La main à la pâte: linking scientists and teachers to improve science education at primary school

David Wilgenbus, La main à la pâte, France

Abstract:

Initiated in 1996 by Georges Charpak, Nobel prize winner for physics in 1992, and the French Academy of sciences, with the support of many institutional partners like the French Ministry of Education, La main à la pâte is an educational program dedicated to develop inquiry-based science teaching at primary school. Its goal is to place children in a position whereby they can experiment, observe, query and reason, opening them up to the beauty of the world around them and its intelligibility. The recent development of La main à la pâte owes much to the efforts of the scientific community in accompanying, coaching, and training teachers. Thanks to a website, providing resources, scientific data, teaching tips, scientific and pedagogical hotline, teachers become more and more motivated, involved and self-confident in such an approach of science education.

The recent development of inquiry-based science teaching in primary schools owes much to the efforts of the scientific community. It was Leon Lederman, Nobel Laureate for Physics 1988, who introduced the movement into poor neighbourhood schools of Chicago in the USA. Three French physicists would later visit these schools, only to discover children fired with enthusiasm for science. Upon their return to France, the three physicists – Georges Charpak, Nobel Laureate for Physics in 1992, Pierre Léna and Yves Quéré – would decide to launch their own version of inquiry-based science teaching, La main à la pâte.

Over the past five years, the movement has spread to schools in Afghanistan, Argentina, Brazil, Cambodia, Chile, China, Colombia, Egypt, Malaysia, Mexico, Morocco, Senegal, Slovakia, Togo and elsewhere.

The teaching technique

The general idea of La main à la pâte is to cause children to participate in the discovery of natural objects and phenomena, to bring them into contact with the latter in their reality (outside of virtual reconstructions), directly through observation and experimentation, to stimulate their imagination, to broaden their mind and to improve their mastering of the language.

More precisely, here is a scenario of a typical La main à la pâte session. A child has asked a question about his/her environment, inanimate or living. Instead of replying immediately, the teacher throws the question back to the class, ‘And you, what do you think about it?’, eliciting the hypotheses of the children and thus firing their imagination. A simple experiment (observation, manipulation, measurement...) is then begun. Led by the children in small groups, it must in principle provide the answer, doubtless making them return to the initial hypotheses, and giving rise to the dialectic of reasoning and experiment which lies at the very heart of all research work. Finally, the children will be invited to express their thoughts (short statements, writing in an experiment book) on what they have just experienced together, being thereby obliged to enrich their vocabulary and refine their logic and, hence, their syntax.

Of course, this is an ideal scenario which, in many cases, may be severed from one of its elements. For example, experimentation on living things (or on astronomical objects) raises specific problems. The experiment may even fail, in which case the teacher will give the answer to the initial question ex cathedra.
1. Children observe an object or a phenomenon in the real, perceptible world around them and experiment with it.

2. During their investigations, pupils argue and reason, centralise and discuss their ideas and results, build up their knowledge, since solely manual activity is insufficient.

3. The activities suggested by the teacher are organised in a sequence for progressive learning. They relate to the programme and give a large share to pupil self-reliance.

4. A minimum schedule of two hours per week is devoted to one theme for several weeks. Continuity of the activities and teaching methods is ensured throughout the entire period of schooling.

5. Each child keeps an experiment exercise book in which they record notes using their own words.

6. The prime objective is progressive acquisition by pupils of scientific concepts and operating techniques, with consolidation of written and oral expression.

**Partnership**

7. Families and/or the local district are invited to assist the work done in class.

8. At local level, scientific partners (universities, Grandes Écoles) accompany class work by making available their skills and knowledge.

9. At local level, colleges of education (IUFM) provide teachers with their teaching and educational experience.

10. On the Internet site ([http://www.inrp.fr/lamap/](http://www.inrp.fr/lamap/)) teachers can obtain modules for application, activity ideas, or replies to queries. They can also take part in cooperative work through dialogues with colleagues, training officers, or scientists.

*From an innovative movement to a profound and stable reform*

In France, teachers are progressively implementing such hands-on principles in their classes. This was not the case 10 years ago. At that time, despite a mandatory two hours of science courses per week—as prescribed in the curriculum—a national survey highlighted that:

- Teachers were focusing on reading, writing, and counting.
- Science was taught in only 3-4 per cent of classes.
- In-service science training sessions were rare.
- No hands-on materials were available at the schools.
- No link existed with the scientific community.

Facing this situation, Georges Charpak, together with Pierre Léna and Yves Quéré launched in 1996 the *La main à la pâte* program, intended to revitalise the teaching of sciences in primary schools in France. This initiative, supported by the Ministry of Education, was
immediately endorsed by a unanimous vote of the French Academy of sciences, implying a
definite involvement of the scientific community.

The programme first started in a limited number of 350 classes. The participation has
progressively grown to more than 10,000 classes. Also, the principles of inquiry-based
science education were officially adopted in 2000 by the ministry of education with whom the
whole process is constantly discussed, elaborated and monitored. A plan for quality science &
technology teaching inspired by La main à la pâte was decided in all schools for 8 to 11 years
old pupils. Two years later, a new official Curriculum based on La main à la pâte principles
was established for all primary classes (350,000). These instructions are not a guarantee of
immediate impact on schools but help to ensure a slow although progressive dissemination
beyond the initial group of primary classes. Official national surveys in 2001 stressed that 10-
15% of classes learned science in 2001, compared to 57% in 2004 and to 70% in 2006 ! Being
purely declarative, these data have to be analysed carefully but it is undoubtedly clear that
today Science is taught more often, as well as according to the principles of La main à la pâte.

The dissemination of a programme like La main à la pâte is however long and difficult,
especially for the following reasons:

- Teachers are not at ease with science.
- Teachers fear to say ‘I do not know’ to children.
- Teachers are afraid to do experimental work.
- Not all people in the education hierarchy are always convinced that science teaching is
  useful.

To overcome these difficulties, La main à la pâte is combining innovative actions and
practical implementation within a large-scale education system. The programme has explored
almost all aspects of science education: inquiry-based teaching in schools, Information and
Communication Technologies (ICT), resources production, scientific partnership, training
activities and dissemination in developed and emerging countries.

Among the most important issues, teacher training was targeted as a key point. In France,
teacher training for science has to be rethought entirely. La main à la pâte contributes to
disseminate the following guidelines:

1. teachers have to be trained in the same way as children will be taught;
2. training will involve scientists & associated persons;
3. accessibility to resources (e.g. class sequences, books, local sites, and centres) will be
   one of the outcomes of the training session.

After the training, teachers have access to their own resources and to those developed by
private and public publishers. They can also buy the material-kits made by dedicated
companies (certified ‘La main à la pâte’) or by themselves. In order to stimulate teachers’
creativity and to respect the diversity of the local context, no systematic model has been
imposed. On the other hand and to assure coaching of these trainers, an extensive system of
various support-ways has been implemented.

The involvement of scientists
To assist teachers, La main à la pâte offers support aids which bring together scientific and
teaching circles. Scientists have the role of accompanying, supporting, sponsoring teachers,
and in no way substitute for the teacher. A charter have been drawn up (in collaboration with
the ministry of education) to lay down the roles to be played by each partner.
The involvement of scientists is strongly dependent upon local situations: the existence of scientific centres, Grandes Écoles, institutes of applied sciences and technology, centres for science, technology and industry (CCSTI). In some administrative areas, science students attend classes to assist teachers in designing and implementing science activities.

**Internet: a powerful tool!**

Internet has proved extremely effective in expanding the outreach of *La main la pâte*. Opened in 1998, it is very popular with teachers, 250,000 of whom visit our site every month in 2006. Our website has three missions: to make resources available to primary school teachers in the form of multiple experimental sheets, scientific data and teaching tips; to provide vast "chat forum" enabling teachers to talk to each other, compare teaching methods, share their successes, describe problems and propose sequences they have devised themselves to colleagues; to provide a scientific and pedagogical hotline. More than 100 high level scientists (and more than 100 teacher trainers) have agreed to answer questions on elementary science gratuitously within 48 hours, through the Website. The questions and answers are naturally made public and, in 2006, represent a repertoire of over 2000 entries.

The website has engendered others. A dozen regional sites have been set up in France proposing activities adapted to local circumstances and resources. All the sites are networked with shared search engine and common charter. Since 2000, this strategy has been extended beyond France: activity sheets have been translated and posted online at partner sites: mirror site in China ([http://lamap.handsbrain.com/](http://lamap.handsbrain.com/)), Egypt ([http://lamap.bibalex.org/](http://lamap.bibalex.org/)), sites in Brazil and so on. In 2006, new mirror website are in preparation in Spanish (Universidad de las Andes), Serbian (Vinça Institute of Nuclear Sciences, Serbian Physical Society) and German (Freie Universität Berlin).
Despite a rich and fruitful collaboration all over the world, the amount of exchanges, cooperation and impact on the European education systems and between European countries has, to date, remained minimal. In this perspective, ‘POLLEN’ (http://www.pollen-europa.net), an initiative over 3 ½ years funded by the EU, has been launched in January 2006. POLLEN aims at developing a model for the renewal of science education in primary schools based on inquiry approach already successfully experimented in most of the 12 participating countries: Belgium, Estonia, France, Germany, Hungary, Italy, Netherlands, Portugal, Slovenia, Spain, Sweden, and United Kingdom.

It is therefore expected that this project will play a great role in spreading the hands-on method over EU countries, contributing to strengthening links between countries, scientists, schools, and pupils and to improve primary science education in the European classrooms. The goals are clear but the path to achieve is long. It will take at least ten to twenty years and will depend on the strength of the international and global movement.