

# Excellence 2000 (E2K)

Excellence 2000 (E2K) is an extra-curricular educational enrichment program in science and mathematical thinking. The program, developed by the Israel Center for Excellence through Education of the Israel Arts and Science Academy, is designed for middle school students with strong potential and high motivation.

In January 2004, twenty-three educators, representing ten Jewish day schools and yeshivot went to Israel to learn about the Mitchell Excellence 2000 program, and to determine how it could be best implemented in their schools. At the current time, more than 100 schools are implementing various E2K modules to supplement their math and science curricula in Grades 6-8.

The Excellence 2000 (E2K) program is designed for the middle school students who are interested, motivated and talented in mathematics and science, with special emphasis on students who generally are not being sufficiently challenged in those areas. The program also includes a professional development component for participating teachers.

This innovative program has many goals:

- To increase students' interest, involvement and literacy in math and science
- To stimulate improvement in existing math and science programs
- To help students "learn how to learn"
- To emphasize logical mathematical thinking and experimental scientific thinking
- To enhance the skills of middle school math and science teachers
- To bring about a new teaching methodology throughout the grades

The E2K curriculum is inquiry based and problem centered. The curriculum, created by the Israel Arts and Science Academy, arouses students' curiosity and increases their motivation to learn. The E2K curriculum integrates mathematics and science in each unit, and is designed as an extension of the general math and science curricula taught at the junior high school level. The activities in each unit are hands-on. Communication and discussion are paramount during each session. Developing problem solving strategies and new ways of thinking are stressed.

Students participating in the program must be committed to the challenge and must exhibit an interest in learning and independent thinking. Teachers are supported by CIJE mentors, not only in curricular aspects but more importantly, in appropriate teaching methodology.

The Center for Initiatives in Jewish Education recognizes the importance of development of academic mathematics and science curricula. CIJE is currently implementing this program in more than 100 day schools and yeshivot. This outcome will yield a population of students armed with the talents and skills to face the rigors and challenges of the 21<sup>st</sup> century.

# SCIENCE

## Skyrocketing into Space (S)

What are the forces causing a rocket to take off into the skies? What speed is required to break free of the earth's force of gravity?

Students answer these questions by building a rocket themselves, using simple and easily available means (soft drink bottles and bicycle pumps) but the laws that are studied are thorough and deep. At the end of the unit, students learn about the structure of the solar system and the universe.

## The Unseen World (S)

This module introduces students to the world of microbiology. Through various experiences, students become familiar with many types of microorganisms and learn microscope skills and techniques of isolating and culturing these organisms. Safety procedures and relevance to everyday life are stressed.

## Riddles of Nature (S)

This unit consists of the study of a series of natural phenomena and some everyday occurrences, presented as challenge problems to be solved. Why does hot air rise? Does the tip of a branch of a tree get longer from its tip or from its base? Through experimentation and reasoning students make very interesting discoveries.

## Apollo 13 (S)

Through the famous account of Apollo 13 flight, we learn about the dramatic events which took place in 1970. A great number of scientific principles are drawn from the experiences of Apollo 13 in an interdisciplinary fashion. Experiments which address the mathematical\* biological and the physical are derived from the various phases of the Apollo 13 journey.

## Chromatography (S)

This is a subject of considerable importance in chemistry and the development of drugs. The topic includes learning about the properties by which molecules are separated to obtain pure material from compounds. The special feature of this program is that these complex principles are reached through the use of wonderfully simple and inexpensive means as chalk, filter paper and so on, available in any school or laboratory.

## The Chicken and the Egg (S)

What is the egg we eat as an everyday food? What is the meaning of the structure so characteristic of the egg? And where is the chicken in all of this? Again, using simple means, it is possible to reach a high theoretical understanding of subjects such as the tertiary structure of proteins and the principles of solubility.

### The Wonders of Soap Membranes (S)

This is an interdisciplinary unit for math and science. The unique feature of soap membranes is their ability to "analyze" complicated mathematical tasks such as determining the shortest way to connect New York, Chicago, and Los Angeles by telephone line.

### Rising to the Occasion Principles of Capillary Motion (S)

This study unit introduces a comprehensive and interdisciplinary understanding of one particular scientific topic—capillary motion. What appears to be a mysterious phenomenon is investigated by the students through a creative and exciting scientific journey.

### Taste of Science II (S)

This unit is a compilation of science activities on different topics. Stories and examples taken from real-life events encourage experimentation, independent learning and creativity. The chapters include "Coastal Towns Beware!", "High and Dry", and "Cold vs. Mold".

### Taste of Science III (S)

This unit provides another compilation of science activities on different topics. The observation of phenomena students will recognize from their daily lives encourages experimentation, independent learning and creativity. The chapters include "Take it with a Grain of Salt", "The Hidden Light", "The Bear Fur Mystery" and "The Redro Tool".

### Sorting Things Out (S)

One of the basic activities in applied chemistry involves dividing a mixture or solution into its constituent parts. Students are challenged to carry out a variety of experiments, and they observe how one separation technique, chromatography, can be used to solve mysteries and crack riddles.

### E2K Challenge (S)

This unit provides a variety of activities, especially designed for use on E2K Challenge Days. After studying these games and tasks, the Excellence 2000 students are encouraged to present the activities to their peers, through a series of stations at a competitive, school-wide event. Students work in groups to solve exciting scientific and creative thought puzzles. This hands-on experience provides a unique opportunity for team-building and cooperative learning.

### Science and Beyond I (S)

Students now take the scientific skills and knowledge they have gained one step further, and begin to apply this information to inventive and technological uses. The unit provides a variety of activities including "Yeasts in Action", "The Jewel in the Crown" and "Iron from Rock".

# MATH

## More Than Meets the Eye (M)

This unit delightfully exposes statistics for what they appear to be—and what they really are—based on how data is supplied. The purpose of the unit is to develop critical thinking in the young readers and encourage them to doubt questionable authority. Examples are taken from real life.

## Crossing Bridges (M)

This is an introduction to graph theory. Four structured challenges guide students to Euler's theorem, culminating with the riddle of the Königsberg Bridges. The students gradually gain an understanding of the problem, and in some instances, arrive at the basic solution on their own. The final chapters are designed to illustrate the application of Euler's theorem in practical terms.

## Math Adventures I

This module contains a mixture of activities in various fields of mathematics. Each activity is both fun and challenging and requires intuitive thinking and creativity on the part of the students.

## Math Adventures II

This module contains a mixture of activities in different fields of mathematics. Each activity is both fun and challenging and requires intuitive thinking and creativity on the part of the students.

## Calculated Risks (M)

This unit features problems and puzzles that are set in consequential and fateful circumstances. Every problem is interwoven into a "life and death" story and every incorrect or careless solution ends in tragedy. Every correct mathematical solution begets happiness or at least a sigh of relief, however. There are two parts to this unit: difficult problems and symmetrical strategy.

## A Taste of Math (M)7.8)

This unit contains a number of brief activities, touching on a variety of subjects in the mathematical field. Teachers will find "tastes" of various subjects: Sequences, bases, game theory, odd and even numbers, and more. Each chapter contains an important mathematical message incorporated into thought-provoking games and activities.

## Take a Chance on Fractions Oh)

This booklet combines two topics. The main topic is simple fractions, while the other is probability. The activities are constructed using stories, games and challenging puzzles in order to create an atmosphere that is clearly different from what the students are used to in their regular lessons on these topics — particularly when it comes to fractions.

### Getting into Shapes (M)

This unit contains three activities related to the field of geometry. The activities differ from one another and are also very different from typical geometry lessons, in which the emphasis is often on Euclidean Geometry.

### Math Adventures II (revised) (M)

The Math Adventures III unit contains five activities on different topics, each of which can be seen as independent. The concept of confronting tasks for which the students have not been taught a solution technique (a mainstay of the Excellence 2000 program), is evident in all the activities.

### In Pursuit of Algebra (M)

The main objective of this study unit is to create a natural bridge between quantitative thinking and algebraic thinking. By presenting students with a variety of interesting situations in which equations can make the task surprisingly simple, we hope to make algebra more meaningful.

### On the Surface of Things (M)

This study unit deals with geometry — planes and spaces. It contains 4 activities that will enable students to gain profound insights regarding the relevant mathematical topics as well as develop their thinking abilities and ability to confront challenges.

### Mathemat-mix (M)\

In this unique unit, each of the 3 activities combines two or more mathematical topics. By mixing series with geometry, geometry with algebra, and series with algebra — students are offered an opportunity to expand their thinking and see how these mathematical concepts are interconnected.