Societal Mathematics As A Futuristic Trend For School Mathematics Curricula

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Prologue

"Absolute, true and mathematical, time – of itself and from its own nature-flows equally without relation to anything external"(Weyl,1963). In spite of that Newtonian assertion , it seems that the " time-arrow" is enchanted with the transition to the third millenium . This is due to the on-going and expected radical changes and vast high-tech advancements taking place in many aspects of life. It is recognized that mathematics plays a cardinal role in almost all such endeavors. However the high esteem given to mathematics as a discipline and as a key tool for science and technology, are not matched with the affect given to mathematics as a learning subject. Negative effects can be sensed in many students reactions. This is also reflected in the so many changes in the content of mathematics education at all levels, specially in pre-university Curricula.

Restless Curricula And Effects

If there has been a symptom which characterizes mathematics, here and there, in the last half century this will be the symptom of change after change in math curricula and its pedagogies. Following the long time domination of the canonical traditional math syllabi of the pre- fifties, the international enthusiasm for modern mathematics infused most of the math curricula almost all over the world. Unhappy with the rigidity of the axiomatic approach and the abstractness of "modern" concepts, associated with the deterioration in student's achievement in basic skills, led to the "Back to Basics" movement, broken and contradicting interpretations of "what is basic" led to vast diversities and fluctuations in mathematics content to be taught in schools. So many international, regional and local projects appeared and preached for reform. Ebeid (1999) reported that the justifications given for the continuous changes give the impression that mathematics-through it's importance-has become a subject at risk. He cited: Skemp, in his words, saying that "mathematics is a subject to be endured, not enjoyable and to be dropped "(1971); Cockroft, in his report, saying that "mathematics is known as a difficult subject both to teach and to learn"(1982). Kloosterman(1996) indicates that it is important to note that affective reactions to mathematics vary with the content of the mathematics being taught. Jensen, Niss and Wedege (1998) asserted that because of the intrinsic abstractness and generality of their issues, concepts and methods both mathematics and physics are hard subjects to study….there are no roads to their acquistion that do not involve hurdles to be overcome and hardships to be endured. In investigating causes given by college students preparing to be "other subjects" teachers, for not choosing mathematics as their major study, Ebeid (1998) indicated that a high percent of his sample had negative conceptions and beliefs about mathematics such as: there is a lot of knowledge to be memorized, it is taught in a foreign language, difficult problems make the student feels inferior and lead to intellectual and physical fatigue, it requires proving the obvious, it is a black forest of symbols and vague terms even when taught in the mother language, math professors look arrogant and don't care whether students understand or not, why prepare to teach a difficult subject while having the same salary as those teaching easier subjects??

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Futuristic Trends

It goes without saying that the future will witness more and more globalization which will effect all societies. This can be viewed through the increasing rate of growth in multi-national enterprises, cultural interactions, human interrelations, trans-activities of different natures, wider spaces for world wide webs and inter-nets for communication and the usage of the same digital languages (instead of the different verbal languages) to receive, convey and process information. All such trends have an impact on societal changes.

Consequently, as the demands of society change, so do the essential competencies needed by individuals to cope with such new demands and to live productively in their society. The National Council of Supervisors of Mathematics in USA views as essential that those competencies that are necessary to employment and further education remain open, (Carl,1989). We view essential mathematics as the mathematical competence needed for the student to share and enhance the productive activities of the society in which he lives . Ding Er-Sheng of the Beijing University in China (1998) attributes the urgent needs for mathematics curriculum reform to changes in the social needs for mathematics and changes of the nature of mathematics and its applications. Hence, we think of societal mathematics as the mathematical skills and competencies which go beyond computational skills and which to be acquired and used through high order thinking skills (HOTS). It ought to be developed via genuine societal learning environments and societal problem solving situations. In such learning environment, the learner sees, or senses, in the real world of this society the number, the operation, the function, the statistics, the probabilistic manipulations, the space … etc. Futuristic societal needs require analytic abilities more than abstract arithmetic and algebraic operations. Many cognitive theories of learning, such as the expectancy value theory are based on the idea that actions are the direct result of beliefs about mathematics and its expected values, (Leder, 1987). Students and their parents need more useful mathematics which will help them to be reponsible adults, help them to find productive careers and can be adapted or transfered to possible changes in jobs in a changing technologized work. In this respect we refer to a quotation from Prof. Engineer John Perry as cited by John Westwell (1999):

"The study of mathematics began because it was useful, continues because it is useful and is valuable to the world because of the usefulness of its results, while the mathematicians, who determine what the teacher shall do, hold that the subject should be studied for its own sake". In the famous "Tree of Knowledge" of the Chicago Museum of Science and Industry, mathematics is represented as the main root of the tree and springing from it are the other roots, stems and branches representing the various basic and applied sciences. Such illustrations ought not to be mere rhetorical motivation, but should be embodied in the content of school mathematics curricula to teach them a societal subject in reality.

Suggestions For Math Curricula Development

In order to reach the objective of developing societal mathematics curricula we introduce the following guidelines as a framework:

1- Survey and use all available information about the main activities of the society and its market place. Put in consideration futuristic aspirations.
2- Analyse such activities to find out the included mathematical skills and methods.
3- Content inputs may be divided into explicit mathematics and implicit mathematics. Explicit mathematics includes direct experience with facts, concepts and skills. Implicit mathematics is represented as various ideologies that play the role of meta cognition of mathematics such as ideas of number, space, function, statistics, probability, optinization, awareness of applications….
4- Develop essential competencies such as contextual problem solving, communicating mathematical ideas, mathematical reasoning, estimation, direct and indirect measurement,

awareness of correct procedures and reasonableness of steps and results; using appropriate technologies for computation and processing information, mathematization and modeling.

5- Incorporate new applicable concepts at relevant levels, such as: sampling techniques, data analysis, linear programing, topological maps, patterns and recursions, fractals, game theory, discrete mathematics.
6- Introduce probability as a tool for dealing with uncertainity in random, chaotic and unpredictable situations.
7- Decrease the much tedious work and time given to facts and exercises related to arithmetic and algebraic operations, formal Euclidean proofs, trigonometric identities and paper and pencil manpulations.
8- Add modules with specific relevant applications, wherever appropriate, such as: mathematics of the farm, mathematics of construction, mathematics of a factory, mathematics of running a family budget…. etc.
9- Adopt a core program for all students to cover 60-80% of the allotted time for mathematics and use the rest of the time to meet students diversities in abilities and interests, whether slow or fast learners.
10- Teaching materials ought not be restricted to a one and only one textbook. Use different learning resources including disks, CD's, Videos.

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