Buone pratiche

Meet Math: a tool for cooperation between Palestine and Israel

Peter Hillman
Hebrew University and Bloomfield Science Museum Jerusalem. Jerusalem 91904, Israel. E-mail: peterh@mada.org.il

Maya Halevy
Direttore Bloomfield Science Museum Jerusalem. Museum Boulevard, Hebrew University, Givat Ram. Jerusalem 91904, Israel.
E-mail: mayah@mada.org.il

Hasan Dweik
Executive Vice President Al Quds University Jerusalem, Palestine. E-mail: hdweik@planet.edu

ABSTRACT
An interactive exhibition on Mathematics called "Meet Math" was created in a joint project of La Citta' della Scienza (Napoli), Bloomfield Science MuseumJerusalem (Israel) and Al Quds University, Jerusalem (Palestine). The cooperation faced political and social difficulties (border closures by Israel, Palestinian antipathy) that were overcome by the sheer enthusiasm of the participants on all three sides, resulting in a highly successful exhibition - interactive, attractive, informative. The process itself was also very productive - training of Palestinian staff, and creation of an atmosphere and infrastructure of cooperation. The exhibition was first presented at La Citta' in 2005, moved to the Bloomfield Museum in 2006, and finally, together with a beautiful "temporary" hall in which it was housed at Bloomfield, it found its permanent home in 2007 at Al Quds University. There it forms, together with a small interactive Science Centre created locally, the core of the future Palestine National Museum of Science and Natural History. The project arose from discussions between President Bassolino of Regione Campania and President Sari Nusseibeh of Al Quds University. It was funded by the European Union, with substantial help from UNESCO and from Regione Campania.

Key words:
exhibition, mathemathics, international cooperation.

RIASSUNTO
Meet Math: uno strumento di cooperazione tra Palestina e Israele.

Una mostra interattiva dedicata alla matematica, intitolata "Meet Math", è stata proposta con un progetto congiunto tra la Citta' della Scienza (Napoli), il Bloomfield Science Museum Jerusalem (Israele) e Al Quds University, Jerusalem (Palestina). La cooperazione ha dovuto fronteggiare difficoltà politiche e sociali (chiusura dei confini da parte di Israele, e una generica non collaborazione palestinese) che sono state superate dall'entusiasmo dei partecipanti delle tre parti e che hanno portato a un alto successo della mostra interattiva, piacevole e istruttiva. Tutto il processo è stato anche molto produttivo e si è svolto attraverso un training dello staff palestinese in una generale atmosfera di collaborazione. La mostra è stata prima presentata a La Città della Scienza a Napoli nel 2005, spostandosi poi nel 2006 al Bloomfield Museum di Gerusalemme (Israele) e infine, in abbinamento a una mostra temporanea che era allestita a Bloomfields, ha trovato la sua sede permanente a Al Quds University a Gerusalemme (Palestina). Ora, la mostra forma, insieme a una piccola sezione interattiva di Science Center locale, l'anima del futuro Museo Nazionale di Scienze e Storia Naturale di Palestina. Il progetto è frutto di un confronto tra il presidente della Regione Campania (Antonio Bassolino) e il presidente di Al Quds University (Sari Nusseibeh) ed è nato grazie al supporto dell'Unione Europea, dell'Unesco e della Regione Campania.

Parole chiave:
mostra, matematica, cooperazione internazionale.

When the idea first arose to create a major exhibition as the core of the new Interactive Science Center at Al Quds University in East Jerusalem (AQU), the small consortium in charge of the project considered a number of themes. Mathematics might not seem a natural choice, since math is often perceived as generally inaccessible, abstract and difficult to make interactive and attractive. Nevertheless, we chose mathematics, and for several reasons.
First, we wanted to highlight the major contributions that the Islamic world, along with other cultures, has made to the development of mathematics. Second, we recognized the urgent need of Palestinian (as well as Israeli and Italian)

school populations for a program that would enrich the teaching of mathematics. And finally, we welcomed the challenge of doing something different.

The "we" in this case consists of AQU, La Città della Scienza in Naples, Italy (Città), and the Bloomfield Science Museum Jerusalem (BSMJ). All of the partners have had experience and success in bringing the "joy of science" to the public, and we felt we would like to try doing something similar for mathematics. The partnership was developed under the aegis of Ecsite (see "The Meet Math Partners"), and much of the groundwork was done at annual Ecsite conferences, which were also the venue of presentation and discussion of preliminary stages of the project. Major funding for the project was provided by The European Union, with additional contributions from UNESCO, Regione Campania and The Jerusalem Foundation.

THE PROCESS

The one big problem encountered in the cooperative process was external: the difficulties of mutual Palestine-Israel travel. The Palestine team also had to deal with widespread hostility to any cooperation with Israel. The success of the process is due entirely to the total devotion of all three teams to the goal.

Development of the exhibition began with the formulation of a rationale and aims, continued with the characterization of content, and finally resulted in a list of specific exhibits and activities. The whole process was supported by front-end evaluation at BSMJ, where Jewish and Arab teachers and potential exhibition visitors were surveyed in an attempt to establish existing attitudes and knowledge, as well as needs and expectations.

Among potential Israeli visitors we found that a surprisingly large fraction (half) claimed to "love" maths, while the main deterrent for the others was that it was "boring" rather than the expected "difficult". Palestinian teachers, on the other hand, felt that relatively few of their students were attracted to maths, and that instructional aids such as the exhibition were vital; in fact their expectations reguard the effectiveness of the exhibition were rather too high.

COMMUNICATION STRATEGY

Most of the participants in the process of creating the exhibition had been widely exposed to the cultures of the others - enhanced by mutual visits among the three organisations - and accordingly were able both to appreciate their own different attitudes and needs, and to insert this knowledge (in English) into the planning process.

We started by identifying some fundamental questions about mathematics that the exhibition would try to raise (and, in some cases, answer):

- What is mathematics?
- Is it a language of all sciences, or a science for its own sake?
- Is mathematical thinking deductive or inductive?
- Does the mathematician discover or invent the mathematical world?
- What does one mean by saying that mathematics is the pursuit of structure?
- What is the relation between mathematics and the experimental sciences?
- Is there experimentation in math?
- What is a proof, and why does it stand forever?
- What is a mathematical prediction?
- What is the relation between mathematics and aesthetics?
- What do mathematicians look like?

The criteria for choosing themes were explicitly the presentation of the beauty and elegance of mathematics, and not of maths as a tool. Within that constraint, our team of mathematicians, headed by Prof. Udi de Shalit of The Hebrew University sought subjects in which they had expertise and whose content would be attractive and accessible to the average intelligent visitor and that could be presented in an interactive and preferably mechanical model.

After much discussion, we decided to build the exhibition, which we named Meet Math, around four themes, or "islands":

- Number: most people connect mathematics with numbers, but the concept of "number" has undergone dramatic changes.
- Shape: application of mathematical tools to the study and classification of geometric shapes leads to a broadening of our concept of space and to many surprises.
- Pattern: the search for order and structure is part of our nature, but is also an important mathematical tool.
- Computing: although a relatively young field of mathematical research, computing has become central because of its connection to computer science.

Creation of components and activities was divided among individuals and institutions according to expertise. Mathematical content was largely determined (and much of the accompanying material written) by professor Udi de Shalit of the Hebrew University of Jerusalem, in consultation with Italian and Palestinian mathematicians.

Overall design of the exhibition - scenery, layout, and exhibits - was the responsibility of the staff at Città, who developed the graphics, managed and administered the project, and also were responsible for production of many of the exhibits. Additional interactive exhibits, most of the exhibition software, and educational activities related to the exhibition were developed by BSMJ, which was also responsible

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for front-end, formative, and summative evaluation. AQU designed and built several exhibits and a team from AQU was involved with the teams from BSMJ and Citta' in developing the specific themes and exhibits and AQU was specifically responsible for the featured Entrance Sculpture and for development of the web site for the exhibition, as well as for guiding the process toward its ultimate Palestinian goal.

By constructing its own math exhibits, rather than purchasing them, AQU is encouraging development of the necessary human resources for independent operation. And thanks to the success of the Meet Math project and the level of financial support it has attracted, a number of Palestinian companies have come forward, offering their support in building new exhibits for the sake of generations to come.

THE EXHIBITION

Meet Math is colorful and light, with a careful mix of surprising, didactic, intriguing, and humorous elements. Each of the four islands is introduced by a thought-provoking quote from a mathematician. Leopold Kronecker's observation that "God made the integers; all else is the work of Man," marks the entry to Number, for example, while visitors entering Pattern read that "There is no place in the world for ugly mathematics" (G.H. Hardy).

Individual islands include five to nine interactive exhibits. Some are related to the school curriculum, while others are surprisingly remote from what most people consider as math. All are examples of central questions in mathematics, however, and many note the distinction between illustrating a mathematical principle and proving it. The following is a sampling:

- Proportions (Number): by getting people to compare the ratio of their arm-spreads and heights to those of other visitors (and to Leonardo da Vinci's "man in the circle"), we show how proportions are pure numbers, independent of absolute size and units of measurement.

- Win $1,000 (Number): pick a number. If it is even, divide it by 2; if odd, multiply by 3 and add 1. Continue, and you will always end up with 1. Besides illustrating the idea of repeated trials and shows, this exhibit based on a simple game demonstrates how an easily-stated and apparently true result may be exceedingly difficult to prove (a cash prize is offered for proving the result or finding a counter-example!).

- The Pythagoras Theorem (Shape): the theorem is illustrated by a colored liquid that flows from a square box on the hypotenuse of a triangle to square boxes on the other two sides. It is proved by manipulation of a tangram-success being clearly independent of the specific angles chosen.

- Geodesics (Shape): airplanes flying from Jerusalem or Rome to Los Angeles take a surprising route over Greenland. A globe with elastic strings shows why and illustrates the difference between flat and spherical geometry.

- Sphere packing (Pattern): not solved for three dimensions until 1998, Johann Kepler's 400-year-old problem of how to pack the maximum number of spheres into a box is illustrated in two dimensions with a variable-angle rhombus and table-tennis balls. The result in 2-D? Hexagonal packing is always best.

- The Koenigsberg Bridges (Computing): the "practical" problem of how to cross all seven bridges of a German town without recrossing any led Leonard Euler to found the important mathematical discipline of Graph Theory. Using a rope, the visitor tries to show how to cross the bridges - and fails, until an eighth bridge is built.

- Design a Person (Computing): A large totem that lets visitors connect one of 5 faces to one of 4 bodies and one of 3 pairs of legs illustrates the discipline of combinatorics, a branch of mathematics that studies collections of objects satisfying specified criteria.

In addition to the exhibit islands, Meet Math also features a History Piazza, emphasizing intercultural contributions to mathematics; a Discovery Area, where younger children (ages 5–9) carry out guided activities similar to those in the larger exhibition; and an Agora, a small informal space for discussion, demonstrations, films, and multimedia access.

FOR A BETTER FUTURE

Meet Math opened in Naples on October 6, 2005; moved in March 2006 to BSMJ for seven months, after which it was transported, together with its beautiful 'temporary' hall to its permanent home at AQU. There it forms the core of the future Palestine National Museum of Science and Natural History. In all three places it is accompanied by a range of educational activities, mainly for school groups and their teachers.

The summative evaluation, carried out only at BSMJ and only on children, demonstrated the success of the exhibition: the children enjoyed both guided and free activities and recalled a significant number of the messages. For younger children, the "Proportion" theme was most accessible.

A story about the exhibition's Discovery Area - where drawings and handprints of Palestinian, Israeli, and Italian children make up the scenery - illustrates the challenges and the potential of this cross-cultural work. "You can imagine the joy and pride of the little Palestinian children when we showed them photographs of their paintings with their names … and told them that all this is now on display in Italy," reports Palestinian team spokesman Awwad Sharaf. Then the children noticed the paintings with non-Arabic names. Told that these were made by Israeli and Italian children, they

initially recoiled, says Sharaf. "However, a short discussion among themselves, and with their teachers and the exhibition team, showed them that all children had similar ideas and that it should be possible to work together for a better future."

Children were not the only skeptics. "We had difficulty convincing others at AQU that our meetings with our partners at BSMJ would lead to something of value, as they do not see results on the ground from other agreements," adds Sharaf. "But when the exhibition comes to AQU next year, we hope and expect that attitudes will change, not only about the fruits of scientific cooperation but also of other kinds of cooperation between the two neighbors."

MAJOR CONTRIBUTORS

- The European Commission - EU Partnership for Peace Program
- Regione Campania
- UNESCO
- The Jerusalem Foundation

THE MEET MATH PARTNERS

BSMJ is a natural partner of the Interactive Science Center (ISC) at AQU. Located only a few miles apart, both institutions are university-affiliated, and both have substantial academic input. BSMJ has also had relatively recent experience both in the creation of a new science center and in hosting Arab teachers and schoolchildren.

In fact, as part of a broader Israeli-Palestinian cooperation in science education, BSMJ and AQU have been working for several years on a pilot project toward establishment of the ISC. AQU had had no prior experience in creating exhibitions, and the partnership has enabled the University to follow an exceptional path toward what will become an independent national science museum.

Nevertheless, political realities mean that mutual access is often interrupted. Difficulties arise from both sides: Israel frequently closes key border crossings, and many Palestinians are hostile to any kind of cooperation with Israel. The result is that it is sometimes easier to meet and work together in Naples than in Jerusalem.

The partnership with Città came about through personal contacts between Professor Sari Nusseibeh, president of AQU, and Antonio Bassolino, president of the Italian region of Campania (Naples). President Bassolino has long expressed a desire to help the Palestinian people, and he encouraged Città, AQU, and BSMJ to submit a joint project to the European Union. This project, which became the mathematics exhibition, was accepted and funded by the EU, and then received additional funding and support from Campania and UNESCO. The Meet Math exhibition came as a follow up of another large project which was also funded by the EU, The Goldsmith Foundation in the USA and Bronfman Philanthropy in which Al-Quds University, with the cooperation of many Israeli institutions, was able to build youth laboratories and a core science centre that then, with the strong partnership of BSMJ, led to the development of the first Palestinian science museum.

ASSOCIATED PARTNERS

- The Hebrew University of Jerusalem
- The Andrea and Charles Bronfman Philanthropies
- L'Universita' di Napoli 'Federico II'
- ECSITE
- Il Giardino di Archimede
- Unione Matematica Italiana
- Comune di Napoli
- Provincia di Napoli

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