Humanistic Mathematics Network Journal

Issue 13 Article 14

5-1-1996

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This paper examines the question of designing a course which will support other courses in humanities in providing a holistic education. Such a course could form a part of an integrative experience in mathematics that many institutions require before graduation. The first three sections look at the philosophy underlying such a course and the last section lists topics that could be used in such a course.

Living at the end of the twentieth century, we cannot fail to appreciate the conveniences afforded by modern technology and the promise of the future in science. Many people may be aware of the role of mathematics in this development and may concede that it is a very useful subject. While its utilitarian value is appreciated, the role of mathematics in the history of civilization and its cultural value may not be well understood. The intellectual values have been recognized in the past by educationists and we have had a tradition of requiring most of our students to take some course/s in mathematics. These courses are not always designed for a cultural education in mathematics. Quite often they are prerequisites for some other subject. Students take these courses, often, to fulfill an inevitable formality rather than out of curiosity. This defeats the purpose of such requirements. While some students complain about the need to take mathematics, there are new exciting results found in mathematics and its applications. In some ways it is like Dickens writing "It was the best of times, it was the worst of times".

Many years ago, the study of mathematics was considered as a worthy form of intellectual pursuit for an educated person. Neither its utility nor its relevance for education was questioned. There are always a few who feel that doing mathematics is "fun". But many more will need greater justification to appreciate the role of mathematics. As early as 1953, the mathematician Richard Courant wrote: "...after an unbroken tradition of many centuries, mathematics has ceased to be generally considered as an integral part of culture in our era of mass education. The isolation of research scientists, the pitiful scarcity of inspiring teachers, the host of dull and empty commercial textbooks and general educational trend away from intellectual discipline have contributed to the anti-mathematical fashion in education. It is very much to the credit of the public that a strong interest is none the less alive" [1]. Many people have attempted to redesign courses so that they are more "meaningful". By trying to relate mathematics to everyday applications, people have tried to make the courses less abstract and more down to earth. This should be looked at as attempts to humanize mathematics. But courses that stress the interrelationship of mathematics to other fields and which are more "cultural" in outlook do not appear to be offered very often. Such courses are in a sense "general" and students tend to opt for "utilitarian" courses as opposed to these cultural courses. Regular math courses have little or no time to dwell on these cultural values.

The liberal arts curriculum attempts to be both humanistic and holistic. It reflects a philosophical thought expressed by the Roman emperor Marcus Aurelius: "Nothing is conducive to the elevation of mind as the ability to examine methodically and honestly everything which meets us in life, and to contemplate these things always in such a way as to conceive the kind of universe they belong to, their use and their value with regard to the whole" [2]. The distribution requirements and integrative experience in the liberal arts curricula are just some ways of achieving this. The distribution courses need not always be designed to provide mathematical preparation for some other course. Some of them could have a broader perspective and provide a cultural education in the field. They could be historical and interdisciplinary in nature. The historical perspective is particularly valuable when one wants to treat mathematics humanistically. George Sarton writes:"It is

(also) the historian's privilege to make young people appreciate the value of the earlier efforts, however crude they may seem, and to implant admiration and reverence into their minds.... A man's moral worth is largely a function of his capacity for admiration and reverence." [2]. At the same time we need to remember that we are not talking about a course in the history of mathematics. It is an interdisciplinary course offered from the perspective of mathematics.

Let us look at some examples. Mathematics developed as part of the human civilization. The interaction between cultures has played a significant role in its development. The development of mathematics in antiquity (Babylonian, Mesopotamian, Egyptian, Oriental and Greek) provides a good example. [ref 4 ,5]. The use of geometry in art and architecture started in Greece because of their belief in the aesthetic beauty of geometry. Later developments in perspective drawings gave rise to the new discipline of projective geometry. [1, 6]. The interaction between mathematics and philosophy or mathematics and other branches of science are well known. Recent work in artificial intelligence and the psychology of learning mathematics are all examples that provide material for such a course.

In the usual curricula, which is time-bound, it is not always possible to expect the regular math courses to discuss such relations in more than a superficial way. A separate course whose object is precisely to examine these relations is what we need. The non-science student benefits from such a course by becoming aware of the role of mathematics in human civilization. The math/science majors benefit from the integrative experience that such a course provides. Since the value of the course is enhanced by drawing upon the experiences of the students, it is recommended that the course should be offered to students who are juniors or seniors. It can be made more meaningful by expecting students to read selected parts of the original works. The mathematician De Morgan once said that the amazing thing about mathematics is the flights of imagination that one sees in its ideas. We can hope that our students may get a glimpse of it by being exposed to such courses.

In this section we list topics that could be used to develop the kind of course we indicated. They are arranged under headings for convenience. Each heading is followed by topics that could be included under that heading. There is an overlap of the topics. The inclusion of topics is not meant to be exhaustive. The bibliography at the end gives sources where more information on these topics can be found. The book by Prof. Morris Kline [1] is a good book where most of the topics mentioned are discussed along with more references. A two semester course can cover all this material in a leisurely fashion. A one semester course will have to be less ambitious.

Mathematics in Antiquity

Development of number systems, algebra and geometry, decay of Greek mathematics under the Roman empire, its rediscovery through Arabic and Hebrew translations, Greek geometry and the development of early Greek philosophy.

Mathematics and the Arts

Use of geometry in Greek art and architecture, aesthetic value of geometry and art, development of perspectivity in painting, projective geometry, works of Da Vinci, development of cartography, ideas of symmetry in art, the works of Escher, computer art and fractals, Pythagoras and the musical scale, the trig functions and the mathematical description of sound waves, the work of Fourier.

Euclidean and Non-Euclidean Geometries

The impact of non-Euclidean geometries, mathematics as a deductive axiomatic science, the Erlangen program of Klein, use of geometries to describe nature and space.

Calculus and the Newtonian Influence

The search for universal laws from Aristotle to Newton, the creation of calculus and the study of deterministic processes, its influence on philosophy, religion and literature.

Probability

Nondeterministic thinking, from games of chance to the description of physical phenomenon.

Mathematics and Philosophy

Greek philosophy and logic, works of Descartes, Leibniz, & Boole, the impact of set theory and the works of Whitehead and Russell, logic versus intuitionism, the works of Gödel.

Mathematics and Learning

Mathematics used as a universal language, the use of language in mathematics, learning problems, math anxiety, women in mathematics, and math education.

REFERENCES

[1] Kline, Morris. *Mathematics in Western Culture.* Oxford University Press, N.Y., 1953.

[2] Sarton, George. *The History of Science and the New Humanism* Midland Book Edition, 1962.

[3] Waerden, Van der. *Science Awakening.* Noordhoff, Groningen, 1954.

[4] Neugebauer,Otto. *The Exact Sciences of Antiquity.* Brown University Press, Providence, R.I., 1957.

[5] Resnikoff & Wells. *Mathematics in Civilization.* Holt, Rhinehart, & Winston, 1973.

[6] Ivins, William Jr. *Art and Geometry.* Harvard University Press, Cambridge, 1946.