The Experience of the Arab Supercourse

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Introduction: The aim of the supercourse is to contribute in developing mathematics education in different countries. We thought of achieving this goal by means of establishing books in the light of the principles of the Mathematics Education into the 21st Century Project. These principles are based mainly on connecting mathematics education to life, humanizing it, focusing on problem solving.
The Arab group, working in this project, has come to the belief that the "enrichment activities" is the most effective approach to contribute in developing mathematics education in our countries, since our programs are characterized by their lack of such activities and being centralized programs.
The first product of this project is already published in Arabic and in English at the name of: **"ENRICHMENT ACTIVITIES IN SCHOOL MATHEMATICS, For the Second Stage of Primary Education".** In the present paper we shall introduce some features of this book, the philosophy behind this work, and a classification of the activities of the book according to certain criteria, while giving explanations for some of these activities.
The choice of the Arab group: The reality of teaching and learning mathematics in our schools is that some objectives are almost absent, especially, those concerning developing scientific thinking and the ability to research. This fact is due to different reasons, one of these reasons concern programs and textbooks that are basically focused on knowledge, rules and techniques, and are centralized all over each Arab countries. In addition, there is a great lack of publications (in Arabic) containing manipulation activities, challenging exercises, open-ended problems, investigative and research problems, … etc. For these reasons, the Arab group decided to establish a series of books that focus on "enrichment activities" covering all the stages of general education: kindergarten, early primary, advanced primary, preparatory and secondary. The first book of this series is already published for the second stage of primary education.
Overview on our first book: It is a booklet of 134 pages, divided into five chapters (three numerical, one on geometry and measurement, and the fifth is general). At the beginning of the book, there is an introduction, as well as a message for teachers and parents. Answers and guidelines are put at the end of the book.It must be noted that despite the partition of the book in chapters according to different domains (or subjects), most of the activities of the book serve multiple and common purposes.
Principles respected in preparing the book:
When we prepared the plan of this work, many questions came to our minds such as:
- Why are many students not interested in learning mathematics? And how can we make learning mathematics interesting for them?
- How to develop the interests of students towards the study of mathematics in future?
- What is the real meaning of learning mathematics?
- What do our programs and textbooks lack? (using the international standards as our yardstick)
- What are the materials used by teachers or by students in teaching or learning mathematics in our countries?
- What kind of balance must be done between breadth and depth in our school mathematics?

The discussion of these points (and others) led us to follow some principles in writing the book such as:
- The activities must interest students, and engage them in thinking and carrying out a plan of a solution.
- The activities must be "somewhat" related to the subjects of the school program, but shouldn't take the form of the usual exercises.
- The activities must be presented in different and attractive ways.
- The activities must be focused on methods and reasoning more than knowledge or techniques. Students must already know the prerequisites needed to solve.
- The ideas must challenge students and lead them to develop and apply various strategies. (especially that our textbooks usually include no challenging exercises)
- Some activities must have more than one right answer.
- Some activities must prepare students indirectly to learn new mathematics concepts or approaches.

General description of the activities of the first book:

The principle aim of the supercourse is to help in developing teaching and learning mathematics. In order to achieve this aim, and in respect of the principles mentioned earlier, we determined some objectives, then we tried to design the activities of our first book according to these objectives, without taking into account if the activity belongs to a certain subject or to another.

We shall present in the following the most important of these objectives, with some examples of the activities which concern each objective (The examples are taken from the book).

We must note that it is difficult, for many of these activities, to do a sharp classification, since many have interloping objectives.

- **Enable students to observe and discover a rule, and then to apply the discovered rule.**

In these activities, the student is completely free to discover any rule (or pattern), according to his own way of observation and to his capacity to find relations in the given situation. He/She only must be able to explain his/her point of view.

Example (1): Note and discover In figure (1), numbers are put in the triangles according to a particular rule. Discover this rule and then complete figure (2) with appropriate numbers in the same manner.

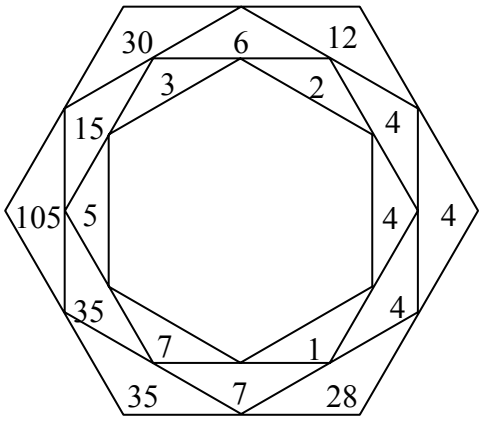


Figure (1)

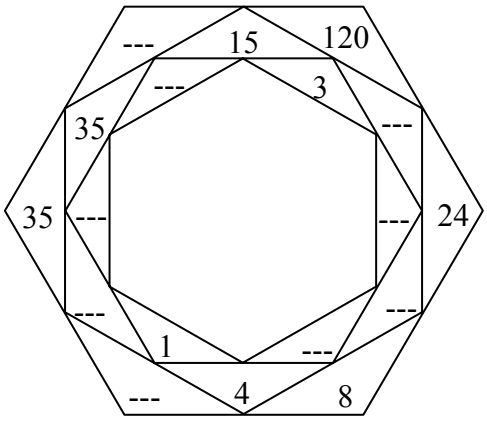
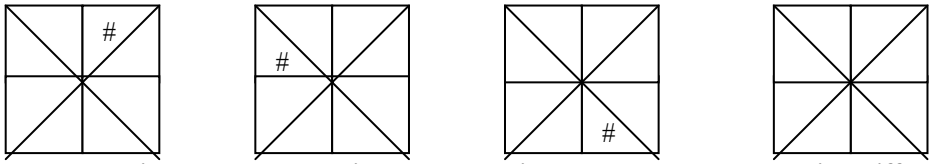


Figure (2)

In this activity, the student starts by trying to discover any relation between the numbers of figure (1). Once he/she finds a relation, he/she experiments with all the numbers of the first figure, if this relation is always valid. If it is, he/she uses this relation to complete the second figure. If not, he/she must try to find another relation (or to modify the first one). We can easily find more than one relation. What is only needed, is to verify the validity of the discovered relation.

Example (2); discover and complete



- **Enable students to practice and apply their knowledge in other contexts, and with different representations.** Example (1): Operations and brackets. Use the signs + , - , x , : while putting brackets in appropriate places so that the following equalities are correct.

10 10 10 10 = 0.01	10 10 10 10 = 0.05
10 10 10 10 = 1	10 10 10 10 = 0.9
10 10 10 10 = 2	10 10 10 10 = 101
10 10 10 10 = 3	10 10 10 10 = 9.5
10 10 10 10 = 4	10 10 10 10 = 9.9
10 10 10 10 = 9	10 10 10 10 = 10.1
10 10 10 10 = 19	10 10 10 10 = 10.5
10 10 10 10 = 90	10 10 10 10 = 11

Most of these equalities have more than one right answer, such as:

10 : 10 + 10 – 10 = 1 , (10 x 10) : (10 x 10) = 1 , 10 + (10 – 10) x 10 = 1 , …

In this activity, the student must be able to choose the "good" operations, and to decide in what order the chosen operations must be put (which needs a good understanding of the effect of each operation). The skill of doing operations has not the same importance here.

Example (2): The suitable digit in the suitable place

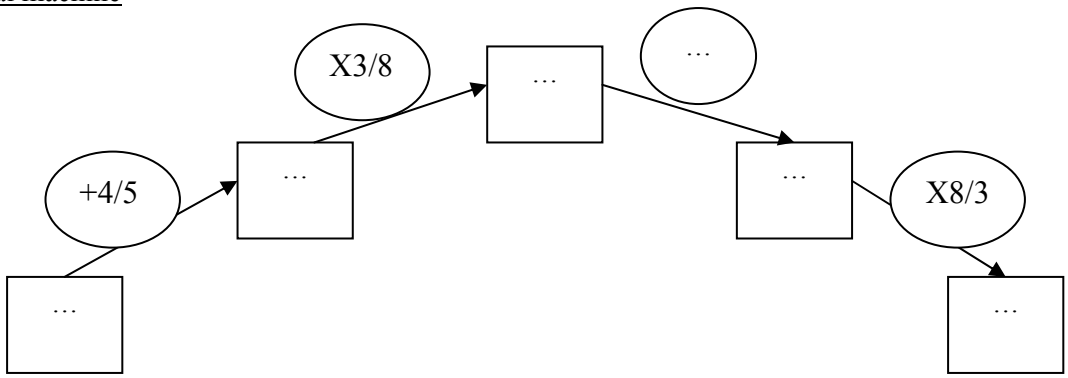
Put the digits **0 , 1 , 2** in the empty squares in each of the following so that the equality is correct:

35 x = 6300	35724 x 0. = 357.4
0.05 x = 0.52	_5 x .1 = 315
97 : 97.2 =	8420 : = 42
1528 : 10 = 5.8	1 : .02 = 100
1783 : 10 ≈ 78.2 to the nearest tenth	19.56 : 10 ≈ 3. to the nearest tenth
4983 : 1000 ≈ 42 to the nearest unit	7537.5 : 00 ≈ 80 to the nearest hundred

- **Enable students to build new mathematical knowledge and approaches**

(ie: relations, functions, properties of parallel and perpendicular lines, …)

Example (1): The neutral machine

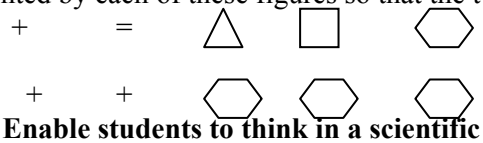


Start Finish

(1) Complete the missing operation so that you always finish with a number equal to that of the start.
(2) Verify by choosing numbers of your own.

Example (2): New symbols

In the following, some figures (symbols) were used instead of digits. Deduce the digit, which is represented by each of these figures so that the two equalities are correct.



- **Enable students to think in a scientific way: Experiment, conjecture, prove, generalize**.

  In these activities, students find themselves facing a research situation, in which the need to argument comes naturally.

Example: Intersecting lines

- What is the greatest possible number of points that four different straight lines intersect at?
- What is the greatest possible number of points that five different straight lines intersect at?
- What is the greatest possible number of points that ten different straight lines intersect at?
- What is the greatest possible number of points that six different straight lines intersect at if five of them are parallel?
- What is the greatest possible number of points that six different straight lines intersect at if four of them are parallel?
- What is the greatest possible number of points that ten different straight lines intersect at if four of them are parallel?
- What is the number of points that ten different straight lines intersect at if four of them are parallel and the other six straight lines are parallel as well, but in a different direction?

Enable students to use manipulation and to play mathematical games.

Many activities of the book consist of composing figures using pieces of cardboard at the form of geometric figures (a sort of puzzle). In such activities, students manipulate, examine, and discover geometric properties and relations. They also feel the effects of geometric transformations in a natural way.

In some other activities, we describe the rules of a game, and the materials needed to play this game. In such activities, students are usually motivated to play together, mathematics discussion and argumentation comes naturally through playing (in order to won).

As examples of games, there are especial dominos, equal cards, and comparison game.

Future perspective:

In addition to the supercourse project, a goal for the future is to design and to execute a **supertraining** for teachers (and maybe for parents as well). In fact, teachers are not prepared to lead a workshop in such activities, either during the phase of the student's research, or when the students present their ideas or solutions. Usually teachers are not able to lead a scientific discussion in classroom. Doing activities in classroom demand a "different" type of practice and it is very difficult for teachers (without appropriate training) to innovate their practice.

We hope also for the future to complete all the series, and to receive comments and/or suggestions, either from users of the books or from specialists.