

nanoKOMIK - Endowing superheroes with nanoscience

Arregui, Amaia⁽¹⁾, Otegui, Itziar⁽²⁾

⁽¹⁾Donostia International Physics Center (DIPC) – Basque Country, Spain

⁽²⁾CIC nanoGUNE – Basque Country, Spain

Summary: nanoKOMIK project proposes the creation, production and dissemination of the first participatory nanofiction comic in 2016. In an initial phase, youngsters aged between 12 and 18 have been involved in a free creative process where they created their female and male comic superheroes, providing them with nanopowers through astonishing features acquired by matter thanks to nanoscience and nanotechnology. With six science&comic workshops for youngsters and a special one for high school art and science teachers, finally, more than a hundred students from France and Spain participated and presented their work in the nanoKOMIK challenge. In a second phase, most original ideas will be recreated in a professional comic which will be distributed among the general public via the publication of a comic-book and an itinerant exhibition.

Keywords: nanoscience, nanotechnology, comic, mediation

Introduction

With the nanoKOMIK project, **CIC nanoGUNE** and **Donostia International Physics Center** (DIPC) research centres, specialised in nanoscience and materials science, propose the creation, production, and dissemination of the **first participatory nanofiction comic** in 2016.

This is a multidisciplinary dissemination project of international scope which aims to transfer the potential of breakthroughs taking place in the fields of nanoscience and nanotechnology to society.

To achieve this goal, a project structured in two phases with a total duration of one year has been designed. The initial phase comprises a nanofiction comic contest for young people, the so called nanoKOMIK challenge. In the second, the best ideas will be recreated in a professional comic which will serve to introduce basic concepts from nanoscience.

nanoKOMIK is carried out in four languages - Basque, Spanish, French, and English - with an especial focus in the Basque Country and Aquitaine. The project establishes new transboundary collaboration for science dissemination between both countries, France and Spain.

The project has been inspired by *Learning from Nature's Best* (Gould, 2015) and AMBER's 'Invent Nano!' schools competition.

nanoKOMIK challenge

The challenge has involved youngsters aged between 12 and 18 in a free creative process where they have created their female and male comic superheroes, providing them with nanopowers through astonishing features acquired by matter thanks to nanoscience and nanotechnology. The project's website (www.nanokomik.com) contained a great amount of useful information, allowing to participate in the nanoKOMIK challenge directly by exploring

it.

To create the character's power or skill, the participants could browse **six nanopowers** and the incredible properties of the materials behind each of them:

- [Chameleon effect](#): invisibility is achieved by camouflaging with the environment thanks to a nanocrystal network that changes its density to interact with light and changes its colour as a real chameleon. (Teyssier et al. 2015)

- [Gecko power](#): thanks to nanostructured gloves which imitate geckos' feet consisting of millions of very fine hairs, climbing through vertical walls and hanging from the ceiling is possible. (Autumn, 2006)

- [Bionic arm](#): this superdeformable arm recovers its original shape thanks to a memory metal which changes its nanostructure with temperature. (Kauffman and Mayo, 1993)

- [Nano Smell](#): the nanosensors detect the slightest chemical alteration in the environment enabling to anticipate events. (Shekhawat et al. 2016)

- [Super speed](#): the superhero suit imitates a shark skin thanks to nanostructures with superhydrophobic properties which reduce water friction while increasing swimming speed. (Li Wen et al. 2014)

- [Fire-resistant power](#): nanoretardants in the suit enable the superhero to control fire without burning. (NanoSchoolBox, Kashiwagi et al.)

This exercise inspired youngsters to create a new nanopower or transform those proposed into a new version. Also, a handbook with the main steps for comic creation was available.

Comics and science workshops

The 2h long workshops combined theory and practice parts guided by **a nanoscientist** and **a comic cartoonist**. In the theoretic part, the nanoscientist introduced the nanopowers relating them with animals and plants which have been gifted with sophisticated nanotechnology by nature and showed how science can be inspired by this to design new smart materials with useful applications to society. After that, the comic cartoonist explained how to use comic language to write and draw stories; distinctive expressive features of the genre were presented giving to the assistants a basis to reinvent them. In the second part, youngsters used all the acquired information to start the elaboration of their stories. At the end, participants were encouraged to finish their works at home and to present them to the nanoKOMIK challenge.

From January to April 2016, more than **one hundred young people** participated in the six comic and science workshops organized in San Sebastian, Bilbao, Vitoria-Gasteiz, Pamplona, and Bayonne.

A **special workshop for educators** brought together 16 high school teachers from both artistic and scientific disciplines and government technicians for science education innovation. In some cases, two art&science teachers came from the same school with the aim to bridge the gap between these two disciplines. The workshop had essentially the same format (theory+practice) as the one for teenagers; while creating their own comic with superheroes, teachers were provided with all the useful information and finally, they were encouraged to reproduce the experience in the classroom with their students. As far as we know, four high schools from the Basque Country (Hernani BHI, Mendillorri BHI, Escolapias

Vitoria, Aita Larramendi Ikastola) have introduced nanoKOMIK challenge in the subject for artistic education during the semester.

Final Works Exhibition and Award Ceremony

More than a hundred students presented their works in Basque (77), Spanish (18) and French (7) to the challenge. In their works, the youngsters used, adapted, and created new nanopowers dealing with issues such as health science, society, environment or technology. [Submitted works](#) are visible in the project's website.

The [award ceremony](#) took place the 10th June in the headquarters of the European Capital of Culture of San Sebastian (DSS2016), where an exhibition containing all works in the challenge was inaugurated. Three main awards were submitted by the official jury together with the award of the public which was voted by the audience in an open ballot during the previous days in the website. After the prize-giving, the attendees had the chance to enjoy a scientific, humorous show specially created for nanoKOMIK by the Big Van monologists.

Engaging teenagers

One of the key aspects was to find the appropriate channel to reach and engage young people. Enquiry reveals that up to 81% of the participants in the challenge found out about nanoKOMIK through their teacher, 10.9% through both their teacher and a poster announcement in the school, 6.7 % in the social media and just 1% thanks to the poster announcement itself. Thus, it seems that communication with teenagers needs a mediator (educator, family, etc.).

Some participants demonstrated to be very imaginative while introducing the proposed nanopowers in their comic. However, few did some investigation in the applications of nanotechnology to create a new one. The proposed new nanopowers were based in nanostructured systems in medicine for selective drug delivery, efficient environmental catalysts to clean up pollution or graphene, the most widely known nanomaterial.

Regarding workshops, even if 103 youngsters participated in different towns, just 14% of the works finally presented to the challenge were originally conceived in the workshops. In contrast, the special workshop organized for teachers showed to be very effective, leading to a contribution of up to 49% of the final works.

In general, teenagers need encouragement and support to elaborate their own nanoKOMIK. A workshop of 2h seems insufficient to engage them to give continuity to the work on their own. Overall, more than 90% of the participants were involved thanks to their teacher. Thus, working on new methodologies together with educators seems the most effective and promising way to introduce innovative projects such as nanoKOMIK among the teenagers.

Comic recreation

In the second phase of the project, the most original ideas will be recreated in a comic by Hodei Iparraguirre, a professional comic cartoonist. Overall, the objective is to create an attractive product for a non specialized target audience which introduces concepts related to nanoscience and nanotechnology in a clear and funny way. The comic-book will also enter in the classrooms as an innovative didactical material for teachers to learn and teach nanoscience and nanotechnology to the students.

The final product will be distributed among the general public via multiple communication channels: comic-book in the educative community, science dissemination events and comic fairs, publication in specialized magazines, and posters for itinerant exhibitions.

Acknowledgements

nanoKOMIK project has been cofinanced by the Foundation for Science and Technology (FECYT) - Ministry of Economy and Competitiveness of Spain. We would like to thank Rumble!! magazine and Artebizi art students association (UPV/EHU) for joining nanoKOMIK. Thanks to the University of the Basque Country (UPV/EHU), Artium, FNAC, and the council of Pamplona and Bayonne for providing the spaces for the science and comic workshops. We would like to acknowledge very especially Hodei Iparraguirre, Jose Carlos Torre, Jon Ander Arregi and Irati Kortabitarte for their implication in this project.

References

Autumn K. (2006) *How Gecko Toes stick*, American Scientist Vol. 94, N. 2, pg. 124.

Gould, J. (2015) *Learning from nature`s best*. Nature 519, S2-S3.

Hodei Iparraguirre

<http://www.domestika.org/en/hodei>

Invent Nano!

Kashiwagi, T., Du, F., Douglas, J.C., Winey, K.I., Harris, R.H. and Jr1 & Shields, Jr & J.R. (2005) *Nanoparticle networks reduce the flammability of polymer nanocomposites*, Nature Materials 4, 928 - 933.

Kauffman, G., and Mayo, I. (1993) *Memory Metal*, Chem Matters, Oct 4-7.

Li Wen, L., Weaver, J.C., Lauder, J.V. (2014) *Biomimetic shark skin: design, fabrication and hydrodynamic function*, Journal of Experimental Biology 217: 1656-1666.

NanoSchoolBox, Saarbrücken: NanoBioNet e.V.

<http://www.nanoschoolbox.de/en/nutzungsbedingungen/nanoschoolbox.html>

Shekhawat G.S., Dravid, V. P. (2013) *Nanomechanical sensors: Bent on detecting cancer*, Nature Nanotechnology 8, 77-78.

Sun, T., Jiang, L. (2010) *Surface microstructures and Nanostructures in Natural Systems*, Nanotechnology, Volume 8: Nanostructures Surfaces, Edited by Lifeng Chi, Wiley-VCH

Teyssier, J., Saenko, V.S., Marel, D., and Milinkovitch, M.C. (2015) *Photonic crystals cause active colour change in chameleons*, Nature Communications 6:6368.