

Mission: Nano

Ennio Tasciotti describes an interactive video game app that helps children learn the concepts of nanomedicine, and hopes to expand it by attracting like-minded scientists, educators and investors.

Five years ago, the Children's Museum of Houston had a special exhibit on nanotechnology. Being a nanoscientist, I was invited to meet the curator, Aaron Guerrero. We immediately clicked and he asked me to contribute to the programmes organized by the Nanoscale Informal Science Education (NISE) network, which is a community of scientists, informal science educators and teachers dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering and technology (<http://www.nisenet.org>). Because I saw so much enthusiasm in the children exploring the exhibit, I registered as a volunteer the same day. Shortly after this I became part of the nationwide network.

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NISE, which is supported by the National Science Foundation, aims at introducing the basic concepts of nanotechnology to children ages four to fourteen. Members have access to materials and tools for teaching nanoscience through simple experiments. These activities, which we used for educational events in the US and Italy, allowed us to explain the properties and functions of nanomaterials in ways that would capture the curiosity of our young audience. However, through interactions with hundreds of participants over the years, I realized that the children were struggling to connect the experiments and concepts with real-life problems of scientists and doctors. To help them make the connections, we began presenting medical problems that could be solved by the concepts they learned. This approach proved useful because the children began asking good questions and proposing solutions to the problems. Upon realizing the time and commitment required for this concept to reach its full potential, I began thinking about alternative ways to make this information more accessible to a wider population of children.



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With the help of two close friends, Paola Ferrari and Rebecca Hall, we came up with the idea of building a computer app or game based on the same principles and concepts explained by the activities. We felt that a well-designed video game could offer endless hours of fun learning.

When I presented the idea at a local meeting, another member of the NISE network, Carlos Monroy, a scientist at the Digital Learning team of Rice University, introduced me to Joe Warren, who teaches undergraduate video game programming at Rice's Department of Computer Science. Warren invited me to pitch my idea to the students in his class. I collected the best looking images of cells and nanoparticles I could find and developed a storyline that would get them interested.

The idea was to assemble a nanomaterial in the guise of a 'nanoshuttle' to destroy a tumour in the human body. Players would gather information about their 'enemy' (which could be the cancer type and stage) and be educated on the different properties of the nanoshuttle (for example, the size, shape, stability), and of the weapons (drugs, proteins, nucleic acids) that they wanted to use for their mission. They could add 'shields' to their nanoshuttle to protect it from being cleared from the body and/or 'homing devices' such as aptamers, antibodies and tumour-specific ligands to target the tumour.

Three courageous students accepted the challenge to build the game as part of their class project. Sunny Kim took charge of

the storyline and concept, Mircea Berechet programmed the commands and Erin Willey developed the computer graphics. I was ecstatic, but during our first brainstorming meeting, reality struck — it became clear that what I had in mind was too complex and overambitious for the time and money we had.

Back at the drawing board, the trio proposed a simpler game based on the series of events that occur from the moment a scientist or doctor enters a room to the time the patient is cured. Each room is a separate game, instructing the player about the concepts necessary to solve a medical problem. The video game (called Mission: Nano) was eventually developed on a US\$3,000 grant from NISE with the help of Stefano Provenzano, a computer programmer at Shin Software. With such a small budget, the game could only have the bare essentials.

Although the game was well received by the children, more resources are necessary to improve the storyline, create other missions and virtual spaces, and improve the educational value of the game. If we had the funds and collaborators, we would create three-dimensional graphics to better represent the structure of nanoparticles and their mechanisms of action. Importantly, we believe that adding a 'social' element to the game by allowing multiple players 'battle' each other at scientific tasks, or team up to solve difficult tasks would facilitate learning the most difficult concepts. In addition, I keep thinking that a video game based on unsolved clinical problems might echo the recent success of Foldit, which enlisted internet users to look for possible ways to fold sequences of amino acids.

Collectively, we could help win the battles of medicine using the many nanotechnology tools available. For scientists, educators, developers and entrepreneurs interested in the spreading of knowledge, we welcome contributions, collaborations and expertise. □

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