WORKSHOPS

THE 5TH INTERNATIONAL CONFERENCE ON CREATIVITY IN MATHEMATICS AND THE EDUCATION OF GIFTED STUDENTS.

HAIFA, ISRAEL, FEBRUARY 24-28, 2008
FUNCTION MODELLING USING E-STAT DATA AND FATHOM™

JENNIFER HALL
Statistics Canada and the University of Ottawa, Canada

Abstract
In this workshop, participants will be introduced to Statistics Canada’s resources for function modelling. Participants will be shown how to retrieve real-world data from E-STAT, Statistics Canada’s extensive database for teachers and students. Then, participants will import the data into Fathom™ dynamic statistical software and use sliders to fit mathematical functions to the data. This workshop will highlight the benefits for gifted students in using real-world data for function modelling, such as investigations of real-world explanations for the curve shapes and analysis of the validity and utility of mathematical models.

RATIONALE
Making mathematics relevant and applicable to the ‘real world’ is a very important facet of mathematics teaching and learning; this is particularly essential for gifted students (Rotigel & Fello, 2004). The United Kingdom’s National Numeracy Framework notes that “Real data present problems that ‘textbook’ or contrived data can skirt around; by using them pupils will gain useful transferable skills” (Department for Education and Skills, 2001). In the Canadian province of Ontario, high school mathematics curriculum documents explicitly recommend using secondary data for function modelling. For example, a specific expectation for the Grade 11 university-preparation course states that students will “collect data that can be modelled as an exponential function… from secondary sources (e.g., websites such as Statistics Canada, E-STAT), and graph the data” (Ontario Ministry of Education, 2007, p. 49).
However, it is extremely difficult for teachers and students to find real-world data that can be closely approximated by non-linear function models. The Learning Resources team at Statistics Canada recognized this problem and sought to assist teachers in fulfilling their curricular needs. The Learning Resources team, including the author of this paper, searched E-STAT, Statistics Canada’s extensive database for teachers and students that contains more than 36 million time series and data from over 250 surveys, and located several real-world datasets that could be closely approximated by linear, quadratic, exponential, sinusoidal, and logistic models. Statistics Canada’s function modelling resources (available at www.statcan.ca/english/edu/mathmodel.htm in English and www.statcan.ca/francais/edu/mathmodel_f.htm in French) provide teachers and students with easy access to these datasets and supplementary resources for function modelling.

MAIN PURPOSES

The main purposes of this workshop are to expose participants to the wealth of benefits that Statistics Canada's function modelling resources provide for gifted students and to teach participants how to use Fathom™ dynamic statistical software to fit function models to real-world data. A further purpose of this workshop is to engage participants in discourse regarding the extensions of this topic for gifted students, such as researching sociological and economic reasons for the data patterns and analysing the validity and utility of mathematical models.

MATHEMATICAL TOPIC

The mathematical topic of this workshop is secondary school-level modelling of linear, quadratic, exponential, sinusoidal, and logistic functions using real-world data.

INvolvement of Participants

In the workshop, participants will gain hands-on exposure to both retrieving data from Statistics Canada’s E-STAT database and analysing data with Fathom™, a dynamic statistical software program for secondary and post-secondary students. Participants will be provided with an overview of Statistics Canada’s function modelling resources, such as datasets, sample graphs, and lesson plans. Then, participants will retrieve datasets from the E-STAT database that can be closely approximated by mathematical functions. Participants will be shown how to create graphs directly within E-STAT and how to export the data to a dynamic statistical software program. Participants will then be provided with a brief tutorial about Fathom™ software, focusing on plotting equations on graphs and using sliders to alter variable values in equations. Participants will then fit a curve to the dataset they retrieved, using sliders and equation plotting in Fathom™. If time permits,
participants may also try one of Statistics Canada’s several function modelling lesson plans.

REFERENCES

Abstract
In this workshop, participants will be introduced to Statistics Canada’s Census at School program. This international in-class, online questionnaire program provides elementary school students with a rich opportunity for data analysis and statistical exploration using their own class data. Participants in this workshop will complete the Census at School survey online as though they were students. Participants will then analyse their class dataset using TinkerPlots™ dynamic statistical software. The workshop will culminate in a discussion of enrichment extensions of this program, such as independent research projects and international comparisons.

RATIONALE
Finding ways to make statistics interesting can prove to be a challenge for elementary-level teachers, particularly when the teachers themselves are not mathematics specialists. It has become increasingly apparent that using real-world data can assist with this issue and make statistics more fascinating and relevant to students’ lives. Furthermore, using data about one’s own class has been shown to assist in statistical learning as it “does seem to make the conclusions they [students] draw more meaningful, and it appears easier for pupils to come up with good, sensible reasons for their results” (Turner, 2006, p. 23).

One initiative that uses students’ own data for statistical analysis is Statistics Canada’s Census at School program (www.censusatschool.ca in English or www.recensementecole.ca in French). This program is explicitly featured in the Ontario Mathematics Curriculum as a key resource for collecting primary data. For example, a specific expectation in both the Grade 7 and Grade 8 Data Management and Probability strand states that “Students will collect and organize
categorical, discrete, or continuous primary data... (e.g., electronic data from... Census at Schools [sic])” (Ontario Ministry of Education, 2005, pp. 107 and 118).

This international in-class online questionnaire program for students in Grades 4 to 12, now in its fifth year in Canada, features questions that cover cross-curricular topics, such as the environment, health, and social studies. The questionnaire also includes measurement questions, timed interactive activities, and questions similar to those featured on the Census of Canada. As such, the questionnaire results in both categorical and numeric data for analysis. Questionnaire data are entered anonymously into the Canadian database and can be analysed as a class set or compared to data for other Canadian classes or to the previous years’ Canadian Summary Results. Students from the United Kingdom, Australia, New Zealand, and South Africa also participate. As such, Census at School also provides a fascinating opportunity for international data comparison.

MAIN PURPOSES

The main purposes of this workshop are to teach the participants about the wide variety of benefits of the Census at School program for gifted students. This workshop will also introduce participants to TinkerPlots™, a dynamic statistical software program for elementary school students. On a broader level, this workshop will engage participants in discussions of how the Census at School program can be used with enriched classes for exploration, analysis, and independent project work.

MATHEMATICAL TOPIC

The mathematical topic of this workshop is elementary-level statistics. Specifically, this workshop will cover primary data collection and analysis, including graphing and data display.

INVolvEMENT OF PARTICIPANTS

In this workshop, participants will be provided with hands-on exploration of both the Census at School program and TinkerPlots™ dynamic statistical software. Participants will complete the Census at School survey online, as though they were students, and then export their class dataset to TinkerPlots™ to conduct analyses. Participants will also be given a guided tour of the Census at School website, including more than 20 provided learning activities. The workshop will culminate in a discussion of independent research projects, which provide the vital opportunity that gifted students need to design projects, test hypotheses, and answer their own questions (Mann, 2006).
REFERENCES


DRESSING OF MR. CUBE

DARINA JIROTKOVÁ

Charles University in Prague, Faculty of Education

RATIONAL

Arithmetic and geometry traditionally present two basic pillars of school mathematics and from the view point of history these areas were the only two parts of mathematics until the beginning of differential calculus. School arithmetic is focused on number, basic operations, structure of numbers, the extending of natural numbers into rational and negative numbers, and equations. We can find this structure of arithmetic in the syllabuses for primary mathematics in many of countries.

The situation in geometry is different. Geometry does not possess such a tool by which it would be possible to create all geometrical objects. The world of geometry seems to be a world of remarkable individual objects. Some of these create groups which are internally organized in certain ways like regular polyhedra, convex polygons, isometries, … However, the organisation of the particular group does not relate to the society of all geometrical objects. We have to admit that geometry offers to children a rich pallet of possibilities for the development of their intellect especially in the area of creativity. Creativity in arithmetic is mainly aimed to the discovery of patterns, regularities and relationships between already existing objects. In geometry a pupil can discover entirely new objects and can create entirely new meaningful terminology.

According to both our own experience and experience of our collaborating teachers the traditional, transmissive approach to the teaching of mathematics and especially geometry still prevails. The terminology of geometry is very rich but most terms are introduced to the pupils in a transmissive way exclusively: “This is called a… “, “Name of this is …“. Moreover, most primary school textbooks offer very few activities which relate to the geometry of shapes. We believe that this is one of the main reasons for the generally accepted fact that the level of pupils’ geometrical knowledge is lower than the arithmetical level. The geometrical language is an obstacles for consistent work with geometrical objects like cube or even cube net for pupils from the first grade of primary school. Concepts like vertex, edge, face
are not appropriate to this age of pupils because of its abstractness, and moreover, in many languages the meanings of the mentioned terms do not correspond to the pupil’s everyday experience (Jirotková, 2001). Hence the necessary condition for the work with a cube or with other geometrical objects for first grade pupils is to find suitable language and suitable activities which help to develop the important abilities for “doing” mathematics.

MAIN PURPOSES

The main purpose for the workshop is to introduce an effective educational strategy for building the concept of cube net. Vygotski’s theory of ZPD (zone of proximal development) (1971) was the background theory used when we solved the problem of what age of pupils is suitable for the consistent development of the concept of cube nets in school. We also took into our consideration the fact that the children of pre-school age, especially boys, have lots of experience using building blocs (cubes), and the girls have experience of dressing and undressing their dolls. Metaphorical language and a metaphorical situation is a bridge between these children’s experience and geometry. The metaphorical situation is a tailors’ saloon where the have very special customers – Cubes, inhabitants of the Cube Planet.

MATHEMATICAL TOPIC

The concept of a cube net links several geometrical concepts. These are: 1. the cube as a 3D shape, which is basic concept for the development of spatial intelligence in the meaning of Gardner (1999). That means that it refers both to 2D and to 3D space, including the structure of the attributes of a cube; 2. the cube net as a 2D shape both as a hexomino and as a certain polygon; 3. the 2D-3D correspondence between the cube and cube net as a relationship between attributes of a cube and the relating attributes of a certain hexomino; 4. square polyomino.

WAYS IN WHICH THE PARTICIPANT WILL BE INVOLVED

Participants of the workshop will first solve tasks, most of which will be manipulative ones. These will be presented on the different levels for pupils of different intellectual abilities. The possibilities for modifications of the tasks for gifted pupils will be discussed.

REFERENCES

Vygotskij, L.S. (1971), Myšlení a řeč, Praha, SPN
PROBLEM POSING AND CREATIVITY IN MATHEMATICS – THE CASE OF THE “WHAT IF NOT?” STRATEGY

ILANA LAVY
The Max Stren Academic College of Emek Yezreel

ATARU SHRIKI
Oranim Academic College of Education

Abstract
In this workshop we present and engage the participants with activities of problem posing using the "what if not?" strategy, and discuss its potential for developing creativity in mathematics.

RATIONALE
In many mathematics classes, math is taught as a complete and inflexible body of knowledge. The learning assignments, students are required to accomplish, usually necessitate merely the implementation of rules, procedures and algorithms. As a consequence, students are not provided with sufficient opportunities for developing their creativity in mathematics.

As an alternative, we suggest to incorporate activities that will promote the involvement of students in building their knowledge as well as developing their creativity. These activities include problem posing utilizing the "What If Not" (WIN) strategy (Brown and Walter, 1990). The WIN strategy is based on the idea that modifying an attribute of a given statement can yield a new and intriguing conjecture which consequently may result in some interesting investigation. Such problems can be applied as long term projects, for the purpose of developing inquiry skills, creativity in mathematics and mathematical knowledge. Unfolding generalization of a known theorem is a very exciting and educating process, which enables students to experience the beauty of mathematics.
MAIN PURPOSES

The workshop will illuminate ways for implementing the WIN strategy within various learning environments, using the aid of computer software.

The purposes of the workshop are:

- To explain and demonstrate the WIN strategy, beginning with basic well-known theorems.
- To engage the participants in a process of problem posing using the WIN strategy and uncover new regularities.
- To discuss the potential of using the WIN strategy for developing creativity in mathematics and how to generate appropriate learning environments for implementing the strategy in class.

MATHEMATICAL TOPICS

Problem posing using the WIN strategy can be applied in various mathematical topics learned at school. In the present workshop we demonstrate its implementation on well-known geometrical theorems, arriving at some more advanced ones, through a process of generalization. The geometrical theorems concern special lines in triangle ways in which the participants will be involved in the activity.

The participants will use computerized geometrical software in order to implement the various stages of problem posing using the WIN strategy. In addition, the participants will work in pairs and will be asked to document their thread of thought while working on the inquiry assignments.

Finally, the participants will take part in whole class discussion in which we will refer to: (a) The impressions gained from the inquiry process; (b) The potential of the WIN strategy for developing creativity in mathematics; (c) The contribution of the computerized geometrical software to the development of creativity in mathematics; (d) Ways for implementing the WIN strategy in class.

REFERENCES


GENERALISATIONS FROM PATTERNS?

GRAHAM LITTLER,
University of Derby, UK

DARINA JIROTKOVÁ
Charles University, Prague, CZ

RATIONALE

Patterns are a fundamental part of mathematics and the ability to recognise them by pupils/students of all ages is important to the development of their mathematical understanding. We find patterns in all aspects of mathematics, arithmetic, algebra, geometry, statistics and games. The development of pattern recognition and experimental tasks in which patterns are formed and then generalised, would ease the way to the use of symbolism and algebra.

Traditionally the greatest use of patterns has been in the determination of series such as the arithmetic and geometric series and these were usually introduced at the gymnasium stage (16+) of schooling. However in contemporary teaching, pattern has a much broader meaning beginning in pre-school from the actual numbers we use in arithmetic in which every succeeding number is determined by adding one to the previous number to primary school pupils being able to express a pattern they had developed from some experimental work as an algebraic function. (UK National Numeracy Project, 2001) For instance, using experimental and creative techniques older primary pupils can show that rectangles with a constant perimeter of 20 units have the relationship: \( l + b = 10 \), where \( l \) is the length of a rectangle and \( b \) its breadth.

By their very nature many patterns are associated with spatial phenomena. In early number work children recognise the count of numbers more easily if the objects they are counting are in set patterns such as those on a die or domino.

Given appropriate tasks pupils will derive sets of data from their experiments and from the data or the graphical representation of the data see if they can see any relationship between two parameters say. At the upper primary level, we have found that many able to give the generalisation or relationship in words, whilst the
most able would be able to express the relationship in symbolic form. (Hejný et al, 2006)

MAIN PURPOSE

To develop in pupils the awareness that by having the ability to manipulate simple apparatus to represent numbers by some form of pattern, can often lead them to a generalisation giving the \( n \)-th term of the pattern – a case of geometry illuminating arithmetic (Littler & Benson, 2005). Or using data from experiments with usually two parameters, to graph the results and from consideration of the relationship between the parameters determine the symbolic form of that relationship and the algebraic function which the graph represents. This will lead naturally to the acceptance of symbolic representation and a natural introduction to algebra.

MATHEMATICAL TOPICS

Number relationships and their representation in pattern form. Collecting experimental data, graphing the data and looking for the relationship between the parameters involved. This will apply to measures such as length, area and volume.

HOW WILL THE PARTICIPANTS BE INVOLVED?

The workshop will begin with the participants discussing their solution process when faced with four different piles of sticks and being asked how many sticks would they need for the next two piles, the 10\(^{th}\) pile, the 50\(^{th}\) pile, the nth pile. It is hoped that this would show the value of developing a pattern with the sticks.

Further work would then be given on more difficult series including quadratic relationships as well as linear.

Experimental tasks would then be given to the participants which would generate data and they would have to pictorially represent the data and determine the generalisation which described the relationship between the parameters.

The final part of the workshop would be a discussion to review the work done by the participants and its value in developing pattern into generalisations and hence generalised arithmetic, algebra.

REFERENCES

MONICA NEAGOY

Monica Neagoy Mathematics Consulting Services

P-Cubed is an interactive “mathematics show” in which the presenter challenges audience members with a variety of intriguing problems which can be solved with school mathematics. One or more volunteers from the audience will be invited to participate in every puzzle, paradox or perplexity presented.

RATIONALE

Children of all ages (and adults as well), and in particular gifted students—are fascinated by puzzles, paradoxes and mathematical perplexities which often seem magical. But behind this apparent magic or mystery, there is always a logical or mathematical explanation. This exciting, entertaining, and interactive show was designed for secondary students of mathematics from public and private schools, with the intention of inciting them to think outside the box, to find creative solutions and to push the limits of their reasoning.

MAIN PURPOSE

The main purposes of this presentation are (1) to challenge students to think in creative ways and (2) to gain an even greater appreciation for the beauty and power of mathematics.

DESCRIPTION AND MATHEMATICAL TOPICS

Introduction

This “mathematics show” is one of several shows the author has created that combine her passion for mathematics and her passion for the performing arts. After a 25-year career in mathematics and a parallel 16-year career as co-artistic-director
and performer in her own professional theatre in the Nation’s capital, Dr. Neagoy now combines the art of performing with the art of mathematics in designing “shows” that engage, stimulate, provoke and excite adults and students alike about
the beauty, power and amazement of mathematics.

Description
This entertaining and interactive show presents a series of thought-provoking magic “tricks,” or “puzzles,” or “paradoxes” with hidden mathematical explanations to be “unpacked.” They cover all areas of secondary school mathematics, including arithmetic, algebra, geometry, probability, etc.

The author has had great success with this show in various schools from the Washington DC area as well as from other US states. Her experience has been that audience members, no matter how old, are so curious and motivated to learn how to perform the math trick or how to explain the math paradox (for example, the paradox of concealed distribution) that, in the process of sharing and discussing the logic and strategies that lie behind the apparent magic or contradiction, they learn a lot of mathematics…and retain it. They leave the show excited and enthusiastic to share their learning with friends, family, students, and teachers.

In November 2005, Discovery Education filmed a performance at a public school in Alexandria, VA, edited the show along with a personal interview with the author, and recently added it to its online video library for teachers, www.UnitedStreaming.com.

AUDIENCE PARTICIPATION

The author will model the way in which she performs this math show for secondary students. Like most of her shows/presentations, P-Cubed are very engaging and interactive. For each problem, puzzle, or paradox presented, participants are on task, challenged to figure them out. For each “P,” one or more volunteers are called up to participate. An overhead projector and transparencies are used to show the rest of the audience the participant’s (or group’s) work.

REFERENCES

The tricks, puzzles, paradoxes, and perplexities have been inspired by a lifelong collection of puzzles, brainteasers, magic tricks and mathematical paradoxes which the author modifies and adapts to the level of her audience. The sources of inspiration are countless.
WHAT DOES THE LINEAR GRAPH HAVE TO DO WITH ELEMENTARY SCHOOL?

AVI POLEG, ZVI SHALEM, GALI SHIMONI & KARNI SHIR

The concept of function is one of the most fundamental concepts in mathematics, yet many researches have reported on different difficulties students encounter in the understanding of this concept and its various representations (for example: Vinner & Dreyfus, 1989; Hollar & Norwood, 1999; Szydlik, 2000). Introducing the concept of the linear function in a meaningful manner in elementary school can help students build intuitions that will hopefully, set the ground for a later more relational understanding of functions in general (Tall, 1991; Skemp, 1976).

As we all know, students in 5th and 6th grades are usually not exposed to the topic of linear graphs, especially from an algebraic perspective. In this workshop we will introduce a game that will hopefully lead them to an initial understanding of this subject. Beyond the understanding of the linear graph, the game will give the gifted student an opportunity to a deeper and more meaningful understanding of the graph and the connections between the variables it describes.

The first element of this game is the linear graph. The second element involves strategic decisions that the players will make during the game. These decisions should be based on the players’ understanding of the linear graph, while taking into account a probability factor (dice are used).

The game is played on a grid. Each participant rolls a die. The result of the die specifies a given rule. The rule indicates possible positions on the grid where the participant can now place a dot. During the course of the game, the participants will notice that all the dots they can chose, according to a specific result of the die, fall on one straight line. This way, the linear graph immerges naturally from the game itself.

The discovery of these linear lines by the students can dramatically increase their ability to make intelligent decisions in the game. Even after this discovery they will continue to be challenged by the element of chance which constantly demands of the students to apply their analytical skills and evaluate the different possibilities...
they have in the game. This keeps the game fun and most of all interesting for a long period of time.

During the game the students were asked to mark points according to given rules, at the last part of the lesson, they are asked to find rules that satisfy a specific set of given dots. This part of the activity requires exceedingly higher analytical skills and gives the gifted and talented children a chance to reach there own potential and get the most out of the activity.

In our workshop we will present the game and few interesting riddles (Shalem & Shimoni, 1996). We will also describe anecdotes and insights that aroused from the gifted students that participated in these activities.

REFERENCES


The constructivistic approach is a theory which strives to create learning conditions, which allow the student to build his/her own understanding on the basis of his/her own experience. According to this approach the learner is conceived as an active participant in the learning process (Von Glaserfeld, 1989; Karagiorgi & Symeou, 2005).

In the beginning, the constructivistic theory was influenced by the developmental-cognitive approach developed by Piaget which emphasizes the way in which an individual builds his/her knowledge. Today it is possible to look at constructivistivism from the perspective of a cultural and social approach, developed by Vygotsky. According to this approach there is a social process of interaction, sharing and acquiring meaning on a social basis. In other words, the social structure as a whole acts as a system for forming and building a structure of common knowledge (Confrey, 1995).

The important role that the social interaction plays in learning and the building of knowledge is stressed by Wood, Cobb and Yackel (1990). In their opinion, the social interaction enables a wide range of possibilities to learn mathematic subjects, in such a way that the building of the knowledge involves cognitive conflicts, reflection and reorganization of knowledge. They claim that the study of Mathematics is an interactive activity in addition to being a constructivist process.

In the framework of this workshop a game activity will be presented. The activity is taken from a study unit in the field of “Set Theory” written for gifted children (Shalem & Shimoni, 2006). The activity is based on the constructivistic approach to learning and enables students to build and develop their knowledge of basic and advanced concepts in “Set Theory”, in the course of a social game.

In addition to the game that will be presented, a few interesting riddles will also be discussed. The riddles are built in such a way that concepts from “Set Theory” will naturally immerge from the students themselves during an interactive social game.
The concepts that are mainly dealt with are: union and intersection of sets. At the end of the activity we will also discover the De-Morgan rules and see how they can be used to simplify the tricky problems that appear at the end of the unit.

The activity that will be presented is designed for gifted middle school age students. During the workshop we will also describe anecdotes and insights that came from various groups of gifted students that participated in these activities.

We invite you to play with us, and promise to conclude the session with a colorful riddle for you to take home.

REFERENCES


This workshop deals with the problem of choosing and constructing proper mathematical problems and situations that stimulate creative thinking. Despite our intuitive feeling and skill to recognize "good" problems, the precise description is hardly achieved.

We try to differentiate between difficult and non-standard problem and to derive some essential features of creativity-stimulating and giftedness-promoting activities. At the first stage, participants will be involved in the process of problem solving. We try to discover some surprising links between numbers' sums and products, between figures' areas and perimeters etc. All trial problems are in the fields of numbers and elementary geometry and require the very initial mathematical level for understanding. On the other hand, the way of solution seems to be "tricky" even for "over-educated" students. What is the point? Why does a creativity-stimulating problem - a secondary school level one, attract us?

The workshop deals with reconstruction of possible strategies that students would imply to solve these problems – depending on their age, mathematical experience and skills. According to G. Wallas's classic scheme, we draw attention to several aspects of four stages in creative problem solving process (i.e., preparation, incubation, insight and verification).

On the base of their own activities and this reconstruction, participants are invited to formulate some criteria that may be fruitful to distinguish and to define a class of creativity stimulating problems.

Because of the obvious need of pure experimental procedure, the set of problems will be distributed at the workshop itself.
POSTERS

THE 5\textsuperscript{TH} INTERNATIONAL CONFERENCE ON CREATIVITY IN MATHEMATICS AND THE EDUCATION OF GIFTED STUDENTS.

HAIFA, ISRAEL, FEBRUARY 24-28, 2008
POLICY-MAKERS APPROACHING EVALUATION TOOLS AND QUALITY INDICATORS FOR THE INTERNATIONAL ICT NETWORKING IN GIFTED TALENTED EDUCATION

EVGENIA T. MELETEA

Apollon International Interactive Educational Network & University of Athens

Having worked on the issue of gifted talented education (as a test bed for applying innovations in education) on an international scale, the author has identified a need for some common goals and activities, in order to develop international qualitative collaboration. This collaboration will be largely based in interactive ICT (Information Communication Technology) networks for the TG/GT (Target Group of Gifted Talented Students).

The need for international collaboration for the gifted talented education, has also been noticed by Dracup (2005) who proposed the development of “quality indicators” Dracup (2006) for international cooperation in gifted talented education, as well as the development of international quality standards, as a way of cementing international collaboration in G&T. The recent and rapid improvements in the field of ICT have also been incorporated in educational systems, enhancing the personal development of children. The large number of such ICT networks and the variable degree of validity of the information they contain, dictate the need for an “evaluation tool”, which shall enable policy makers to evaluate these networks. The author proposes to conduct an international survey, in order to collect the important factors that need to be included in this evaluation tool, Meletea (2007). Theoretical models shall be applied to the development of interactive educational ICT network designs and the evaluation of systematic educational environments using existing anthropological values, scientific knowledge, educational methods and ICT utilities.

References


Proceedings of The 5th International Conference on Creativity in Mathematics and the Education of Gifted Students.
Haifa, Israel, February 24-28, 2008
ENRICHMENT LEARNING GROUPS IN MATHEMATICS AND JUDAISM

SHLOMO HARIR, MOSHE STUPEL, JOHN OBERMAN

Shaanan Academic College Haifa Israel

The learning groups are made up of primary school children, grades 5-6, selected as children with a high potential in mathematical ability not being catered for in ordinary classrooms. The project is now entering its fourth year. The group of children meets every week for four hour sessions. The group activities are open investigation and problem solving activities using real life familiar contexts from mathematics and Jewish subjects.

The material from Biblical and Post Biblical sources demand mathematical competence and a deep understanding of the sources.

As these sources are not unfamiliar to the children, joining their mathematical ability with a search for a deeper understanding of the sources creates for them a unique learning environment. The children are computer literate and thus such tools as Excel enable them to store and develop their computations.

Familiar mathematical series like Fibonacci are at the root of several Talmudic subjects dealing with reproduction of pigeons. Biblical subjects as the vessels used in services in the First Temple are based on

Complex mathematical computations. These topics are learnt in Bible Studies in the regular classrooms and are familiar to the children. The opportunity to learn new mathematical tools in a real context enables the children to enrich their knowledge both in mathematics and the Jewish subject under study.

References


482

Proceedings of The 5th International Conference on Creativity in Mathematics and the Education of Gifted Students.
Haifa, Israel, February 24-28, 2008
POSTERS, CMEG-5

GIVING STUDENTS THE OPPORTUNITY TO CHOOSE – A WAY TO OPTIMIZE INTEREST AND PARTICIPATION

BORIS SINGER

FIES, Bucharest, Romania

The poster reports on an experiment involving 820 students, 14 to 15 years old, who participated in the Applied Mathematics Competition Kangaroo in Romania. Each participant had to choose and solve 30 problems among 60 proposed in the written test. In order to analyze students’ preferences and their problem solving abilities, two problems (left-right) were proposed for each item, usually from different mathematical domains. The study has compared students’ preferences and results.

The problems were classified using two criteria. On the one hand, we used the matrix for structuring mathematics competences (Singer & Voica, 2002) to analyze the mathematical content and, on the other hand, we used a practical versus theoretical criterion to discriminate the applicative value of the problems. The matrix for structuring mathematics competences offers a two-dimensional scale consisting of nine mathematical knowledge domains and four levels of complexity. Concerning the distribution of problems among the mathematical domains, the 60 problems of the test belong to the following categories: Numerical computing – 20.37%; Algebraic computing – 9.25%; Equations & Inequalities – 9.25%; Functions – 1.85%; Logic and set theory – 5.55%; Positional and transformational geometry – 18.5%; Metric geometry – 3.7%; 2D and 3D properties – 18.5%; Processing data, probabilities – 12.96%. The comparative analysis allowed us to observe students’ preferences concerning mathematical domains and practical versus theoretical discrimination, in correlation with their mathematical outcomes. Having the opportunity to choose, the student becomes more confident in what he/she is doing and more interested in participating in problem solving activities. The poster will present some statistical data, as well as booklets with problems from the competitions. Other materials such as problem-books and workbooks for various school grades will be also exhibited.

REFERENCES

MALTED- MATHEMATICS AND LITERATURE TOGETHER - EDUCATIONAL DELIGHT

BRENDA STRASSFELD

New York University Steinhardt School of Culture, Education, and Human Development

Burns (2005) stated that literature “can spark students’ imaginations in ways that exercises in workbooks or textbooks often don’t”.

This poster presentation describes how we used literature as a vehicle for problem solving and reasoning in mathematics in a project that was conducted in several elementary public and private schools in New York City.

One of the pieces of literature, The Pied Piper of Hamelin (Browning, 1888) involved the students in interactive storytelling with puppets and costumes. After the story the children were asked “What in the story was there a large number of?” When the students replied, “Rats!” we brought out our ‘rat’ attribute set and engaged the students in several exciting activities. The activities included:

- Generating the attribute set
- Which piece is different and why?
- One and two difference trains
- Difference puzzles
- Sorting loops using Venn diagrams

Another attribute set used with The Pied Piper of Hamelin was: The children of Hamelin. In the upper elementary grades we read The Grain of Rice by Helena Clare Pittman with the students. In the middle of the story the students were asked to make predictions about whether the amount of rice would be greater than a million grains? As the story continued the students were asked whether they wanted to revise their predictions. Students were involved in calculating large numbers painlessly (without calculators in some classrooms) as they checked to find out if their prediction was correct. Afterward we brought large bags of rice and estimated how many grains there were using spoons, cups and scales.

One fifth grade class engaged in an entire interdisciplinary unit about rice, culminating in a class production of The Grain of Rice. This project clearly reflected the pupils’ creativity. The literature ‘hooked’ the students into a solid engagement with problem solving and reasoning in mathematics.
DIVERSITY OF APPROACHES TO THE PROBLEM
ASA WAY TO AROSE CREATIVE THINKING

MIRIAM DAGAN AND PAVEL SATIANOV
Sami Shamoon College of Engineering, Beer Sheva, Israel

Mathematics teachers look for attractive topics for their lessons, which truly draw attention to studies of mathematics and provoke student's creative thinking, rather than merely provide them with technical skills. Such topics may be directed to different mathematical problems, but they may also integrate different mathematical themes by applying different methods to solving of a single problem. The latter is in the spirit of the Poincare’s definition of mathematics as "the art of giving the same name to different things" (in Rose, N., 1988). By solving a single problem in various ways students are likely to gain a deeper understanding of the problem. Moreover, by being exposed to different kinds of mathematical ideas, students are provided with a range of effective patterns for their own mathematical thinking. Thus, our presentation takes as it motto and guiding principle Polya’s advice that, “It is better to investigate one problem from many points of view, than to solve many problems from one point of view” (Polya, G., 1962). We will present an extended example, based on this principle, related to the formula for computation of the sum:

\[ 1 + 2 + 2^2 + \ldots + 2n \]

In our presentation, we shall give many different approaches to discovery and proof of the formula for this sum based, as a rule, on finding connections of it with some practical processes. We trust that diversity of approaches to solution of a single problem stimulate creative thinking and arose interest of the students in mathematics.

REFERENCES

The study was aimed at assessing gifted students' satisfaction with school. The research sample comprised 229 Israeli elementary and Junior high school gifted students, studying in separate classrooms, pullout programs, and pullout program dropouts, and 140 regular students studying at the same schools. Satisfaction was measured using a self-report questionnaire comprising the following factors: Teachers' characteristics, level and pace of studies, teaching methods, academic self-concept, and general self-concept. The study concludes that a male gifted junior high school student, who had dropped out of a pullout program, and whose mother is a high school graduate, will express the lowest level of satisfaction with school. Practical implications, referring to students' preference of school enrichment practices, are available.