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APPLICATION OF MATHEMATICS IN REAL LIFE

By Jayshri Patil

Assistant Professor,

Head, Dept. Of Mathematics

Bharat College of Commerce

Badlapur, Maharashtra, India

Abstract

Mathematical concepts always seem to be a difficult subject. But most of the professions require the knowledge of Mathematics as the base for being successful. The irony is even the teachers are unable to link the subject with the real life. So the paper is an attempt for such learners and the teachers to practically understand the application of mathematics in the real life situations. The paper leads from the use of the subject in radiation, computers, natural calamities so on and ending with the major part of our life i.e. workplace.

Most students would like to know why they have to study various Mathematical concepts. Teachers usually cannot think of a real-life application for most topics or the examples that they have are beyond the level of most students.

Introduction

When teachers try to convince their students that mathematics is useful in many professions, such as engineering and medical sciences, many of their students may not be interested in these occupations. For example, when I was a teacher, some of my students wanted to be computer game designers instead, but they wrongly believed that this profession did not require much mathematics: only when I demonstrated to them that computer programming required some mathematics did they show any interest in studying mathematics. Other students of mine aspired to be When teachers try to convince their students that mathematics is useful in many professions, such as engineering and medical sciences, many of their students may not be interested in these occupations. For example, when I am teacher, some of my students wanted to be computer game designers instead, but they wrongly believed that this profession did not require much mathematics: only when I demonstrated to them that computer programming required some mathematics did they show any interest in studying mathematics. Other students of mine aspired to be soccer players but they did not realise that the sport could involve some mathematics: they erroneously thought that they would have to kick the ball high enough to clear it as far away as possible; obviously, it could not be at an angle of 90° from the ground but they believed it to be about60° when in fact it should be 45°. Although this is a concept in physics, kinematics is also a branch of mathematics, not to mention that "mathematics is the queen of the sciences" (Reimer & Reimer, 1992, p.83) – a famous quotation by the great mathematician Carl Gauss (1777-1855).Sub scientific mathematics was often transmitted on the job and not found in books, but in modern days where mathematics is divided into pure and applied mathematical knowledge, the latter is usually taught at higher levels in schools because of the utilitarian ideology of the industrial trainers and the technological pragmatists who argue that schools should prepare students for the workforce (Ernest, 1991). However, groups with a purist ideology believe in studying mathematics for its own sake. For example, the old humanists advocate the transmission of mathematical knowledge because of their belief that mathematics is a body of structured pure knowledge, while the progressive educators prefer to use activities and play to engage students so as to facilitate self-realisation through mathematics because of their belief in the process view of mathematics and child-centeredness. There is a third type of ideology called the social change ideology of the public educators who wish to create critical awareness and democratic citizenship via mathematics through the use of questioning, discussion, negotiation and decision making. The different ideologies of these diverse social groups have affected and will continue to affect the aims of mathematics education (Cooper,1985). For example, the New Math movement in the United States of America in the 1950s was an attempt by mathematicians, who could be viewed as old humanists with a purist ideology, to integrate the contents of academic mathematical practice into the school curriculum by teaching students more advanced mathematical concepts, such as commutative, associative and distributive laws, sets, functions and matrices, in order to understand the underlying algebraic structures and unifying concepts (Howson, 1983; Howson, Keitel & Kilpatrick, 1981).But many students were unable to cope with this type of high-level mathematics and they ended up not even skilled in basic mathematical concepts that were needed in the workforce. Mathematicians suggests that students should focus on activities that parallel what mathematicians do, for example, posing problems to solve, formulating and testing conjectures, constructing arguments and generalising. This is more in line with the purist ideology of the progressive educators and perhaps even the social change ideology of the public educators who believe in the use of questioning and negotiation. It will be argued in Section 6 that these thinking processes have become important in the modern workplace where the requirements of the workforce are ever changing and technical skills are no longer enough.

Applications of Mathematics:

1) Use of Similar Triangles in Radiation Oncology:

Geometry plays a very important role in radiation oncology (the study and treatment of tumours) when determining safe level of radiation to be administered to spinal cords of cancer patients (WGBH Educational Foundation, 2002). Figure 1 shows how far apart two beams of radiation must be placed so that they will not overlap at the spinal cord, or else a double dose of radiation will endanger the patient.

2) Encoding of Computer Data using Large Prime Numbers:

Before computer data are sent through the Internet, especially sensitive data like online banking, they are encoded so that hackers cannot make use of the data unless they know how to decode. Ronald Rivest, AdiShamir and Leonard Adleman have invented the very secure RSA cryptosystem which makes use of very large primes and a complicated number theory. To break the code, hackers need to decompose a very large composite number into its two very big prime factors using trial division. Even with the fastest computers, this will take years because trial division for very large numbers is an extremely tedious process. Although the actual encryption (refer to Wolfram Math World Website,Weisstein, 2009a, for more information) is beyond the level of the students, there are three other things that teachers can do with their Students.

3) Earthquakes:

Logarithm is used in the Richter scale to measure the magnitude of an earthquake, e.g., the Indonesian earthquake, that set off giant tidal waves on 26 Dec 2004 and killed at least 159 000 people, measured 9.0. What does this magnitude mean and how does it compare with a 4.8-magnitudeearthquake that struck Northern Italy on 5 Apr 2009 and killed almost300 and left 60 000 homeless? Although some people may know that a9.0-magnitude earthquake is ten times stronger than an 8.0 earthquake, complications arise when the difference in magnitude is not an integer. The Richter scale is a measurement of earthquake magnitudes based on the formula $R = \log(x/0.001)$, where x is the intensity of the earthquake as registered on a seismograph.

4) Mathematics Everywhere (by Marja Makarow) :

The developed world is full of modern technology that we take for granted. Mobile phones, Internet, credit cards and CD and DVD discs are only a few examples of innovations that have revolutionized everyday life in the past thirty years. Common to all these is that their functioning depends heavily on mathematics. Another thing to note is that in all these cases, the mathematics was not invented for the sake of the technological innovations - it had already been developed as pure mathematics and lay ready to be applied when the time was ripe.

In Internet and mobile phone telecommunication the message is encoded and passed from one computer to another or from one phone to another. Errors always occur and may lead to the message becoming completely obscured. Error detection and self correction is therefore essential in all telecommunication. Modern automatic error correction is based on deep mathematics such as Galois theory developed in the early 19th century by Evariste Galois. Telecommunication, as we know it, would not be possible without Galois Theory. Error correction is equally important for the proper functioning of CDs and DVDs.

Digital security is an important issue in today's society. We want to be confident that our phone calls are not eavesdropped, that we can safely shop on the internet without our credit card information being intercepted and that bank secrecy and safety is not jeopardized. The solution to the security problem is efficient encryption. Cryptography for this purpose uses modular arithmetic (a part of number theory). A standard method in public-key cryptography relies on the fact that no fast algorithm is known for factorizing a very large number. Therefore the public key used for encryption could be based on the product of two very large prime numbers, whereas the secret private code needed for decryption would be based on the prime factors themselves.

The European Science Foundation is preparing a Forward Look on Mathematical Modelling, and has received a proposal from the CNRS, France, to develop one on Mathematics and Industry. Forward Looks serve as strategic instruments, where the best researchers describe the status quo of their scientific domain, envision its evolution and impact in the next 5-10 years, and predict the needs for training, infrastructure and funding. The Forward Looks provide the national research funding and performing organizations as well as the European Commission a Europe-wide analysis to facilitate their decision making on targeting research funds.

Mathematics is in principle inexpensive. As the old joke says, a mathematician needs only paper, a pencil, an easy chair and a waste basket. Also, the criterion for success in mathematics is by and large universally accepted. This makes mathematics an attractive 'investment'. Moreover, a mathematical result is valid forever.

5) Maths in Flood Protection (by Jörg-Volker Peetz, Barbara Steckel and Norman Ettrich):

The 2002 flooding of the Elbe River in Dresden, Germany, showed that apart from the obvious destruction caused by surface water, considerable damage was caused by groundwater and water from the sewer system. Groundwater levels can rise quickly due to overflowing sewers or above-ground flow, causing basement flooding and structural damage to houses. Thus, a coupled simulation of the three components – surface water, groundwater and the sewer system – is important for flood risk management.

6) Clouds by Chance: Improving Atmosphere Models with Random Numbers (by Daan Crommelin) :

The performance of numerical models that simulate atmosphere and oceans is essential to weather prediction and climate research, both of which are topics of obvious societal relevance. In the past, the quality of weather forecasts and climate simulations has increased thanks to several developments. Increases in computer power, more detailed observations concerning the state of the atmosphere and oceans, and theoretical advances in the formulation of numerical models have all contributed to the better performance of weather and climate simulations.

7) Applications of Mathematical Processes in the Workplace:

Yet, teachers are expected to teach their students how to think! As one senior executive from Dell revealed, “Yesterday’s answers won’t solve today’s problems.”

Other vital skills include leadership and collaboration, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analysing information, and curiosity and imagination. Thus there is value in developing students’ mathematical problem-solving strategies, investigative and research skills, analytical, critical and creative thinking processes, teamwork and communication, and arousing their curiosity and interest in mathematics, because these are essential skills in the workplace. Although the domain may not be mathematics per se, hopefully, students are able to transfer their habits of minds to new and unfamiliar situations in other fields. If we believe that one of the purposes of education is to prepare students for the workforce (Cowen, 2007), then schools and teachers should heed Wagner’s (2008) advice to teach and test the skills that matter most.

8) The Future of Mathematics Education in Europe (by Olga Caprotti and Mika Seppälä) :

The level of education of their workforces determines the success of nations in global competition. Quantitative reasoning and the ability to apply mathematical methods in general will be the most important components in the skill set of tomorrow's workforce, meaning mathematics education has great strategic importance. The question of how to educate more people in mathematics, preferably with fewer resources, is an equation that cannot be solved by mathematics alone. computer science and linguistics are also needed. The WebALT eContent project has developed solutions that automate parts of mathematics instruction. Automation is the only way to improve the delivery of education, and to offer the opportunity to learn to everybody.

Conclusion

Mathematics is of practical value in many professions. It is not just the mathematical knowledge itself but the thinking processes acquired in genuine mathematical problem solving and investigation that can be applied to unfamiliar situations in other fields. Mathematical knowledge and processes are also useful outside the workplace in everyday life to understand and interpret certain events and news reports so as not to be deceived or swayed by others' opinions without any reasonable basis, thus improving one's own quality of life when one is able to lead a meaningful and responsible life.

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