



Nanosciences, Nanotechnologies, Materials and New Production Technologies Deployment in Latin American Countries

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Fact sheet no. 2 August 2015

Standardising education in nanotechnology

Educating researchers and workers in interdisciplinary nanosciences and nanotechnologies is a global issue. Nature Nanotechnology has featured debate about it since 2013, in the wake of discussions in the Journal for Nanoeducation and conferences all over the world. NanoAndes is developing a common curriculum for nanotechnology involving professors from universities in several Latin American countries, while NanoDYF coordinates public awareness raising initiatives. NMP-DeLA Community of Interest members call for building capacity for nanoeducation in a Euro-Latin American cooperation.

Decision makers and stakeholders: professors teaching nanotechnology, students, industrial and non-industrial employers handling nanotechnology, government departments of education, the general public.

Introduction: quality, quantity and relevance of nano-education

Education is a *conditio sine qua non* for building capacity for nanoscience, technology and innovation. While increasing numbers of universities all over Latin America are offering courses or even complete curricula on nanotechnology, three issues remain unresolved: their quality, quantity and relevance to the labour market. In the early stages, graduates with nanotechnology qualifications mainly fulfil academic jobs, but as the technology matures, industry, government and other employers require personnel with knowledge and skills in nanotechnology.

Some proposed solutions

In most Latin American countries, the quality of academic education in Science, Technology Engineering and Mathematics (STEM) is open to improvements.

UNESCO's regional training centres including the South American Institute for Fundamental Research in Sao Paulo, Brazil and the Meso-American Centre for Theoretical Physics in Chiapas, Mexico disseminate international standards for education. The introduction of a new interdisciplinary subject like nanotechnology offers a unique opportunity to catalyse reforms like more practical training. The shortage of qualified nanotechnology professors in most countries is addressed through online lectures offered via the NanoAndes platform of nanoscientists in Andean countries and France. The relevance of academic education to jobs in industry and other sectors may be improved through engagement of these employers in the curriculum. This is demonstrated by the EU funded project NanoEIS, which has received interest from Latin American stakeholders. A wide variety of public outreach initiatives is coordinated through the Ibero-American platform NanoDYF.

Promising technological developments

The quality and quantity of nanotechnology education can be improved through two technological developments, in addition to political and socio-economic reforms of the education systems.



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One trend is the increasing offer of Massive Open Online Courses giving access to academic education to students all over the world. The other is the increasing online dissemination of information on low cost experiments and affordable access to laboratories offering students practical training opportunities.



Fig. 1: A cleanroom is needed for some research and education in nanotechnology. © VTT.

Organising the intervention - Short term (2020)

Within five years, policy makers in CELAC in cooperation with the EU and the NanoAndes network should introduce a monitoring system for nanoeducation. In order for Latin America to meet the regional demand for nanotechnology specialists, the numbers of curricula with up to date nanotechnology contents and the numbers of collaborative academia-industry theses on nanotechnology should be collected and published annually. A growing knowledge base and increasing commitment for Responsible Research and Innovation in nanotechnology should be fostered by monitoring the adoption of new curricula involving this topic. The capacity for technology transfer and nanoinnovation should be built through monitoring the numbers of experts in technology transfer and nanotechnology as well as the numbers of cases of successful technology transfer and the numbers of start-ups that can commercialise their products.

Medium to long term (2020-2030)

Within fifteen years, the United Nations Sustainable Development Goals set two targets relevant to nanoeducation.

“4.4 Substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship”. Investments in good quality nanoeducation in universities as well as vocational training schools in all Latin American countries should contribute to this goal. National and local outreach initiatives and the NanoDYF platform form a good basis that must be developed further through integration in government policies and funding strategies.

“4.b Substantially expand globally the number of scholarships available to developing countries in particular least developed countries, small island developing states and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries”. Many countries in Latin America and Europe already offer such scholarships. As the demand tends to exceed the offer, more investment seems appropriate. In addition, the UN Sustainable Development Solutions Network recommends to develop an indicator. To enhance the relevance beyond mobility of researchers, it should enable monitoring the impact on the socio-economic development of the countries of origin, stimulating brain circulation rather than brain drain.

Conclusions

There is a need to standardise the procedures for increasing the level of understanding of nanotechnologies from a societal point of view, and to increase skills for creating and handling nanotechnologies in order to serve industrial needs. It is up to policymakers across Latin America and Europe to address these needs The basis on which to build the solutions for these needs exists already.

Further reading

This fact sheet is based on literature and experts participation in interviews and events reviewed in the NMP-DeLA final roadmap, including all the original references. They can be downloaded from www.nmp-dela.eu