

Nanoclub: A Platform to Launch Innovative Research

Moayed Fatemeh¹, Moradi Mohammad Amin¹, Eslamipour Faegheh¹, Ahmadvand Emad² and Darab Mahdi¹

¹Nanoclub Office, P.O.Box : 14565-368, Tehran, Iran

² Department of Education, Iran Nanotechnology Initiative Council, Iran
P.O.Box: 14565-344, Tehran, Iran

I. INTRODUCTION

Child prodigy, nanotechnology, climbs up the steps of evolution quite rapid and it is now one the hottest field of prominent scientific journals all around. Meanwhile, different countries programmed for growth necessities and utilities of this great potential with the aim of increasing life standards and qualifications. Similar to other technologies, a way to resource and effective development is education and preparation of human resource. The interdisciplinary character of nanotechnology urges specific education necessities such as pre-university educations. Some countries backgrounds in pre-university nano education shows effects in future developments, which consist of the adequate acceleration in pioneering and providing new education opportunities. Education is a local parameter. Therefore each country needs to develop a special roadmap to meet its own needs.

In Iran, Iran Nanotechnology Initiative Council (INIC), as the top policy maker in nanotechnology, has established a scientific non-official club for pre-university students called "Nanoclub" to provide students aged between 15 and 18 the ground of understanding nano science and technology, paving the way of their nano-research in upcoming days of university. A wide variety of programs of this club have been developed by experts in both education and nanoscience. During last two years the activities of Nanoclub mainly focused on supporting short courses (experimental and computational workshops) in several cities, performing public shows, producing text books in Persian, programming and executing project-based education by an interactive website, and taking initiative to organize Student Nanoscience and Technology Olympiad in Iran. Based on recent studies on Nanoclub's student in comparison with other students, the first group of graduated students of Nanoclub – having a proper experience in team-working through the participation in interdisciplinary projects – exhibits a distinguished potential in learning basic sciences and skills to master mini research projects.

This current article is based on of Nanoclub staff's experiences as science-entertainment assistants and would represent some hints to design such student scientific clubs. The structure of Nanoclub, activities, student's feedbacks, and challenges and benefits are discussed.

II. NANOCLUB ESTABLISHMENT

INI council established a special action plan in summer 2004 to teach the basics of nanotechnology to students and primary and secondary school teachers all over the country. Studies at INI showed that students would be the most affected category of nanotechnology among the Iranian population. This subject was interesting to study from three different points of view: High school students are the future consumers of nanotechnology products and will be the main potential of its great market. Secondly based on predictions for the year 2015, 2 million job opportunities worldwide will be formed as nanotechnology develops, then current students equipped by nanotechnology skills will be future competitive applicants for these positions. Many countries are to take this into account so that can grab a considerable share of these coming opportunities and that is why nano-training of pre university students is a popular trend for technology policy makers all over the world. Third point here is the fact that Iran's development in nanotechnology needs a significant acceleration to compromise on unavoidable the third-world country's obstacles in developing a new technology. Such acceleration is not reachable unless both general and academic educations have been well established [1].

From the educational point of view introducing nanoscience to students, is a great opportunity to gain news experiences; working in a high-tech field with young people. On the other hand for the students these educations survey to involve them in a growing process of learning and offer them a deep taste of experimental science.

A. First phase: *e_Nanoclub*

Advertising and educating nano science and technology in Iran started up by launching a website: www.Nanoclub.ir. This website aims at training students with a quite few basics of nanotechnology in long term and with some specific nano based scenarios in short term In this step Nanoclub tries to increase the extent of students knowledge of nanotechnology and its upcoming products.

Educational aims which happen in longer periods could be referred as making sense about nanoscale and the physical meaning of ten to the power of minus/plus nine, acquainting the students with nanoscience and technology concepts (what's interesting about the nanoscale, how do properties change at the nanoscale, why do properties change and so on), writing simple scientific articles in nanotechnology and

significantly increasing students' comprehension of chemistry, physics, biology, and material sciences at the molecular level. From this side Nanoclub is the only source to offer nanotechnology relevant content for students in the internet in Persian language.

Another important here is the reason to choose cyber media as the first step. At the beginning of this project, 20 million Iranian students were in classes, which need a great team of professional teachers for face to face education while university majors in nano science were just new born in Iran and there were not enough experts to do so. On the other hand, statistics showed that most of internet users in Iran are high school students. Besides that the low cost of web based education was fairly stimulating to start the project in the cybernetic space. Gathering interested students and forming a cybernetic society of students, publication of over 150 Persian scientific papers and reports, attracting more than 200000 visitors per month, a bulletin named "REEZ NAMEH" (Tiny Letter in Persian) in whole country, and a competition called "Nano and Future" were the activities of the first phase [2].

B. Second phase: Nanoclub develop face-to-face activities

By the year 2007, the Nanoclub was reorganized and the second phase in its activities started. It was to communicate with students in real space to concentrate on students from the point of learning concepts to the point of creating scientific ideas.

The aim was to make a higher level human force for the beginning stage of university studies in nanotech. Therefore Nanoclub new mission comes in the following targets: Supporting seminars and short courses, Educational public show for nano science and technology, First Nanoscience and Technology Olympiad and The project-based education.

According to the encouraging budget of INI in last years there was a 5000 member containing society of nano science and technology experts available for pre-university education. Then it was programmed to perform seminars and courses for students by these Master and PhD graduates. The support was both financially and educationally. Preliminary files for presentation by the Nanoclub team management team prepared and offered to university newborn experts under supervision of old and famous teachers to make standards of nano education. By the first year in this program 59 seminars and courses performed for student and teachers while it increased to 104 by the second. Face-to-face education offers this opportunity to those students which have not suitable access to internet.

The educational public show was first designed to transmit snapshots of key concepts and outstanding products to non-expert people in order to make them eager to learn more about nano scale sciences. This would cause in a numerous innovative set of volunteers for nano science courses in universities, where it is hoped to have higher level

researches than last 5 years. The public show contains two main branches; first to give a sense of Nanotech outputs in world offered as products. In this part, students play and sense the changes nanotech provide to new products in an interactive space. In the second, main concepts and basic famous molecular structures are introduced. This part has some experimental-educational modules which offer the concepts of changing scale, monitoring the verified characteristics of nano materials, and basic manners of production. Based on its bright function in attracting people, it is programmed to perform it in different cities, with modified containing materials.

Among quantitative advertising and low depth activities, a selecting competition of intelligence and prodigy is designed by the famous format of international scientific Olympia, called Nano Science and Technology Olympiad. It will be held locally in Iran by the first performance but will be developed to international media in next steps. The well-known structure of Olympiad attracts students greatly to work, discuss and live with nanotechnology. According differences of science and technology, this competition will be held in two parts. In the nano science part, the student should know chemistry, physics and biology from the approach of molecular reactions and relations. Then mathematics and computer should be used suitably to analyze the problems. In the technology part, the aim is to make a technical product out of a scientific idea. This is a projective education which is being performed in a longer process. According to management program the first selecting exam nano science and technology Olympiad in Iran will be held in December 2009 and the second level in May 2010.

After long time study on positive and negative points of education in pre-university levels, it has been found according to TIMSS exam that Iranian students are somehow weak in power of analyze, theory making, and methodology of solving problems. Despite of important weakness of pre-university education, INIC policies made a surprising improvement in Iranian scientific publications. it is mentioned in project-based education that students should expertise the complete process on scientific activity and theory making themselves. They should make an idea, do a literature review, make their own assumptions and try check up its truth or extract its conditions and limitations by experiments and laboratory activities then discuss on results and report the results and even make a theory, in a fine and light project supervised by sharp and well-communicating university graduates. This is simply achieved by monitoring students which have university professors in their family, and organized in an executive structure in Nanoclub management team.

III. DISCUSSION AND CONCLUSION

Save Iranian strategy to climb up in the ranking of nanoscience and nanotechnology was successful till now. But coming up to the top 10 countries is a little different and

needs new nonlinear budgets and programming. It also needs a stronger and reliable innovative human source platform for launching the pioneer-ship in near future.

This article showed that a concentration on high school students as the critical mass for next university researches will provide the essential platform. The new strategy should focus on weaknesses of current education in Iran and use the potential of this triangle: advertising for nanoscience, project-based education for more achievements, and performing a competition like nano science and technology Olympiad, to let the university choose stronger human force for later researches.

The first reflections from society show positive responses to the supplementary strategy. A new statistical study on 451 students in 19 different locations in Tehran showed that 73 percent of them know something about nanotechnology which has an increase of 8293 percent comparing to the previous statistics from 2004 [3]. In another question people said that nanotechnology relates to energy (27.5%), medicine (18.4%) and environment (15.7%). This information shows more knowledge of people about applications of nanotechnology in relation to last data which showed people think nanotechnology almost related to just medicine. The promising response is that still more than 70 percent of people rely on INI to develop the country based on the new technology.

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