الفصل الرابع

Designing a Global Curriculum in Mathematics for Basic Education Pupils in Egypt[(*)]

Introduction

The World has seen many changes in the past one hundred years. the pace of change is increasing rapidly and our school must help students to live in this changing world. "A child born today will be faced as an adult, almost daily, with problems of a global interdependent nature, be it peace, food, the quality of life, inflation or scarcity of natural resourses.. he may rightly ask: ...Why did my teachers not tell me about these problems and indicate my behavior as a member of an interdependent human race?" (Muller, 1979: 74).

"Today the human race as a whole shares these two basic problems on a world - wide scale: how to survive' how to assure a good life to its members. We need a system of organized international co - operation in order to cope with these bassic world - wide problems... Young people should begin in school to learn about these problems "(Abraham, 1973: 9). To satisfy this,a global curriculum is needed. Gibbons and Neuman (1986) pointed out that the global curriculum was designed to prepare our youth to live successfully in an uncertain world, and to actively pursue solutions to global problems. this curriculum is global because it is intended to prepare a generation to ceate a better world. lt is based on four simple themes: global citizenship, family of humankind, environmental management and cooperative conflict resolution. But how

can these glopal problems be approached through the matematics curriculum?

"Mathematics can and should serve as a vehicle for global understanding... Mathematics is a powerful language, one that can convey meaning and evoke emotions for more effectively than mere words". (Swetz, 1985: 207). Swetz, (1985) also pointed out that any aspect of mathematics can be used to develop global awareness in students. Some activities can be designed to demonstrate the use of computation, fractions, percentages, scientific notation, graphing, algebraic manipulation and functions to create this awareness in students. Through these acivites, students develop skills in collecting and interpreting data mathematically.

From these views it can be seen that:

- A global curriculum will be very important in this century and the next.
- This curriculum can be based on global problems.
- Mathematics can help students to achieve better global understanding.

The following question must however be asked:

Is our mathematics curriculum dealing with thesde global problems?

To answer this question, a content analysis was made of mathematics textbooks used in Egypt from grades 1 to 8 to determine:

- The extent to which global problems are included in the curriculum.

- The mathematical concepts that are used to examine these problems.

- The grade levels at which these problems are introduced.

As a result of this content analysis, only two global problems were found:

- The first problem: Population, taught through statistics (bar - graphs) for fourth grade pupils.

- The second problem: Soil Utilization taught through statistics (bar - graphs) for fourth grade pupils.

From this evidence the need for a global mathematics curriculum in Egypt is clear.

Previous Studies

There are many studies about global education, but those which relate to mathematics and a global approach can be illustrated by the following:

Lopes and Tavares (1989) present a collection of creative, imaginative, classroom activity units designed for grades K-4. They use a multiculural approach in which each unit is to be utilized in teaching various subiects such as: language arts, mathematics, science, etc. Exsamples of their material are: a multicultural mathematics puzzle for children to solve using Egyptian numerals, addition, and subtraction

problems using the Attic- Greek numerical system; Japanese optical and geometrical art; and a French puzzle using 28 dominoes.

Overly (1985) states that the amount of attention given to global studies in early childhood and elementary settings is very limited. Indeed, many educators question the advisability of global studies at this level. Impediments to intoducing a global approach to the preservice education of elementary school teachers are discussed. Suggestions are made for a cumulative and realistic curriculum for teacher education programs implementing global awareness studies into their programs.

Trujillo (1983) discussed culture in terms of the symbolic system that encodes the values of hnmanity at the levels of language, social structure and world view. He outlined schools of thought on culture and knowledge, concluding that educational foundations must be established for society to develop a greater sense of global awareness and multiculturalism in order to allow many value systems to exist in harmony.

Mann and Stapp (1982) provide teaching activities related to some problems such as: food production and distribution, energy, tranportation, solid waste, etc (11 problems). The activities, designed to help learners better understand the relationships between their actions and the world environment, focus on cultural linkages and demonstrate the

overt and covert interdependencies among the nations of the world and between people and systems.

Legrand (1980) summarized educational trends in elementary and secondary levels in countries throughout the world. Specific sections deal with the teaching of language, mathematics, natural science, human science, art, music, and physical education. There are common empheses in both developed and developing nations: an increased emphasis on preparing students for the working world, and an interdisciplinary approach aimed at helping students understand world problems.

Aquino - Mackles and others (1979) intended to help elementary and intermediate level students develop a global perspective. This manual contains ready - to - use activities dealing with the concept of "myself and others". The materials can be used in courses in social studies, language arts, mathematics, arts and science, or in the interdisciplinary couses. There are four parts to the manual. The first three parts, intended for the primary grade, contain activities to help students explore how they are interconnected with other people in the school, in the neighbourhood and in the community, and to recognize similarities between their live and concerns and those of people in other cultures. The activities in the fourth part, intended for intermediate students, help them to learn about the larger world.

General comments about these studies:

- Some studies introduce global activities which can be taught through a variety of subjects.

- Global problems which can be identified in these studies include: food production and distribution, energy, transportation, solid waste, chemicals in the environment, resource managment, pollution, population, world linkages, endangered species, lifestyle, and environment.

- A global perspective can be developed in students (in these studies) by using a multicltural or global problems approach.

- Students in the elementary stage need to understand problems in their own nation at first and then in the rest of world.

- Global studies at the elementary stage are limited.

From these comments, it is obvious that there is a need for more global studies at the elementary stage. This study will consider how global perspectives can be developed through the teaching of mathematics at the elementary and intermediate stages.

The Problem

Our curriculum in mathematics is not interested in presenting global problems to our students. To begin develop a curriculum with a global problems component, this research will focus upon answering the following:

- What are the global problems in the 21 st. century?

- What are the global problems which are suitable to teach through the mathematics curriculum?

- What is the scope and sequence of these problems through mathematical topics?

The Limitations of This Study

- This study attempts to design a segment of a mathematics curriculum for grades 1-8 that will provide an opportunity for the incorporation of a global problems dimension. The design of this curriculum in the present study will be limited to build up a relevant scope and sequence chart.

- The collection and classification of global problems was limited to 25 university teachers from two universities in Egypt (Ain shams U. and Cairo U.) and New Mexico state U. in U.S. A.

- The assessment of students' perceptions of and interests in global problems was limited to 220 students representing on intact class of each grade level from grade 4 to grade 8 in Beni - Suef city in Egypt.

The Procedures

(1) Global problems were identified and classified through:

- Theoretical study about global education.

- Surveys of previous studies in global education.

- Interviews with a sample of students in basic education to determine the global problems which interested them and the extent to which they wished to know more about them.

(2) A questionnaire to university teachers from different fields was circulated to:

- Ensure all the problems were considered global problems.

- Ensure the classifications correct and suitable.

- Choose some of the problems which could be easily to presented through the mathematics curriculum.

(3) A scope and sequence chart was compiled to demonstrate these global problems through mathematical concepts, the objectives for each of them and the grade in which they may be taught.

(4) This scope and sequence chart was circulated to selected specialists in education and in mathematics for comment.

(5) The scope and sequence chart was modified to reflect comment received.

Definition of Terms

Basic Education: grades 1 to 8.

Global problems: problems that have world -wide significance.

The Global curriculum: a curriculum focusing upon the konwledge, skills and values necessary for improving or eliminating world problems.

The Sample

The sample of thes research consists of two sets:

- A sample of students from the basic education stage (220 students) as shown in the following table.

Table (1) the sample of students in basic education stage

The Grade	4	5	6	7	39
The number of students	52	47	40	42	8

- A sample of university teachers form many different fields (20 teachers).

- A sample of univesity teachers specialising in curriculum and methods of teaching mathematics (5 teachers).

Data Collection Techniques

The following data collection techniques were used in the study:

- An interview with a sample of students (220 students) who were asked the folloing question:

What global problems have you heard about and are you intersted studying and learning more about them?

- A questionnaire sent to a sample of university teachers from different fields. This questionnaire is designed to:
  - Document the opinions of the sample about whether the problems were or were not global in nature.
  - Classify the problems.
- An interview with a sample of university teahers specialising in curriculum and methods of teaching mathematics (Ain Shams U- New Mexico State U.) to ask them two questions:
  - Whichg global problems (from the table) are suitable for study through the teaching of mathematics?
  - Which mathematical concepts would be easy to use in teaching about global problems?

The Results

(1) Follwing the theoretical study, the survey of previous studies in global education, and the interview with the student sample (grades 4 to 8) the global problems were collected and classified into different areas as following:

  - **Environmental problems:** pollution, floods, volcanoes, desertification, ozone - hole and shortage in potable water.

  - **Social problems:** population, homeless, unemployment, religious fanatics, immorality of young people, and drop-outs.

- **Economic problems:** famine, inflation, energy and tranportation.

- **Political problems:** peace-Keeping, nuclear armament race, and distrust among nations.

- **Cultural problems:** cross-cultures, illiteracy, and the Knowledge explosion.

- **Health problems:** handicapped, high rate of death among children, drug addiction, malnutration, AIDS, cancer.

(2) These problems was present to the sample of teachers in the university through a questionnaire. The result of this questionnaire is presented in the following table:

Table (2) the percentage of
response of 20 university teachers

Question	Response	
	Yes	No
- Are all these problems global?	80%	20%
- Are there other global problems not mentioned in these problems?	40%	60%
- Is this classification accurate?	85%	15%

- 20% of the sample indicated that some prohblems are not global such as:

transportation, knowledge explostion, religious fanatics and drop-outs.

- 40% of the sample indicated that there are other global problems not included in this table such as:

    * Mutual trust between the rulers and their people.

    * Desert reform and desertification.

    * Environmental imbalance.

    * Family imbalane.

    * The irreligious approach in modern writing (texts).

    * The spead of diseases in the third world.

    * Terrorism.

    * Racism.

    * The negative interference of men in the natural balance.

    * Conflicts over natural resources.

    * Technical and computer illieracy in the third world.

- 15% of the sample indicated that:

    * Many of the problems have variables such as:

    population; may be an environmental problem, a cultural problem, or a health problem.

    * There are some problems that occur as a result of other problems such as:

Transportation $\rightarrow$ pollution $\rightarrow$ ozone-hole

Increase of population $\rightarrow$ increase in pollution

$\rightarrow$ transportation problems

$\rightarrow$ food problems

$\rightarrow$ educational problems

$\rightarrow$ housing problems

$\rightarrow$ health problems

$\rightarrow$ unemployment

(3) According to these responses, the following table was created:

Table (3) classification of global problems

Environmental Problems	Social Problems	Economic Problems	Political Problems	cultural problems	Health Problems
-Pollution -Floods -Volcanoes -Desertification -Ozone-hole -Shortage of potable water	-Population -Homeless -Unemployment -Religious-fanatics -Immorality of young people -Family imbalance	-Famine -Inflation -Energy -Desert reform and desertification	-Peace-Keeping -Nuclearar-mament race -Distrust among nations -Terrorism	-Cross-Cultures -Illiteracy	-High rate of death among childen -Drug addiction -Malnutrition -AIDS -Cancer

(4) This table was presented to selected teachers who are university specialists in curriculum and methods of

teaching mathematics (5 teachers) and they decided that:

- Most of these global problems can be taught through mathematics.

- These problems can be taught through mathematical concepts such as:

  * Statistical concepts: can be used to demonstrate the size of these problems and to predict some conclusions about them.

  * Some arithmetical and algebraic concepts such as:

    > great numbers, arithmetic operations, ratio and proportion, percentage, measurement, functions, etc.

- These problems can be demonstrated through the mathematics curriculum by:

  * Some applications of the previous mathematical concepts.

  * some activities, including mathematics lesson.

Som considerations for designing a global curriculum

- The presentation of the global problems in this curriculum begins graduallly at the elementary to intermediet stage (on the local level first then on the global level).

- Emphasis about prediction (based on projection and estimation) when the students study any problem to be sure from their percept about this problem.

- the presentation of suggested global problems will be written in the framework of the existing mathematics curriculum.

- All the numbers which used in applications or in any activity,must be true.

- Methods of teaching or learning this curriculum must be adapted to both competitive and cooperative learning. "More attention needs to be given to recent developments in learning which stress collaboration and teamwork. The cooperative learning method assumes heterogeneity and emphasizes interactive learning opportunities. They are better designed to cope with the diverse needs of students and the requirements for success in an interdependent world. Cooperative learning is an important element of global education"(Becker, 1991: 81).

According to these considerations, the scope and sequence for two global problems; pollution and population is presented as a model example:

Note: mathematical concepts are identified by putting them between brackets in the scope and sequence chart.

Table (4) Scope and Sequence Chart For Pollution Problem

Global Problem	Objectives of Grade	ONE	TWO	THREE	FOUR
Pollution		-Count the number of motor vihicle horn's sounded per hour in a main street and in a branch street **(Measure Time-count)** -Compare these two numbers. **(Comparing Numbers)** -predict some results if there is an increase in the number of horn's sounded per hour **(Estimation)**	-Count the number of ice cream wrapper per in a five meter section of a street. **(Measure Length-Count)** - Calculate the number of wrapper found in the complete street numbers. **(Addition Operation)** - Estimate the number of wrapper found in this street if every person living there threw down one wrapper **(Estimation)**	-Count the number of motor-cars which pass through one street per half hour. **(Measure Time - Count).** -Calculate the amount of exhaust which results from these cars (if the amount of one car's exhaust per half-hour was (Khown). **(Multiplication Operation),** - Estimate the amount of exhaust which would result from the motor - cars in one day. **(Estimation)** - Identify bad effects of this exhaust and suggest some solutions to deal with these effects. **(Problem Solving)**	- Construct, read, and interpret a bar- graph which represents the population of different cities in Egypt. **(Bar - Graph)** - Construct another bar-graph which represents the number of motor-cars in these cities. **(Bar-Graph)** - Identify the cities which have: • highest population • greatest number of motor-cars. **(Greatest- Number)** - Discover the relationship between the increasing population and the pollution. **(Estimation)**

Table (4) Scope and Sequence Chart For Pollution Problem

FIVE	SIX	SEVEN	EIGHT
- Calculate the percentage of people who have cancer in different countries, (Russia and North Europe) From 1984 to 1988 **(Percentage)**	- Calculate the area of regions which have a high probability for pollution according to the different countries in smoke of volcanoes to a nuclear accident at Chernobyl. (at the same year) **(Circle Drawing - Circle Area)**	- Construct, read, and interpret a broken line graph which represents the number of deaths in different countries due to a nuclear accident at Chernobyl. **(Curve - Graphs)**	- Construct, read, and interpret a curve - graph which represents the size of the ozone-hole through different periods. **(Curve - Graphs)**
- Construct, read and interpret a circle graph which represents the percentage of cancer in these countries for each year. **(Circle Graph)**	- Identify the harmful effect of the volcano smoke on the human body, then suggest some solutions to deal this problem. **(Problem Solving)**	- Calculate the mean, median and mode for the number of deaths in this accident. **(mean-median-mode)**	- Calculate the growth rate of the ozone - hole's size through these periods. **(Ratio)**
- Identify the changes in relationships between these percentages. **(Comparing Areas)**		- Construct, read, and interpret a curve graph which represents the number of deaths in this accident in one country through different years. **(Curve - Graph)**	- Predict the size of ozone - hole after 5 or 10 year if the growth rate stays constant. **(Estimation)**
- Discuss how the Chernobyl accident might have affected these percentages. **(Estimation)**		- Discover the relationship between the rate of deaths and the distance from the nuclear center. **(Inverse Proportion)**	- Suggest some solutions to stop this growth rate. **(Problem Solving)**
		- Discover the relationship between the time and the rate of death. **(Inverse Proportion)**	

Table (5) Scope and Sequence Chart For Population Problem

Objectives of Grade / Global Problem	ONE	TWO	THREE	FOUR
Pollution	-Count the number of students and the number of desks in the student's class. **(Count and Write No.)** -Calculate how many students there are per desk if the number of desks is reduced (not mentally but experimentally). **(1-1 Matching)** - Determine the best-suitable number of students per desk. **(1-1 Matching)** - Predict some results if the desks are too crowded **(Estimation).**	-Record the number of people in each family in the student's house or in his apartment block. **(Write Numbers)** - Order the families according to size from smallest to largest. **(Ordering No.)** - Calculate the total number of people living in the student's house or apartment block. **(Addition Operation)** - Calculate (experimentally by using models) how many buses are needed to take them to their work or their schools. **(Experimentaly Division Operation)** - Predict: what happens if there are not enough buses. **(Estimation)**	-Calculate the amount of food or money available to each family which is required for each family (if the amount per person is Known), the amount per person is... **(Multiplication Operation)** -Predict: what would happen if this amount did not exist or is reduced? **(Estimation)** - Suggest some solutions to solve this problem. **(Problem Solving)**	-Find out how many rooms are available to each family in the student's house or apartment block. **(Count and Write No.)** - Calculate for each family how many people there are per room. **(Mentaly Division op.)** -Predict: what problems arise when the number of peopl per room increases. **(Estimation)** - Suggest some solutions to treat such crowded conditions. **(Problem Solving)**

Table (5) Scope and Sequence Chart For Population Problem

FIVE	SIX	SEVEN	EIGHT
- Read and record the population in different countries. **(Read and Write the Greater Numbers)**	- Calculate the density of population in different countries **(Ratio)**	- Calculate the rate of population growth per year in different countries **(Ratio)**	- Calculate the mean and median of populations in different countries through a period of years. **(Mean, Median)**
- Construct, read, and interpret a circle graph which represents populations of different countries. **(Circle Graph)**	- Order these densities from smallest to largest **(Ordering Ration al No.)**	- Calculate the population in these countries in 10 – 20 years after (by using mathematical formule) **(Exponent)**	- Construct, read, and interpret double - bar graphs which represent the population and standard of living in many different countries. **(Double - Bar Graph)**
- Construct another circle graph for the energy which used in the same counties **(Circle Graph)**	- Predict: some problems resulting from high and low density populations. **(Estimation)**	- Predict: some results according to these calculations **(Estimation)**	- Discover the relationship between the population rate of growth and the standard of living in different countries. **(Inverse Proportion)**
- Discover some relationships between these two graphs **(Comparing Areas)**	- Suggest some solutions to obtain a suitable density **(Problem Solving)**	- Suggest some solutions to help these countries to made a control about this growth. **(Problem Solving)**	
- Predict: what are the problems if the population in creases and the energy available does not increase. **(Estimation)**			

Recommendations and Suggestions

The following recommendations and sugestions are based on the results of this survey.

* The scope and sequence chart for Mathematics should be revised to include the global problems classified in table3.

* New units should be developed for the appropriate textbooks in Mathematics which contian activities related to the global problems identified .

* Field testing of the new Units should be undertaken to determine their effectiveness in raising awareness of those global Problems identified at each grade level.

* The global problems identified at each grade should be included in the instructions circulated to all prospective authors so they can be integrated, if at all possible, into other subject areas.

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