literature is also dependent on mathematics and mathematical concepts, mastering basic arithmetic helps students to understand poems better. The weight of the poem, the number of words in a stanza, and the effect of a particular rhythm on the reader are all products of mathematical calculations.

Social studies such as history often require reading and examining charts and graphs that provide historical data or information about ethnic groups, and geography requires math to understand how the elevation of an area affects its population. and familiarity with basic mathematical terms and formulas will provide access to statistical information.

People who are interested in theater, music, dance or art should have basic knowledge of mathematics. Musical rhythm often follows complex mathematical series, and this science helps people better learn the basic rhythm used in ballet and theater performances.

People who are familiar with geometry create better works of art, and photographers use mathematics to calculate shutter speed, focal length, lighting angle, etc.

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