

Mathematics through experience

Figure 1 The finale of the Mathematics Through Experience project

Nedyalka Hristozova shares some examples from her Bulgarian project, 'Mathematics Through Experience',

which approaches mathematics from a practical, real-life perspective in order to develop creative thinking: just like science!



The 11–13 year-old students I teach in Bulgaria often ask me 'When will we need our maths knowledge?' I understand they need to put what they have learned into a practical context and so I tried walking in their shoes and asked myself 'What do I want to be? What knowledge of maths do I need to get there?' In order to answer their questions we started looking for answers together to establish that 'Life is mathematics and more'. This grew into the project 'Mathematics Through Experience', which was presented at the international Science on Stage 2015 festival in London.

My aim was to provide my

students with real-life situations and their task was to use their maths knowledge to solve different problems emerging in these situations. The goal was to develop the students' creative thinking and ideas through experience and to create opportunities for their practical application.

At the end of each maths topic we covered, I organised an open lesson outside the classroom in front of the students' parents and the local community. The students were split into teams based on their personal interests and each team was given a task that required certain maths knowledge. They were asked to create a product and a presentation

that showed the different work stages. Finally, they had to defend their work in front of a competent, independent panel of scientists from the fields of maths and technology. The panel's main criteria for evaluation were:

- diversity and creative application of the maths knowledge used in making the product;
- use of accessible and reasonably priced materials for the product;
- practical value and application of the product;
- aesthetics and optimal design of the product according to pre-set criteria;

Key words: ■ Creativity ■ International perspective

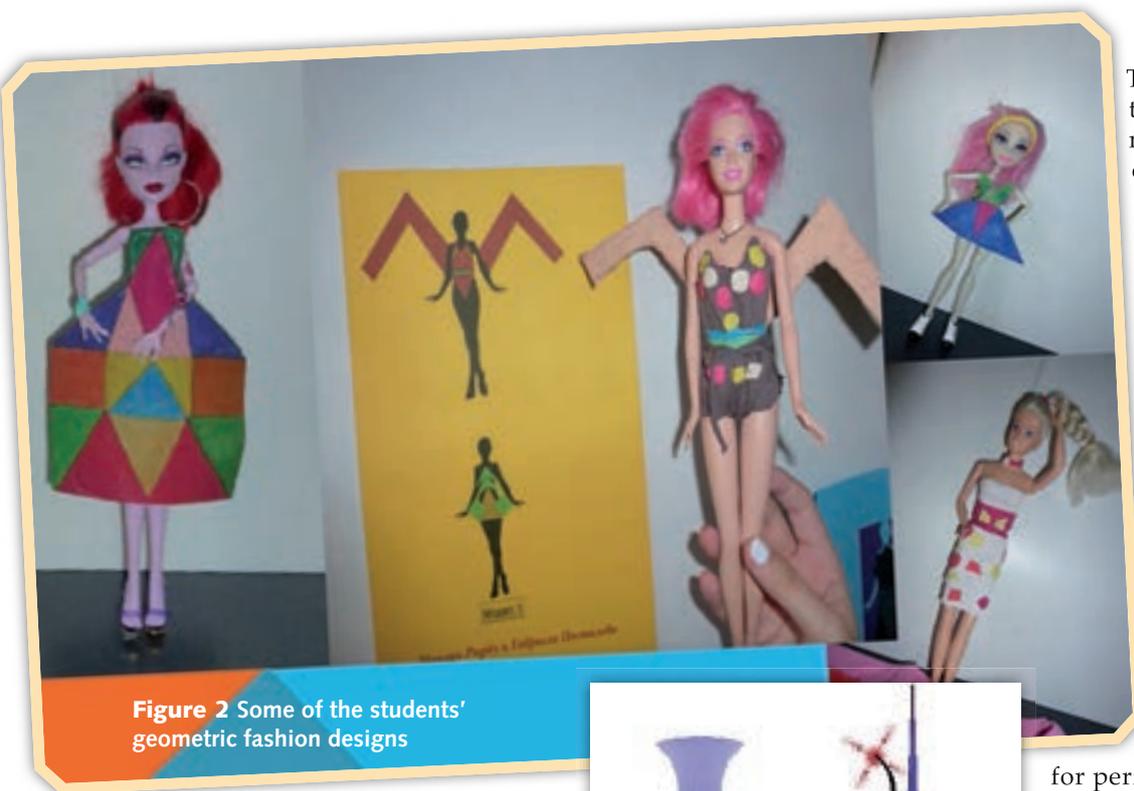


Figure 2 Some of the students' geometric fashion designs

The girls who made up the first team were very inspired and made dresses and outfits from disposable nylon bags and oilcloth. They presented their products at a fashion show in front of their classmates and parents (Figure 2).

The second team made jewellery and document folders out of paper, modelling clay, beads and wood. They had the opportunity to promote and sell their products, for a very low price, at the 'Funny Math Mall' that I organised in one of the real shopping malls, the Galleria Mall, in our home town of Stara Zagora.

A team of boys also presented their designs for perfume bottles made with the dynamic computer programme *GeoGebra* (Figure 3).

The fourth team made masks and hats, applying their knowledge about surfaces of geometric and stereometric figures. We organised a fancy dress ball in a restaurant where the students presented their work artistically (Figure 4). They also performed a mathematics quadrille (a dance) in which they formed different geometric figures with their bodies.

Many of my students go to dancing classes outside school and so they explored geometry in dance. They made a collection of their own pictures while dancing

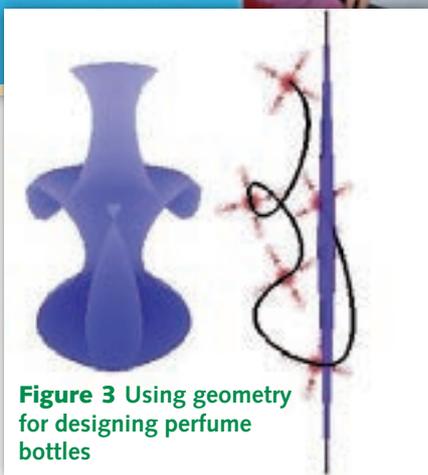


Figure 3 Using geometry for designing perfume bottles

Geometry and fashion, designers, actors and dancers!

Create designs and make women's summer outfits using everyday materials.

● **artistic and convincing project presentation.**

Maths + Professions = ?

I decided that for one activity we would focus on geometry and the impact it has on designs in real life. Designers use geometric forms as base structures to create three-dimensional silhouettes and make various combinations of geometric forms to alter and challenge traditional outlooks. Architecture is another application of geometry and design. Designers use geometry in architecture to generate different shapes. In fashion, geometry features at different levels. For instance, there is geometry in the visual effects caused by body movement. Working with textiles also involves geometry, well illustrated, for example, in the works of the French artist Sonia Delaunay in the fashion industry.

The first task I gave the students was:

Look into the application of the geometry we have studied to the world around us.

After the students had done some research on the application of geometry in everyday life and about what a designer's work involves, they formed four groups based on their interests and I gave the students the following task.

Box 1 Additional skills developed in the project

- Creative thinking
- Solving real-life problems
- Doing research
- Making effective presentations
- Effective time management
- Experience in project organisation and project management
- Teamwork
- Application of theoretical knowledge in practice
- Building up confidence when dealing with unfamiliar situations
- Accepting the opinion and evaluation of their efforts from their parents, friends and acquaintances

and highlighted the geometric shapes formed in the process of dancing. They also came up with their own dances dedicated to different geometric shapes and performed them in front of an audience (Figure 5).

Being rational?

Another very successful example of bringing maths to life involved ‘rational numbers’. To make these engaging and real we again used the ‘Funny Math Mall’ I set up in our local shopping mall. The students were divided into three main groups with the following task:

Using your knowledge about rational numbers come up with your own maths problems describing the job of: (a) a chef, (b) a salesman or (c) a travel agent.



Figure 4 The students ‘had a ball’ making masks

school curriculum, out-of-school activities and their life experience. There were no winners and losers. Everyone’s effort was appreciated and all students had a sense of achievement and satisfaction.

What was most important to me was to motivate my students to study maths and science by giving them a taste of how things

happen in real life and how useful maths is. Not only did they have a lot of fun, but they also realised that the business world involves a jigsaw of knowledge in different fields and a variety of scientific, technical and interpersonal skills.

References and further reading

Kenderov, P., Sendova, E. and Chehlarova, T. (2013) European Project MaSciL – Mathematics and Science for Life. In *Mathematics and Mathematics Education*, 42, 183–186.

Kenderov, P., Sendova, E. and Chehlarova, T. (2014) Development of key competencies by mathematics education: The KeyCoMath European project. In *Mathematics and Mathematics Education*, 43, pp. 99–105.

Sendova, E. (2002) Fashion and modelling (or how to apply mathematics and informatics in art). In *Mathematics and Informatics*, 2, pp.60–72.

Sendova, E. and Grkovska, S. (2005) Visual modelling as a motivation for studying mathematics and art. In *Proceedings of Eurologo 2005*, ed. Gregorczyk, G. et al., pp. 12–23.

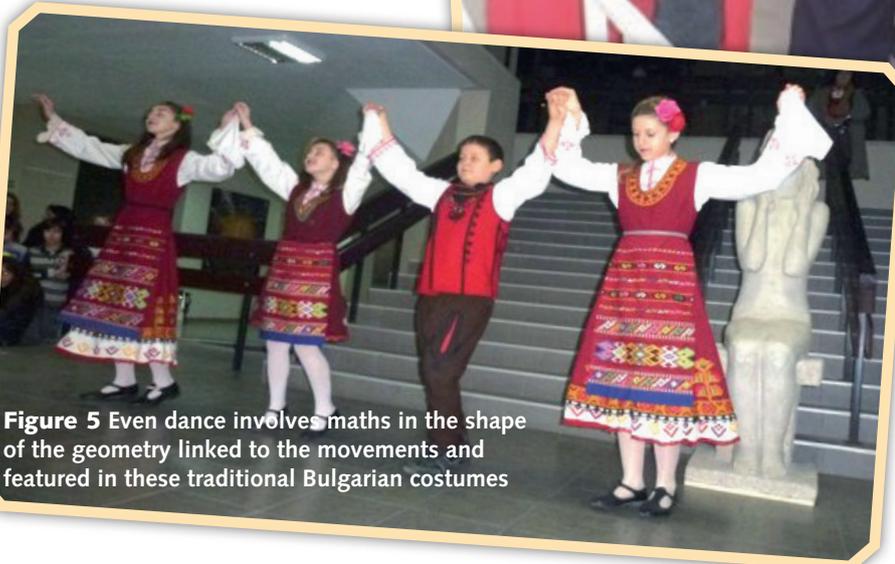


Figure 5 Even dance involves maths in the shape of the geometry linked to the movements and featured in these traditional Bulgarian costumes

Make visual materials and products to demonstrate the job you have chosen.

The students chose to be one of these professionals and then presented their products on real shopping stands in the mall. The students also raised the idea of having a bank at the mall’s entrance, where the ‘customers’ could take out ‘loans’, so we also added a banker to our list of professions.

The Funny Math Mall turned out to be very interesting and real. The salesmen promoted different types of clothes and raised or lowered the prices depending on demand. At the same time we had a ‘statistics company’ that was observing the process and presenting graphically the changes in sales and prices.

Our chefs prepared and sold sandwiches and pizza.

A team of girls set up a travel agency, ‘Einstein’, and told stories about their own trips to Vienna, Paris and London, as they proposed trip itineraries and offered travel advice. Their logo was: ‘Logic will take you from point A to point B and our travel agency will take you everywhere’.

What are the results?

The students developed many skills alongside revising the maths material covered; these are listed in Box 1.

A remarkable aspect of this work was the lack of grading in its traditional sense (giving each student an A–F mark). All students participated in the activities in any way they liked, using all the knowledge they had – from the

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