

SCIENCE EDUCATION, *LA MAIN À LA PÂTE* ABROAD

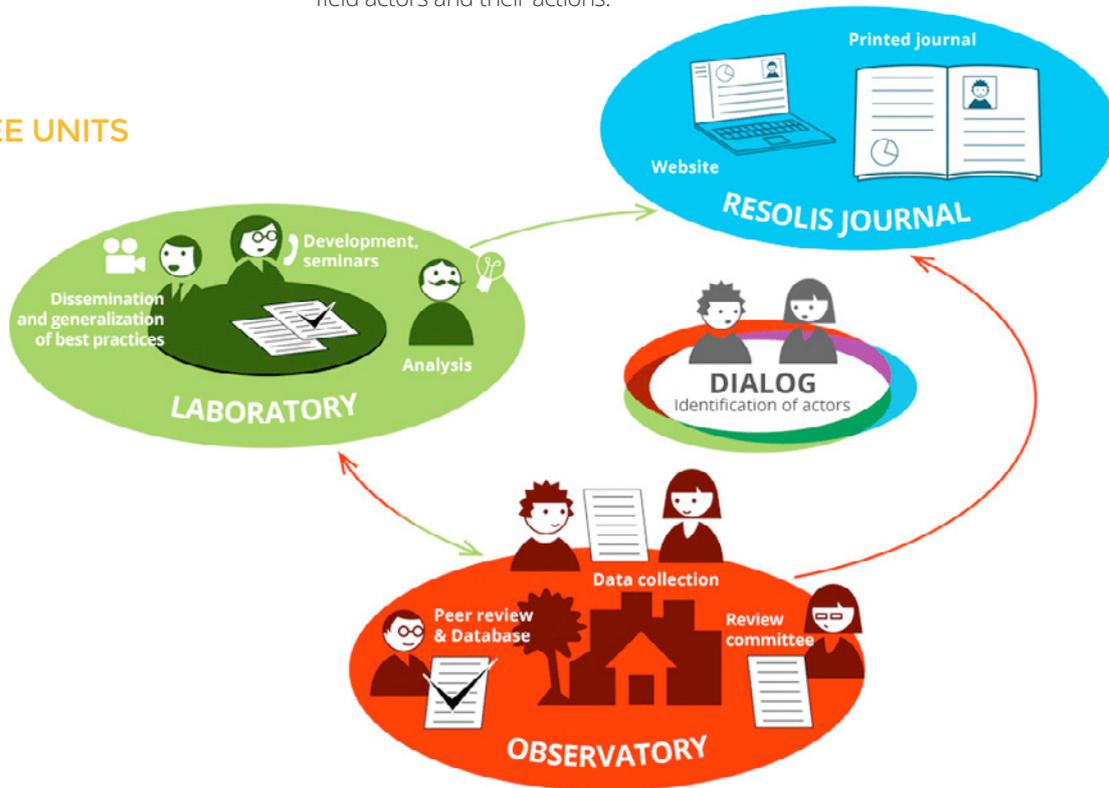


CONTRIBUTE TO SOCIAL PROGRESS THROUGH CAPITALISATION AND SHARING OF KNOWLEDGE FROM FIELD ACTIONS

Guided by this principle, Philippe Kourilsky, Emeritus Professor at the Collège de France, created in 2010 the non-profit organisation, RESOLIS.

Field actions in the area of solidarity are too often unknown, even though they can be a rich source of social innovations. RESOLIS has developed tools to identify, evaluate and promote field actors and their actions.

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Table of contents

Introduction p.5

LA MAIN À LA PÂTE IN A FEW WORDS p.12

○ EDITORIAL

○ AUTHOR: Pierre Léna

Chapter 1: p.7

LA MAIN À LA PÂTE AT THE INTERNATIONAL LEVEL

LA MAIN À LA PÂTE'S INTERNATIONAL ACTIVITY p.12

○ ARTICLE

○ AUTHOR: Laurence Constantini

Chapter 2: p.10

THE WORKING GROUP

THE INTERNATIONAL WORKING GROUP p.11

○ ARTICLE

○ **AUTHORS:** Hour Khim, Diana Hernandez-Szczurek, Margarita Gomez, Anna Pascucci, Stéphan Baillargeon, Gilles Cappe, Alain Chomat, Anne Goube, Charles-Henri Eyraud

○ **SUMMARY:** For its 20th birthday, the *La main à la pâte* Foundation organized a two-day meeting in June 2015 with a group of international trainers having worked with the Foundation, in order to identify key success factor for an Inquiry-based Science Education (IBSE) project. To prepare this meeting, RESOLIS has published fact sheets on IBSE project in 6 countries. This working group made some recommendations to launch a pilot project, but also to scale it up.

TO DEVELOP THE ROLE OF INVESTIGATION IN TEACHING IN QUEBEC p.20

○ FACTSHEET

○ **AUTHOR:** Stéphan Baillargeon

○ **SUMMARY:** At a time of reform of the primary-level science syllabus, two Quebec school boards appealed to the "*La main à la pâte*" (Lamap) Foundation to adopt teaching methods based on the process of investigation or research. This type of pedagogy was then extended to 8 other boards in mathematics and at the secondary school level.

« SCIENTIAM INQUIRENDO DISCERE » (SID) : DEVELOP INQUIRY-BASED SCIENCE EDUCATION IN ITALY p.23

○ FACTSHEET

○ **AUTHOR:** Anna Pascucci

○ **SUMMARY:** The Italian Association of Natural Sciences Teachers (ANISN) discovered the Foundation *La main à la pâte* (Lamap) during an international conference in 2008, and has since established a fruitful collaboration. ANISN adapted resources and materials to develop their own Inquiry-Based Science Education (IBSE) programme: "Scientiam Inquirendo Discere" (SID) which now has 10 centers.

LEARNING SCIENCES AS « PEQUEÑOS CIENTIFICOS » IN COLOMBIA p.26

○ **FACTSHEET**

○ **AUTHOR:** Margarita Gomez

○ **SUMMARY:** The University of the Andes has collaborated with the French Foundation “*La main à la pâte*” to implement inquiry-based science education in Colombia. They are now developing a similar program in mathematics with Canada, and are working with the Ministry of Education to adapt their own curricula.

CIENCIA EN LA ESCUELA : PUPILS BECOMING SCIENTISTS IN VENEZUELA p.30

○ **FACTSHEET**

○ **AUTHOR:** Diana Hernandez-Szczurek

○ **SUMMARY:** In the process of reforming science education, Venezuela has chosen to adapt the pedagogy developed by the French Foundation “*La main à la pâte*”: Inquiry-Based Science Education (IBSE)

EXPERIMENTING WITH SCIENCE IN CAMBODIA. p.32

○ **FACTSHEET**

○ **AUTHOR :** Hour Khim

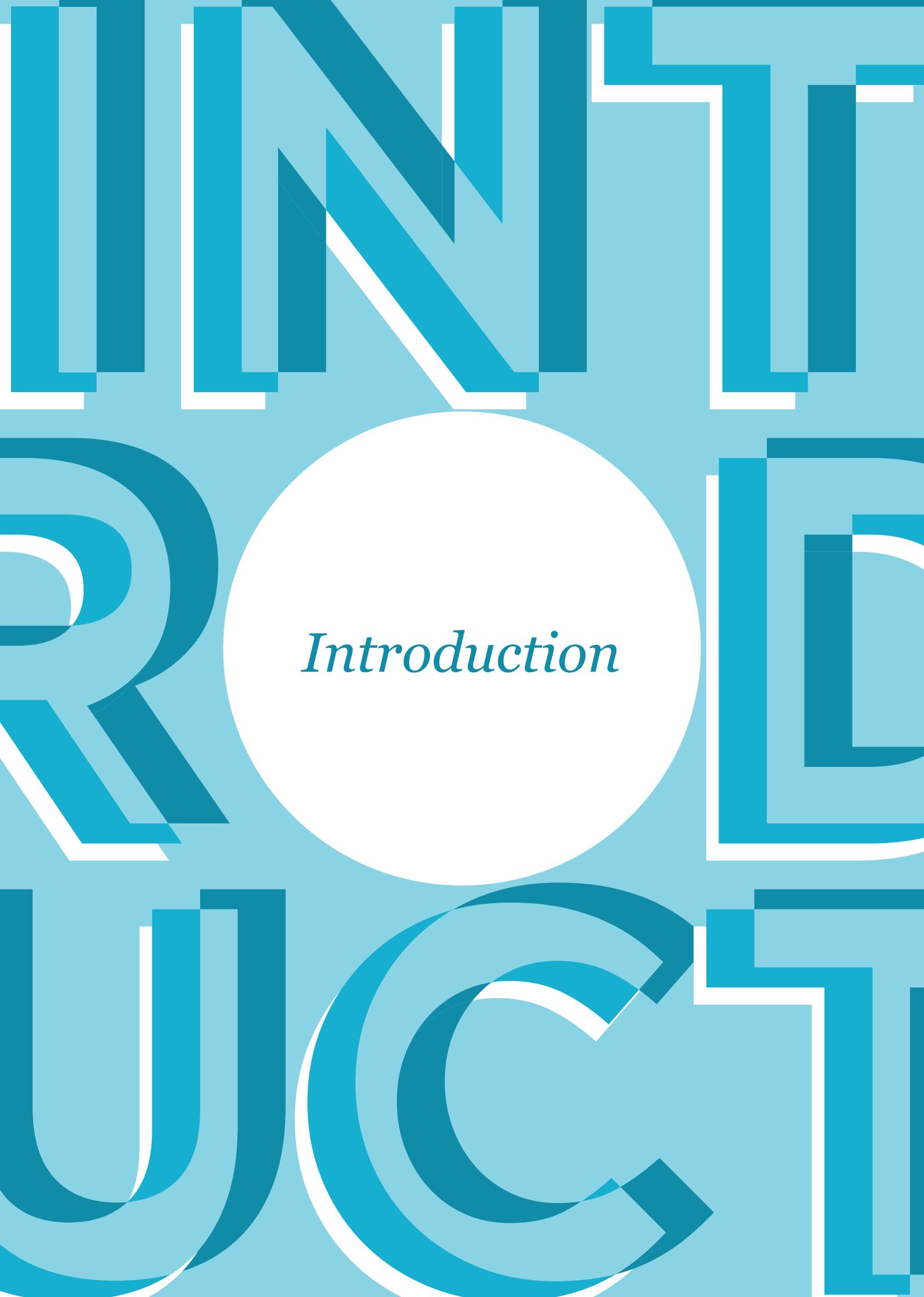
○ **SUMMARY:** Since 2002, the « *La main à la pâte* » Foundation has helped Cambodia to develop and implement a new method of science education based on an investigative approach. Initially only intended for bilingual Franco-Khmer primary school classes, the program then spread out to all primary schools on a voluntary basis for levels 4, 5 and 6.

EXPERIMENTING INQUIRY-BASED SCIENCE EDUCATION IN SOUTH AFRICA p.34

○ **FACTSHEET**

○ **AUTHOR :** Zuki Mpiyakhe

○ **SUMMARY:** The Academy of Sciences of South Africa has launched a pilot project to implement Inquiry-Based Science Education in primary schools, in collaboration with the French Foundation “*La main à la pâte*”.



Introduction

LA MAIN À LA PÂTE IN A FEW WORDS

In 1995, Georges Charpak decided to use his reputation as winner of the Nobel Prize in Physics (1992) for the benefit of science education. He believed that without it, our globalised world – then in the making – risked falling into misguided ways. From this conviction, the *La main à la pâte* movement was born, within the Académie des Sciences. In 2015, it celebrated twenty years of working towards a simple goal: that children, from their earliest age, could learn to bring their curiosity for nature and its phenomena to life, in school and from their teachers, through activities that were fun to discover; to construct their capacity to think in order to understand the world they live in; and to use language with confidence and precision. Working for the most disadvantaged children, opening up school to connect it to the world of science and its professions, the urban or rural community that surrounds it, and beyond with the help of Internet, this was the gamble made in 1995.

The gamble paid off, because during the following two decades, a significant number of countries would discover that their science teaching was not adapted to the developments of science, its role in society, or the stakes of citizenship and living together. *La main à la pâte*, thanks to Georges Charpak's original intuition, expanded, instigating and assisting with partnerships, the translation of class resources, a vast array of new teaching methods in developing countries and countries which, while better equipped on the surface, also discovered the weak spots in their educational system's adaptation to the contemporary world. More recently, this included climate change and sustainable development. The work is just beginning to face the challenges that in the decades to come will concern, more than anyone, the youth of today sitting in their classrooms.



Pierre Léna

Honorary President of the Foundation *La Main à la Pâte*



Chapter 1 :
**LA MAIN À
LA PÂTE AT THE
INTERNATIONAL
LEVEL**

LA MAIN À LA PÂTE'S INTERNATIONAL ACTIVITY



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● **KEYWORDS:** SCIENCE EDUCATION, INVESTIGATION, INTERNATIONAL COOPERATION

Twenty years since it began its operations in France, and fifteen since the launch of the first international cooperation projects, the year 2015 was a year to take stock of *La main à la pâte*'s commitment to promoting inquiry-based science education around the world.

From its beginnings, the international activities of *La main à la pâte* were established in diverse geographical regions, evidence of its goal to share the universality of science through an approach to science teaching bringing with it empowerment, achievement and progress, both for individuals and societies. In this sense, *La main à la pâte* international action has been quite original, paying the same attention to developed, emerging and developing countries in its cooperative projects.

The resulting projects were rich, in terms of the social, economic and cultural contexts where they were established, and the adaptations that they spawned in order to take root in each country. From Quebec to China, Colombia to Cambodia, and Haiti to Afghanistan, over forty countries – including in Europe – took part in the various exchanges and received our support over the years.

The initiators in the countries that took a similar approach to that which *La main à la pâte* promotes, were introduced to the foundation's actions in France – the base for its innovation and experimentation – in pilot centres and schools that practice this teaching method. In 2010, *La main à la pâte* – responding to rising demand from countries outside Europe – also set up its annual International Seminar, which runs for a week. This seminar is an opportunity to give a dynamic, progressive overview of the programmes, resources and support system developed by the *La main à la pâte* operation and the foundation of the same name, created in 2011 to expand and prolong its activities.

Following initial discussions with our international participants, who came from state departments in charge of primary education, institutions providing training and professional development for teachers, and the scientific community committed to science teaching – namely science academies – a large number of successful cooperation projects were developed. These projects mostly focused on two priority fields in teacher and teacher educator support: professional development and access to resources.

La main à la pâte, careful not to undermine the local educational actors and striving to foster an autonomous spirit and the capacity to widely disseminate the pilot activities launched with its support, focused on training local educators, which became the flagship programme of its cooperation projects. Since 2008, over 5,000 teacher educators have been trained in implementing inquiry-based science teaching. All attended intense, five-day programmes, which are often renewed over a number of years in order to create in-depth, transferable competencies.

Alongside these professional development programmes, and in order to assist educators and teachers in their daily practice of science teaching, especially for teachers in the classroom, *La main à la pâte* encouraged and facilitated the appropriation and use of its teaching and scientific resources. In order to do so, it has maintained over the years a policy of free resources. It also accepted, and often even encouraged, the adaptation of its resources by its partners, according to their needs and local contexts, such as translation or adaptations of the content. *La main à la pâte* has also been committed to helping its partners in their efforts to improve the accessibility of its resources. It provided assistance in the development of mirror websites, inspired by its own website, and they exist in no less than 7 languages (English, Spanish, German, Chinese, Arabic, Serbian and Vietnamese).



Picture 1: 2015 International Seminar



Picture 2: FTrainers' training in Timor

Of course, there is many a slip twixt cup and lip, and several countries, including France, have a long path ahead of them before inquiry-based science teaching becomes a widespread teaching practice in their educational systems, and teachers, the cornerstones of these systems, receive on a continuous basis the resources and support needed to implement the practice dynamically and efficiently.

Furthermore, certain countries, especially those in delicate socio-economic situations, encounter greater difficulty in setting up this science teaching method, just like other attempts at improving the quality of education. Overcrowded classes, insufficient pre-service training for teachers, a lack of equipment, and outdated curricula are some of the factors inherent to educational systems which, paired with other more socio-cultural factors (the importance of science in the perception of the world, for example), make the transformation of science teaching an arduous task.

La main à la pâte, while fully aware of these difficulties and obstacles, remains convinced that science teaching is now a greater priority than ever, both for economic development – primarily for poorer countries – and for citizen engagement that answers to the challenges of our era. These challenges are both local and global, they interrogate science and its applications, in understanding the causes and seeking their solutions – climate change is one emblematic example of this type of challenge.

For this reason, the *La main à la pâte* Foundation decided to launch a major workshop, bringing together eminent figures within its International Committee and experienced field actors that have worked with the foundation over the last fifteen years. This enabled us to identify key strategic directions to take in our international activity and also to begin to see possible developments in how cooperation is enacted.

The ideas produced by the expert panel, presented hereafter, are the first step in this changing approach, and they are currently contributing to the development of the Foundation's future international activities. They will be based on a selection of key concepts, namely a reinforced structuring of activities and long-term partnerships; greater cooperation between *La main à la pâte* and its historic partners, in order to strengthen them mutually and for the benefit of new partners; and improved assessment and valorisation of completed projects.

With this approach, *La main à la pâte* and its partners are demonstrating their commitment to continuing to work together to enable science teaching that is better equipped to meet the challenges of sustainable development and citizen engagement, irrespective of each country's individual context.



Chapter 2 :
**THE WORKING
GROUP**

THE INTERNATIONAL MEETING OF INQUIRY-BASED SCIENCE EDUCATION (IBSE) EXPERTS: BUILDING COLLECTIVE EXPERTISE ON IBSE DISSEMINATION



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● **SUMMARY** : « For its 20th birthday, the *La main à la pâte* Foundation organized a two-day meeting in June 2015 with a group of international trainers having worked with the Foundation, in order to identify key success factor for an Inquiry-based Science Education (IBSE) project. To prepare this meeting, RESOLIS has published fact sheets on IBSE project in 6 countries. This working group made some recommendations to launch a pilot project, but also to scale it up. »

● **KEYWORDS** : SCIENCE EDUCATION, INVESTIGATION, INTERNATIONAL COOPERATION

1. INTRODUCTION

The international meeting which took place in Sèvres in June 2015 had the main objective of sharing experiences of the participants in the development of Inquiry-Based Science Education (IBSE) local projects, in order to identify key features of a successful IBSE project and to determine, for each major issue addressed, the obstacles, some recommendations and focal points.

On this basis, the *Foundation La main à la pâte* wished to propose some perspectives on how to optimize international cooperation for the implementation and dissemination of IBSE projects.

A pool of highly experienced educators

All participants in this group were educators who have been involved directly in professional development activities and programmes for teachers and teachers' educators.

The group was composed of foreign educators from six countries where *La main à la pâte* has developed strong cooperation projects: Cambodia, Colombia, Italy, Québec, South Africa and Venezuela. The group also consisted of seven French educators who have been particularly involved in the cooperation projects with these countries or others as well.

A preparation process to build a shared agenda

While the meeting was at the initiative of the *La main à la pâte Foundation*, the objective was not to organise one event only, but rather to set up a small network of highly experienced persons involved in their countries, and sometimes in other countries, in the development of IBSE programmes. The hypothesis was that such a group would be able to analyse their respective experiences and to draw up some lessons for their own use as well as for other organizations, especially those who are newcomers in the promotion of IBSE.

So as to identify major issues of common and key interest for every country, the Foundation, assisted by RESOLIS, created a questionnaire to collect relevant information. Each participating organisation filled in this questionnaire and an analysis was made by the *La main à la pâte* team. *La main à la pâte* also created a second questionnaire to collect information from French educators about their experience as teachers' educators abroad and analysed them.

This study confirmed the key importance of two main subjects in the implementation of an IBSE programme: strategic planning and partnerships. A third issue was added, international cooperation, in order to reflect on common perspectives and mutualized contributions for the dissemination of IBSE in other countries.



2. THE STRATEGIC PLANNING ISSUE

Three working groups produced 3 key notes on the following issues:

- 1. How to start and run a pilot project?
- 2. What contents should be included in professional development activities and how should they be planned?
- 3. How to scale up from the pilot project?

2.1. HOW TO START AND RUN A PILOT PROJECT?

First of all, it is worth noting the key objectives of a pilot project. It can serve two purposes. The first and most obvious one is showing the value of the IBSE approach, the evidence of its relevance and effectiveness in the improvement of scientific literacy and skills among children. Moreover, the pilot project is also an experiment during which the initiators can map the relationships, conflicts, and areas of responsibility: are others doing something similar? What is the difference between what we propose compared to other stakeholders or professional development institutions?

The group then tried to define the minimum requirements that must be met to start a pilot project. Some constants were identified. First, there should be a *starting player*. Different bodies can play this role (universities, institutions, departments, associations) with support possible from *La main à la pâte*; it is worth noting that at this stage, the presence of the Ministry of Education is not mandatory, although it must at least be informed and give its approval for the initiative.

Second, a *coordinator* with recognized leadership should be identified within a small working group; next, a *territory* and a *place of reference* to develop the professional development sessions and resources, etc. should be identified.

It is important to note that the project should start out small, as many failures have been caused by overly ambitious pilot programmes. A minimal set up might involve a *small group of schools* (at least 4-5) in the same area (cluster strategy), with a *minimum of two teachers per school* (for a total of at least 20 teachers).

The role of the school principals/headmasters is key in supporting the participation of the teachers, valuing participation in the pilot project for the professional development of the teachers and the quality of the school.

The first action should be the 'professional development of educators: where there are no identified educators, it will be necessary to find expert teachers who will become the reference educators. The professional development sessions must provide *immediate benefits* for the teachers practice in the classroom (in terms of provision of useful contents, saving time, etc.). Moreover, the pilot project must guarantee the availability of *quality resources, easy/ ready to use* (on IBSE, on misconceptions, scientific contents, on suggested modules, etc.) in the local language. Very simple and cheap materials that enable the pupils to carry out the activities should also be guaranteed.

The duration of the pilot project should be *at least three years*.

Some questions remained unanswered:

- Should teachers participate on a voluntary basis or should such a programme be mandatory?
- What certification could be provided for the knowledge and skills developed (more than a symbolic one) and the added value for the teacher (in terms of career, wage, other)?
- Should an official document attesting to the commitment of all actors in the programme be signed from the outset (including the description of the role of coordinator, educators, teachers, etc.)?
- What is the minimum size of the project? (While some figures were provided above, not everybody agreed on them).

2.2. WHAT CONTENTS SHOULD BE INCLUDED IN PROFESSIONAL DEVELOPMENT ACTIVITIES AND HOW SHOULD THEY BE PLANNED?

The group identified three main points.

First of all, **the programme should include a variety of activities** and not focus on face-to-face workshops alone.

Of course such workshops are important, especially to start a programme with beginners who need to receive substantial contributions to initiate a change in their practice. It is worth mentioning that face-to-face sessions can be complemented by online professional development, especially to address new issues, to go deeper in a subject: such online PD can be organised in a synchronous (to maintain the group dynamic) or asynchronous (to adapt more smoothly to time constraints of participants) way.

However, these PD sessions, whatever their form, are not sufficient to sustain the change; it is essential to **include follow-up activities in the class** (e.g. mentoring, coaching). Co-teaching and co-animation in a classroom can also be a way to support the implementation of new skills, especially in a first phase, while in a second phase cooperation can evolve towards more elaborated projects, for instance interdisciplinary projects with other science or even non-science subjects. External follow-up and support can thus be usefully complemented by creating a peer learning community

between teachers themselves (for example, working within a geographic area or entire schools...).



Picture 1: Trainers' training in Cape Verde

Besides, other complementary activities – based on better use of the school environment - can be organised and create motivation and a taste for change; they could be activities related to the natural environment (field trips or outdoor activities) or the scientific environment (scientific conferences, visits in laboratories, research institutions, industries), for example. They require openness to other stakeholders, especially to involve scientists or science students in the design and programming of activities that address the needs and interests of all parties.

As for **the content of the professional development programme**, it should focus on the use of a scientific method in the class through inquiry-based science education and address different topics, ensuring they are selected from the curricula of the country. Wherever possible, a major input of subject content to the programme might be on the links between disciplines and how to better integrate the various parts of the curricula. Working on national topics and issues (e.g. forests in Peru) and adapting resources to those topics can also help tailor the projects to the locality.

If the implementation of IBSE supposes a change in the way of teaching, it is also necessary to include elements related to the role, attitude and behaviour of the teacher (management of the class, consideration of the learning process and the place of the child). New skills for enhanced cooperation between teachers (especially but not only at secondary level), for instance how to run a shared project, are also increasingly pertinent, especially those concerning the interdisciplinary approach.

Of course, the programme must be progressive and take into account various stages of development in the knowledge and skills of teachers as they acquire more experience; it should also equip the teachers with tools that can be used for self-evaluation and assessment in the class (best practices) in order to enable them to evolve.

Finally, the professional development designers should not underestimate the **importance of the material**. This obviously concerns the material for the professional development workshops themselves but it also includes the availability of ready-to-use resources for teaching, as creating new ones is a very long process, which is not feasible for IBSE beginners. These resources can be managed in different ways: the material can be borrowed (ready-prepared kits on a chosen module/ subject) or lists can be shared (with photos, indications of where to buy the material, how much it costs, etc.).

With such support, it is possible for a teacher to become autonomous after 3 or 4 years of the programme, but this does not mean that s/he will be able to build sequences alone, but rather use existing resources and implement IBSE in the appropriate way.



Picture 2: Trainers' training in Indonesia

Some questions remained unanswered:

- What should be the first feature in the programme? The scientific content (according to the curricula) or teaching skills? What about a combination of both? What is the difference between a teaching skills-orientated approach at primary level vs a content-orientated one at secondary level?
- What about the topic of pupils' assessment by teachers? How can they be equipped? This is a common issue to all countries.
- Should an agreement be signed? An agreement is important not only for financial aspects; it might be important to have some kind of agreement with the schools, the trainers and the teachers (rules, letter of interest). Indeed, a label, or agreement also promotes and adds visibility to the involvement of all partners. However, it should be quite flexible, with provisions that are not too restrictive, at least during the first phase.

2.3. HOW TO SCALE UP FROM THE PILOT PROJECT?

The group identified five main aspects that must be considered when expanding a pilot project.

The first stage occurs during the pilot project itself, right from its beginning. It deals with the **strategic framework** that will remain the compass for any further development. Indeed, it is important

to have a clear framework so the program will not lose its direction during the scale-up, even if it must be flexible. This presupposes a strong theoretical background to inform people regarding pedagogical and scientific issues and to obtain academic support from universities, the Academy of Science, etc. in order to strengthen the legitimacy of the project.

More practically speaking, having a strategic framework means that generalization (or at least expansion) must be an aim of the pilot project from the beginning, even if a long-term one. This is important also to justify and raise the interest for small pilot projects, focusing on follow-up in schools and evaluation or learning progress (among teachers and students as well), even if it means reaching fewer schools, precisely so that “successful” experiences can be shown and advocated.

In short, having a strategic aim can help acquire support even for a small sized project, with no large impact, but with a strong capacity to establish a model.

Secondly, **the role of the Ministry of Education** becomes increasingly important as a project expands. While it is possible to start a pilot project with no real involvement of the ministry or a minimum of participation (they should at least know about the pilot project), it is essential the project is strongly backed for the scaling-up. This may even involve accepting to lose the leadership and become a reference source to the Ministry in the creation of new programs and curricula. However, it is recommended to keep any pilot centres as “models” so if the government or the policy changes the projects will remain.

In the meantime, from the pilot to a possible regional or national policy inspired by a successful experience, the ministry and local education boards will have to be a main target of regular communication to convince decision-makers of the relevance and effectiveness of the project (production of videos and other tools: documents, testimonies, etc.).

A pilot project based on teachers’ professional development alone would in no way create the conditions necessary for its own extension or sustainability. To be expanded, it must rely on the **availability of a sufficiently large pool of experienced teachers’ educators** who have themselves completed a full professional development course on IBSE over at least a couple of years.

This pool will be the most important and long-lasting resource of a large programme and its constituency is the key objective of the pilot project, the professional development of teachers being considered at this stage as a field for educators to experiment and practice their new skills.

It is also important to take into account the fact that there will be different levels in the educators and to use this diversity as a positive asset, as it will increase the exchanges and the cooperation between educators: senior educators (who can for instance develop their own materials or be in charge of the management of the programme locally), junior educators, tutors (if the educator position does not exist and the pilot project must be established with teachers who can dedicate some of their time to the professional development of their colleagues).

Another feature that participates in the scaling up of a pilot project is **networking**. This initially requires a deep knowledge of what is going on in the country regarding science education. Indeed, the pilot project must be an occasion to identify and meet other initiatives and organisations that contribute to the same objective. This is essential not only to identify possible cooperation (especially at local level), but also to be able to define the most adequate positioning for the scaling up phase to follow, taking into account the whole landscape. This is a part of the continuing evaluation of the pilot project to understand where it fits and will fit into the national context and policy at different stages of development.

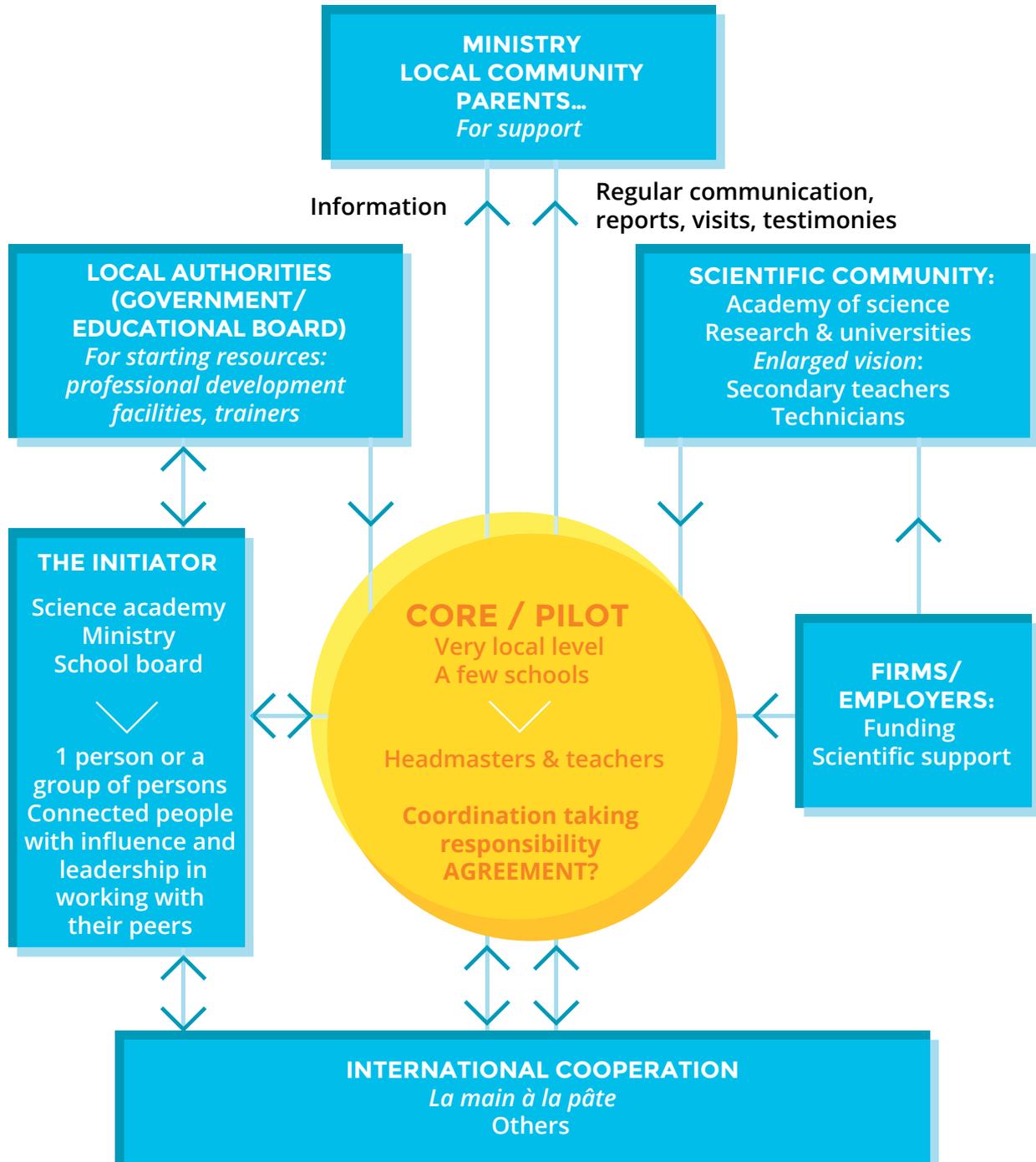
Of course, **evaluation** is the last key aspect to deal with for scaling up a pilot project. A positive evaluation, at least of the impact on teachers (if not on pupils), is important to convince decision-makers to invest in a larger implementation of the experiment and, in the event that other parties are needed to fund a wider programme, such an evaluation would also be essential for fundraising.

3. THE PARTNERSHIP ISSUE

Two different diagrams were produced by the two sub-groups **on the partnership issue including the communication strategy**. Instead of merging both it was decided to keep them as they represent different stages in the development of a given project.

The first diagram describes a process while the second is a picture of an **achieved project**.

3.1. THE PARTNERSHIP-BUILDING PROCESS



MINIMUM TIMELINE



A few comments about this diagram:



AT THE EARLY STAGE:

- Motivated people are as important as institutions to the success of a pilot programme;
- The entry point here is the school or a cluster of schools i.e. a limited area in order to be able to work on local adaptation before proposing dissemination;
- The progressive strategy must also allow for a better understanding of the system, its constraints and power schemes (where might conflicts arise?);
- The involvement of the ministry at central level is not mandatory at first but the local educational authority/ board must be involved at least for a minimum of resources and authorization that are necessary for professional development;
- The initiator(s) of the project may be volunteer(s) but the coordination/ responsibility of the implementation must be taken on by paid dedicated staff.



ABOUT THE COMMUNICATION STRATEGY:

- Informing stakeholders and possible future partners is a key component; for instance, the community, the parents, especially where IBSE may challenge the culture;
- Gathering elements of qualitative assessment for the ministry, showcasing the activities, involving headmasters in this communication.



ABOUT THE ROLE OF THE SCIENTIFIC COMMUNITY:

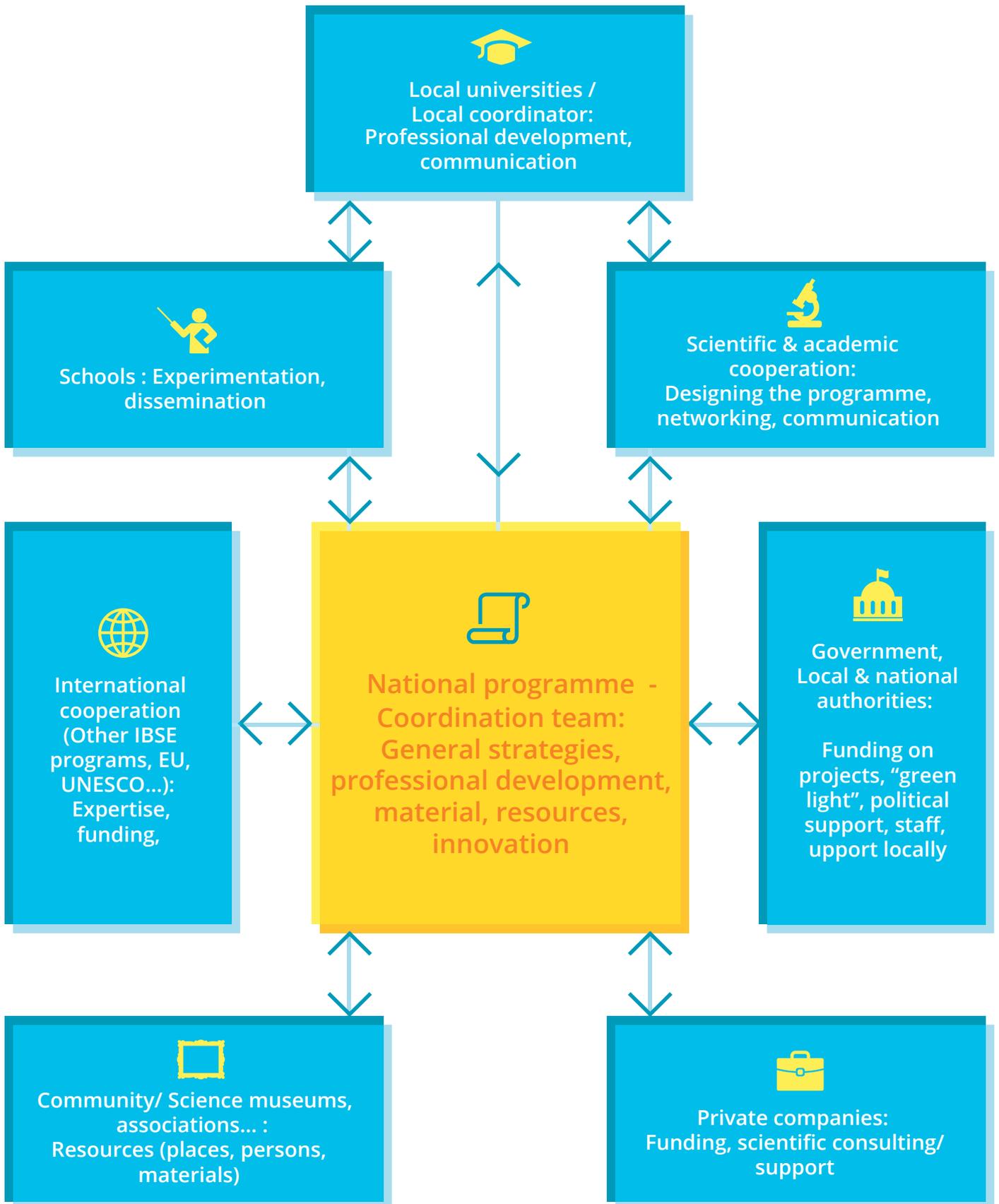
- Be aware there may not be any local scientific community in terms of academics, university or lab researchers, etc.;
- Find other ways to bring living science and technology into the classroom, using parents' professions for material or other local 'resources' (for instance craftspersons, technicians, medical attendants, etc.);
- To implement a pilot centre, the minimum requirement should be a university science department, but it may be possible to explore involving secondary teachers too.



ABOUT THE ROLE OF BUSINESSES:

- They can start with funding through their social responsibility plans;
- Their role can evolve rapidly with other input: organisation of visits, participation in professional development, support in the class, etc.

3.2. A COMPREHENSIVE PARTNERSHIP MODEL IN A COMPLETED PROJECT



A few comments about this diagram:

- This is an archetypal model: not all stakeholders are mandatory at all stages, cooperation and partnership are moving;
- EU or other international projects/ funding might be useful to expand pilot projects but not at their launch (it is more appropriate to start with local mobilization, then to experiment more largely with possible international funds; then again, scaling up requires national funds again, or at least partly, for obvious sustainability reasons);

○ Communication between all stakeholders is a key issue: the use of various tools (website, visits in the classes, testimonies, etc.) must be adapted to the target and objective of the communication (securing funds, convincing decision-makers, opening collaboration, etc.).

4. CONCLUSION OF THE MEETING: MOVING TOWARDS IMPROVED INTERNATIONAL COOPERATION

The meeting was unanimously appreciated. Participants all agreed that it is very important to develop a network of cooperation and exchanges in order to be able to develop concrete and focused activities.

The partners would be therefore prepared to form a group, meeting once a year in a different country (the rotating organizer also coordinates the group during the preceding year). Indeed, participants pointed out that a relevant network - and related activities - should bring together people who can together create both innovative and cumulative expertise on common goals and issues. A process of this type is possible only with a small group of organisations and people who share a similar view on how inquiry is defined, meaning those who have been involved in IBSE for quite a while and are well experienced.



Picture 3: Group of international experts (June 2015)

Such a small network would contribute to the mutual reinforcement of participants in their respective programmes, providing each partner identifies clearly its needs and areas of expertise.

This group could also outline new ways of cooperating at international level for the benefit of countries not yet involved or experienced in IBSE. Until now, very few partners apart from *La main à la pâte* have been involved in promoting IBSE abroad but it seems there are now more opportunities and willingness to get involved in this type of collaboration (see for instance the cooperation of Colombia and Quebec with the Dominican Republic).

A new direction could be for instance to share the leadership of professional development programmes. Indeed, some partners now have the skills necessary to develop cooperation and support activities independently, while *La main à la pâte* could still continue to play the role of a kind of mediator between countries which would not cooperate otherwise.

However, a limitation to the possible involvement of partners in international cooperation is the funding, a point that *La main à la pâte* might help to address through the design of common projects.

Another orientation of the group could be to strengthen the existing regional networks, which are not very active or productive at the moment. The group could explore if it is possible to work better with those networks to develop concrete activities, for instance some common resources, adaptations, translations, etc.

These relevant points will be dealt with in the future, to allow for a better dissemination of the IBSE best practices collected across this international network.

To develop the role of investigation in teaching in Quebec

Summary : At a time of reform of the primary-level science syllabus, two Quebec school boards appealed to the "La main à la pâte" (Lamap) Foundation to adopt teaching methods based on the process of investigation or research. This type of pedagogy was then extended to 8 other boards in mathematics and at the secondary school level.

AUTHOR(S)

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Project Co-ordinator

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Report written by :
Alice Balguerie

PROGRAMME

Start date : 2002

Implementation site : Canada

Budget : 250000 €

Source and details on funding : Private and governmental (educational funds)

ORGANISATION(S)

Pôle régional pour l'enseignement de la science et de la technologie (PREST)

2121, 119e Rue Est
Saint-Georges

G5Y5S1 Saint-Georges (Quebec)

<https://prest.csbe.qc.ca>

Employees : 3

Volunteers : 0



EDITORIAL COMMITTEE

Date of proofreading : 2015/03/10

Opinion of the Committee : High impact !

Solution(s) : Coordination of actions, Education

Participant : Public institution

Country : Canada

Beneficiaries : Pupil, students

Stature of the programme : International

Domain : Science, Education, Training

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*To reference a document published by RESOLIS : Baillargeon, « To develop the role of investigation in teaching in Quebec », **Journal RESOLIS** (2015)*

BACKGROUND TO THE PROGRAMME

In 1999, Quebec launched a major reform which encouraged the school systems to introduce syllabuses that included objectives and skills required for teaching science and technology. School boards thus carried out a pedagogical study in which "La main à la pâte"s (Lamap's) pedagogy was used. Lamap promotes the use of investigation in the teaching of science.

In 2002, Roger Delisle visited a pilot centre and Lamap classes and talked to the school boards (CS) of the Beauce-Etchemin and La Capitale districts. Enthusiastic about the project, they launched a pilot project with 50 volunteer teachers in primary schools.

As this new pedagogy received a very positive response, the project grew to include other school boards, though it did not follow a strategic plan.

Note: the Department of National Education in Canada defines the syllabus but school boards (equivalent of the rectorats in France) chooses the way in which to apply them.

OBJECTIVES OF THE PROGRAMME

-Overall objective: provide teachers with suitable and effective pedagogical training

-From the beginning: train all primary teachers from the two school boards.

-Development of the objectives:

-> Train primary school teachers from 10 school boards

-> Tasks for the Regional Centre for the teaching of science and technology (PREST): to roll out teaching methods to other school boards in Canada; to extend it to the secondary level; to extend it to the teaching of mathematics; to create a network between the teachers and trainers; to find ways to be self-funded.

IMPLEMENTED ACTIONS

-1st phase:

- > Year 1: training of 2 trainers in the two school boards guided by two Lamap trainers + a week long visit by a Lamap trainer to work on the strategy, visit classes...
- > Year 2: co-training with the Lamap trainers of the trainers and teachers, still in these two school boards + a work week
- > Year 3: training of trainers and teachers, still in the two school boards, but only by Quebecan trainers

-2nd phase: deployment in 8 other boards. Same process as for phase 1, but without Lamap trainers + the organization of regional meetings (4 to 5 times a year)

-Creation of PREST (Regional Centre for the teaching of Science and technology)

- > adaptation for high school and organisation of training sessions
- > geographical deployment of training sessions
- > adaptation of the method for the teaching of mathematics
- > translation of educational resources in science and technology into English and Spanish (ongoing)
- > development of an online platform for distance learning in science and technology and to promote exchanges between teachers

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

-At the beginning 2 trainers trained by Lamap who have in turn trained 40 trainers

-For science and technology in primary school: 1200 primary teachers trained in 15 school boards (30 h of training) + expansion to a large number of teachers; 40.000 primary pupils affected by this science teaching every year which adds up to more than 220.000 affected students since the beginning of the program

-For science and technology in secondary schools: 40.000 secondary school students affected; 1.500 secondary school teachers trained (10 hours of training)

-For mathematics in primary schools: 3.600.000 primary school students affected by mathematics teaching; 3.600 trainers trained in mathematics and 90.000 teachers trained (40 h training)

-At the end of the 9th year, a questionnaire was sent to the teachers:

- > 70% of teachers used all or a large part of the teaching tools
- > After 9 years, almost all the teachers continue to use the teaching resources.
- A more formal evaluation of the current programme to understand the impact on the students
- Very positive feedback from the trainers: with the budgetary restrictions, they must be more and more versatile and are therefore satisfied to have key tools to hand for training teachers in science.

COLLABORATION WITH LAMAP

- To change the science syllabus, school boards wanted to rely on what already exists and the Lamap method corresponds most accurately with their needs.

-They have been so inspired by the concept of the pilot centre that they created PREST

- They are satisfied with how Lamap has transferred the skills but they would have liked for there to be more collaboration between the partners in order to exchange ideas and share developments linked to common needs.

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

-Each school board has funded the development of the program locally

-Demonstration centre for Physical Education: to enhance scientific understanding of the trainers

-McGill University: to conduct research in 2 schools documenting the interest of children

-Faculty of sciences and engineering at Laval University: for PREST, for organizing regional competitions in science with the primary schools. Financial and material aid

-Faculty of the science of education at Laval University: to conduct research on the impact of training

-Mecanium: to create technical drawings for the secondary schools

-National Institute of Public Health in Québec: to adapt the project "Living with the Sun" (on hygiene, the harmful effects of the sun)

-Pequeños científicos: to adapt the program to mathematics in Colombia

-Canadian National Institute of optics: optimization of the components of our microscope (100X magnification)

FEEDBACK

Difficulties and/or obstacles encountered during the programmes implementation :

- A lack of funding to have sufficient human resources
- Canada is a huge territory with a low population density; It is therefore difficult to reach all the teachers and the cost of travel is expensive
- Not easy to mobilize the decision-makers at various levels (school management, managers...)
- The teachers must choose between several training options and more of them choose maths and French than science
- The majority of the primary teachers lack scientific understanding
- Low availability of materials in primary schools

Solutions used to overcome the difficulties and/or obstacles :

- Creation of an online platform to enable distance learning for part of the teacher training: enables it to reach more teachers and encourages teachers to seek training in the sciences
- Creation of a resource centre to better manage the materials: the tool kits are available with a lending system for non-perishable material
- Development of detailed lists of materials (supplier, quantity, cost, photos)
- Participation in meetings with educational managers to present the package of measures
- Involvement of engineers, physicists and other scientists to deepen understanding

Suggestions for future improvement :

- Better use of new technologies in the investigation process in particular tablets, iPods and smartphones
- That students may document their investigations and disseminate them. To develop networking among the students
- To foster the education of parents by children

Summary of factors responsible for the programmes success :

- The project began from the grassroots, was built with the teachers and has been able to develop according to needs.
- It succeeded in mobilizing the different levels of decision makers
- Easier to extend the experimentation method in mathematics, including other countries, because the programs and their structure vary less than in science (ex: everyone first learns to count, then addition and subtraction).

TO KNOW MORE

Development of human and financial resources:

- In the first few years, two FTE (full time equivalent)
- Cost of training + development of teaching resources: \$ 200.000 CDN per year.
- In order to develop, the 8 other school committees need a resource manager and trainers + travel costs: \$ 800.000 CDN per year. As the school boards are culturally similar, there's no need to adapt the educational resources
- Now only 2.6 FTE are needed to develop the programs with an annual budget of 250.000-300.000 CDN (which does not include the resource manager that each school board mobilizes)

To learn more about the investigation process:

http://www.fondation-lamap.org/fr/search-document-pedagogique?facet%5Bim_categorie_pedagogique%5D%5B191%5D=191

“Scientiam Inquirendo Discere” (SID): develop Inquiry-Based Science Education in Italy

Summary : The Italian Association of Natural Sciences Teachers (ANISN) discovered the Foundation La main à la pâte (Lamap) during an international conference in 2008, and has since established a fruitful collaboration. ANISN adapted resources and materials to develop their own Inquiry-Based Science Education (IBSE) programme: “Scientiam Inquirendo Discere” (SID) which now has 10 centers.

AUTHOR(S)

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Coordinator
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Report written by :
Alice Balguerie

PROGRAMME

Start date : 2010
Implementation site : Italy
Budget : 40000 €
Source and details on funding : Ministry of Education, local authorities and private foundations

ORGANISATION(S)

Association des Enseignants en Sciences Naturelles
Via Mezzocannone 8
80134 Naples
<http://www.anisn.it>
Employees : 0
Volunteers : 522
Members : 2000



EDITORIAL COMMITTEE

Date of proofreading : 2015/03/23

Opinion of the Committee : *High impact !*

Solution(s) : *Education*

Participant : *Public institution, Association, ONG, Academic, research Institute*

Country : *Italy*

Beneficiaries : *Pupil, students, Adolescents*

Stature of the programme : *National*

Domain : *Science, Education, Training*

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*To reference a document published by RESOLIS : Pascucci, « “Scientiam Inquirendo Discere” (SID): develop Inquiry-Based Science Education in Italy », **Journal RESOLIS** (2015)*

BACKGROUND TO THE PROGRAMME

Anna Pascucci, from the Association of Teachers of Natural Sciences (ANISN), met Pierre Léna, from the Foundation La main à la pâte (Lamap) in 2008 during an international conference on science education. As she was very interested in Lamap pedagogy promoting Inquiry-Based Science Education (IBSE) (where students progressively develop key scientific ideas through learning how to investigate and building their knowledge and understanding of the world), in 2009 she came to Lamap headquarters in Paris for three weeks to study the Lamap model, meet members of the team responsible of different areas, and visit pilot centers and classes.

A strategic plan was designed and presented in May 2010 by ANISN to the Accademia Nazionale dei Lincei, the French Academy of Sciences, and the Ministry of Education. Through different agreements, they became partners to launch the project ‘Scientiam Inquirendo Discere’, promoting IBSE in Italy.

OBJECTIVES OF THE PROGRAMME

- The overall objective is to improve science education in Italy through the implementation of IBSE at schools, setting up a fitted training programme for teachers
- At the beginning, the targets were only the first years of junior high schools, the grades with the most serious problems. The programme has since expanded to primary schools, kindergarten, and the other years of secondary school (high school).

IMPLEMENTED ACTIONS

- Benchmark and study of the existing programmes of IBSE
 - Translation of Lamap materials, and adaptation to different levels. An expert group meets to develop new resources and materials.
 - Creation of the first pilot center in Naples in 2011. When a new pilot center is created, it is associated with an older one that supports it. In each pilot center, there are different contemporary levels of training depending on the age of the pilot center.
 - Trainers (4 to 8 in each pilot center) are trained each year with the support of Lamap and attend 3 or 4 national meetings each year.
 - The Association (ANISN) is connected with the teachers thanks to the activities that it runs. Thus, the programme started with a network of selected and motivated teachers. Since 2011, training of teachers at different grades from kindergarten to junior high school, and development of new materials adapted to each level. Teachers are trained altogether, regardless of the level they are teaching in, because they can help each other thanks to their different backgrounds.
- When a teacher becomes involved, he/she: is trained (attend courses from October to May), receives the needed materials, is supported by trainers, other teachers and scientists to implement the programme.
- In 2014, an external evaluation was made by experts from Brussels

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

- 3 pilot centers (2011/12) ; 5 pilot centers (2012/13); 7 pilot centers (2013/14);10 pilot centers (2014/15)
- 55 trainers and 319 teachers were trained from 1 to 3 years (50- 60 hours/year of courses + at least 20 - 40 hours/year of experimentation in classroom) in 80 schools.
- In total, over the three years, 27,774 students have gone through the programme
- At present 12 ANISN lead members, 70 trainers, 492 teachers, and 21,750 students are working in the SID programme
- No teacher has left it since the beginning.
- Equal implementation in rural and urban schools
- The external evaluation states:
 - > The activities to disseminate IBSE all over Italy have been very efficient especially taking into account the limited means and resources available
 - > Trainers are motivated and committed to the project
 - > Teachers have gained confidence
 - > According to the teachers, an increase of the pupils' team-building skills and the interest and motivation of the pupils to study Mathematics Science Technology.
 - > A key element that needs particular attention to enhance the project's sustainability: the integration and mainstreaming of the achievement of the Scientiam Inquirendo Discere project in the education systems across Italy.

COLLABORATION WITH LAMAP

- The project is based on Lamap pedagogy and experiences. Thanks to the international network developed by Lamap, teachers in Italy feel that they are part of an international programme and they can benefit from experiences of other teachers. Lamap supports the training of the trainers, involves ANISN in European projects (like Fibonacci and SUSTAIN), and allows access to different types of resources.
- Possible improvement: promote the creation in each country of an international Lamap reference center. Each country, through this International Lamap reference center, could share how they train the trainers, exchange resources, create a pool of international trainers, create an international committee to sustain international vision and actions.

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

- Financial support from the Ministry of Education and local foundations
- Some local authorities help with the dissemination of the programme.
- Local Academies, research center, universities hosted the SID pilot centers
- Some scientists from several universities or Accademia di Lincei help developing new material, supporting the programme and the teachers
- The Accademia has facilitated the link with Science Academies in other countries, and has played a political role.

FEEDBACK

Difficulties and/or obstacles encountered during the programmes implementation :

- Shortage of funds, and delays receiving funds from the Ministry. They often have to start the activities in the schools before receiving the funds. In each pilot center, there is a list of schools and teachers that would like to be part of the programme, but the pilot centers cannot accept them because of the lack of funds.
- Lack of stability: since the start, there have been 4 different Ministers of Education.
- Lack of human resources dedicated to the programme. The programme is run mainly on a voluntary base. Many trainers are retired teachers.
- The Association of Teachers is leading the project, and it does not have much political influence.

Solutions used to overcome the difficulties and/or obstacles :

- Find different kinds of financial support: turn to private foundations and look for European funds.

Suggestions for future improvement :

- Reinforce the International connections (participation in international initiatives and projects; train the trainers abroad)
- Improve the National dimension through the sharing of trainers, resources, tools, organising meetings and intensive residential training course for trainers.
- Sustain the existing pilot centers by increasing slowly the number of teachers and schools involved while maintaining the quality of the process. Involve more teachers within the schools that already implement the programme. Involve more schools in the pilot center's area to enlarge the local community of teachers.
- Expand the programme if possible in the 2 main regions that are still not covered by the 10 pilot centers.

Summary of factors responsible for the programmes success :

- The background study of the Lamap model and other European models thanks to the EU project (Fibonacci)
- The close collaboration with Lamap in training trainers and the involvement in International initiatives
- Teachers must know that they are not alone, for which it is necessary to:
 - Have a deep understanding of the schools' and teachers' needs
 - Develop activities that are connected with the curriculum and implemented during school hours
 - Implement a strategy of associating partners (for schools and pilot centers)
 - Encourage the teachers to share their experiences supporting peer communities
 - Provide the teachers with the needed materials, giving the kit boxes for free
 - Support interconnected dimension of training: local, national, international
- Ask for the help of scientific experts for some subjects
- Give the opportunity to students to share their views on IBSE and tell what has brought them to the programme; it is the best means to motivate other teachers about the effectiveness of the programme.
- According to the external evaluation, "there is a clear correlation between the commitment and dedication of the coordination and the partners and the quality of the work achieved".

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TO KNOW MORE

- See the appendix to know more about IBSE
- More details about the pilot centers and the teachers' training:
 - > The model of pilot center foresees: a responsible from ANISN (Association of Teachers in Natural Sciences); a scientific advisor from Accademia; from 4 to 8 trainers; from 20 to 160 teachers; from 600 to 5000 students (4-16 years old) involved. The hosting institution of a pilot center, that gives space and facilities for free, is a research institution, University, museum or local Accademia.
 - > The locations of the pilot centers are chosen according to the local support of the Accademia or of one university, and if the Association of Teachers has a local session there.
 - > In order to be implemented in a new school and break the isolation of single teachers involved in the programme, at least two teachers of a school had to be involved, with the agreement of the headmaster.
 - > In remote areas, schools can play the role of reference school and connect with other schools to facilitate the development of the program.

Annexe 1 : http://www.resolis.org/upload/fiche/annexe/212_20150402_esera_sid_paper_copia.pdf

Learning sciences as "pequeños científicos" in Colombia

Summary : The University of the Andes has collaborated with the French Foundation "La main à la pâte" to implement inquiry-based science education in Colombia. They are now developing a similar program in mathematics with Canada, and are working with the Ministry of Education to adapt their own curricula

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Mauricio Duque

Report written by :
Alice Balguerie

PROGRAMME

Start date : 2000

Implementation site : Colombia

Budget : 400000 €

Source and specificity of funding :
Private foundations and businesses

ORGANISATION(S)

Universidad de Los Andes

Cra 1E N 19A-40

111711 Bogotá

<https://www.uniandes.edu.co/>

Employees : 8

Volunteers : 2



REVIEW COMMITTEE

Date of proofreading : 2015/04/19

Opinion of the Committee : *Should be generalized !*

Solution(s) : *Education*

Participant : *Academic, research Institute*

Country : *Colombia*

Beneficiaries : *Pupil, students*

Stature of the programme : *International*

Field of action : *Science, Education, Training*

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*To quote from a document published by RESOLIS : Gomez, « Learning sciences as "pequeños científicos" in Colombia », **Journal RESOLIS** (2015)*

BACKGROUND OF THE PROGRAMME

After a lecture given by Georges Charpak in 1998 at the University of the Andes, the Lycée Français Pasteur in Bogotá carried out an initial adaptation of La main à la pâte pedagogy: inquiry-based science education (IBSE). Several people from the University of the Andes participated in the training and observed the implementation in the classrooms and launched a similar project in 2000 in 5 public primary schools they were supporting. The "Pequeños Científicos" programme was launched.

The University of the Andes tried to organize several times seminars with the stakeholders to agree on a common strategy, but the strategic plan has remained very informal.

There have always been good relationships with the Ministry of Education that, at the beginning, put the team of Pequeños Científicos in touch with private businesses and foundations. They now are collaborating directly in order to reform the schools' curricula.

GOALS OF THE PROGRAMME

- Overall objectives: improve science education by changing the way teachers teach, especially by promoting cooperative learning and IBSE. Attract more students into science programmes, promote sciences and careers in sciences.
- The goal of Pequeños Científicos is to implement the program in some schools and to look for insights concerning IBSE implementation aspects. The programme seeks a sustained, but slow growth
- At the beginning, the goal was to urge the Ministry into implementing the new pedagogy, but then Pequeños Científicos has been valued more as a laboratory to experiment new teaching methods and to build up its own expertise in order to be able to advise the Ministry.

IMPLEMENTED ACTIONS

- Adaptation of Lamap's pedagogical approach in Lycée français Pasteur
 - Adaptation of several teaching materials, with the support of different international partners including Lamap. With the support of Alianza educativa, the University of the Andes deployed the pedagogy in 5 public primary schools in poor neighborhoods of Bogota. The University of the Andes trained teachers and provided them with sufficient materials, and Lamap came several times to help with the adaptation and the trainings. The University also organized annual national seminars to improve teachers' abilities. Since 2000 the Programme "Pequeños Científicos" has worked with other schools in Bogota and created a national network including local universities to develop regional cores of Pequeños Científicos.
 - 2011: adaptation for secondary schools and expansion to other schools
 - 2012: Adaptation of the IBSE pedagogy for teaching mathematics, with the support of Canada
 - 2013 Design of an open training program for teachers (club de maestros) in order to get them closer to science and science education. The program includes talks, presentations and visits to the universities of science and engineering labs.
 - 2013: start working with the Ministry of Education as an adviser to help them re-design a national professional development program and teachers' training in languages, science and mathematics in primary schools. The collaboration with the Ministry will expand in 2015 to programs in secondary schools and in sciences.
-

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

- The program develops several sessions of professional development (lasting around 78 h for a year) each year. Around 3,000 teachers have been trained since the beginning. 300 to 400 schools have implemented the strategy promoted by Pequeños científicos.
 - Concerning 'Pequeños científicos', the teachers enter the program voluntarily, and almost all of them are satisfied with it. As for the collaboration with the Ministry of Education, it is slightly different because the Ministry decides in which schools they want to work. In that case, it is hard to say how many teachers are really motivated with the new pedagogy, but around 50% of teachers are very interested in this kind of teaching approach.
-

COLLABORATION WITH LAMAP

- Colombia has been one of the first international partners of Lamap. Strong collaboration for several years: Lamap helped with the training and the development of a new website in Spanish. Mauricio Duque has also visited France several times to develop evaluation tools, and to discuss the programme's problems and progress. The Colombian and Lamap programs have changed, and therefore further collaboration for the future needs to be discussed.
 - Collaboration should be stronger with Lamap and with Lamap's partners about some topics that are difficult to tackle alone, e.g. assessment and evaluation. For instance, developing tools that evaluate the impacts of IBSE is a long, costly and difficult process. Moreover, it would be interesting to develop common evaluations to be able to draw conclusions from different situations, especially about the impacts of IBSE upon the students' education.
-

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

- Many international partners: Lamap and Pôle Régional pour l'Enseignement de la Science et de la Technologie (Canada) are the main ones. Other partnerships with Panama, the Dominican Republic, Argentina, Chile, Brazil and Mexico. In the Dominican Republic: training of teachers in a small group of schools, with the aim of reproducing the experience of Pequeños Científicos: experiment at a small scale to then advise the Ministry of Education.
- Colombian Ministry of Education, and local authorities in some cities.
- Several private foundations and businesses to finance the programme (SIEMENS foundation, Gas Natural Foundation, Mamona, Fundation, Techint...)
- Currently there is a project led by Propagas Foundation in the Dominican Republic to develop materials and training about environmental education and sustainability using an IBSE approach –
- Several universities in Colombia, the Dominican Republic and Panama

FEEDBACK

Difficulties and/or obstacles encountered during the programme's implementation :

- Difficulties to find funding to evaluate the impact on the students.
- The teachers often change schools every 3 or 4 years. Pequeños Científicos can train all the teachers of one school, and 5 years later, most of them will have left. When they arrive in a new school, some try to continue with the IBSE, but the other teachers may disagree and they may not have the needed equipment or support.
- Regarding Colombian educational context in general:
 - Poor quality of teachers' initial training
 - In rural areas: schools are geographically dispersed, often only one person teaches in several grades and lack of materials
 - Lack of reference material for teachers or outdated textbooks at schools, which is a serious issue especially when it is combined with poor initial training.

Solutions used to overcome the difficulties and/or obstacles :

- In the schools where Pequeños Científicos is intervening, private foundations finance the teachers' training and the purchase of equipment
- Training has changed along the way to meet the specific needs of teachers in Colombia, looking to improve pedagogical content knowledge and including an important number of classroom visits.
- Development of agreements with local universities to include IBSE basics into pre-service programs for future teachers.
- Collaboration with the Ministry in order to produce deeper longer-term effects.

Suggestions for future improvement :

- Deepen the collaboration with the Ministry while continuing the Pequeños Científicos project
- Learn from the current evaluation and carry out an evaluation on the impact of the programme. Collaboration with other programmes to develop evaluation instruments that could be used in all the countries using IBSE and LAMAP strategies
- Involve graduated students into research about the programme, its fundamentals and impact.

Summary of factors responsible for the programme's success :

- Having a strong academic foundation, using results of research in science education to design and implement training strategies,
- Continuous review of results and evaluation of the workshops and materials.
- The relationship with the Ministry of Education. In Chile and Panama, the Ministries took the lead of the project that has thus been deployed in the whole country. In the case of Colombia, the University is now working with the Ministry. In cases where there is no partnership with the Ministry, it is important to mobilise a large part of the educational system; for example, the structures responsible for the teachers' training (but in Colombia, several universities are in charge of this training, and do not always have the same viewpoints and priorities).
- Arrive in the schools with the sufficient materials, with a precise teaching programme for the teachers

Idea for research topics, basic or applied, that could be useful for the programme :

Research would be important to

- Develop better materials, to measure the impact of the programme and especially to create more effective training of teachers.
- Better understand relationships between math and science in the curriculum
- Better understand how to include arts as part of a STEAM strategy and how to include language and literature into the development of science education.



An Inquiry-Based Science Education class in Vietnam

Ciencia en la Escuela: pupils becoming scientists in Venezuela

Summary : In the process of reforming science education, Venezuela has chosen to adapt the pedagogy developed by the French Foundation "La main à la pâte": Inquiry-Based Science Education (IBSE).

AUTHOR(S)

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Report written by :
Alice Balguerie

PROGRAMME

Start date : September 2005

Implementation site : Venezuela

Budget : 7000 €

Source and specificity of funding :
Academy (public), Polar and Dorta
(private organisations)

ORGANISATION(S)

Academia de Ciencias Físicas,
Matemáticas y Naturales
(ACFIMAN)

Apartado Postal 1421

1010 Caracas

<http://acfiman.org>

Employees : 30

Volunteers : 0



REVIEW COMMITTEE

Date of proofreading : 2015/05/11

Opinion of the Committee : *Should be generalized !*

Solution(s) : *Education*

Participant : *Academic, research Institute*

Beneficiaries : *Pupil, students*

Field of action : *Science, Education, Training*

Country : *Venezuela*

Stature of the programme : *National*

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*To quote from a document published by RESOLIS : Hernández-Szczurek, « Ciencia en la Escuela: pupils becoming scientists in Venezuela », **Journal RESOLIS** (2015)*

BACKGROUND OF THE PROGRAMME

The Academy of Physical, Mathematical and Natural Sciences of Venezuela has been leading the project to renew science education in Venezuelan primary schools. With the support of the Foundation Empresas Polar, a first project was launched in 5 primary schools in Caracas. A trainer, who was an active or retired scientist, was assigned to each classroom to assist the teacher for two hours each week for the duration of a given topic.

In 2008, the Service of Cooperation and Cultural Action (SCAC) from the French Embassy invited a trainer from the Foundation "La main à la pâte" (Lamap) to lead a professional development course for about 50 primary school teachers and trainers in Caracas, with a view to finding bridges between the work of Lamap and the existing programme. The French and Venezuelan Academies of Sciences signed an agreement in 2009 to launch "Ciencia en la Escuela. Educación en Ciencia Basada en la Indagación". The two projects are fairly similar since both of them implement Inquiry-Based Science Education (IBSE), but the Lamap programme is more flexible.

GOALS OF THE PROGRAMME

- Develop a model of teaching and learning of sciences, based on inquiry and experimentation, which equips teachers with appropriate teaching strategies
- Enable students to participate in the development of experiences built on their previous knowledge, and develop their capacities to make observations, questions, and also to communicate and argue about their views and results.
- Develop children's ability to explain the world around them through inquiry-based methodology

IMPLEMENTED ACTIONS

- Translation of Lamap materials into Spanish and adaptation to the primary education curriculum.
- Creation of new pedagogical resources, following Lamap guidelines and experiences from the working group.
- Organisation of trainer groups composed of university teachers and scientists to design the training sessions and to write teaching modules for natural sciences in primary schools.
- Creation of a pilot centre that gathers the material and resources for the teachers and training. It is a place where teachers and students from different schools can exchange their ideas and experiences.
- The teachers are trained during three years: nine workshops of 8 hours each and are supported by a trainer or a scientist to implement the new method (20 to 50 hours per school year). After the three years of training, teachers can still call trainers or scientists for help according to their needs.
- Partnership with a school in France in order to improve foreign languages and science classes, and to create a relationship between the students by videoconferences.

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

- 14 trainers and 2,500 teachers trained since the beginning of the programme
- 55,000 students aged between 6 and 12, from the first to the sixth grade, have gone through the programme
- The program is more implemented in urban areas because transport is more developed. But efforts are made to reach rural teachers too.
- One evaluation of the pilot centre was conducted in 2012, and concluded:
 - The success of the program depends on the involvement of the management team
 - After the first training, it would be good to support the teachers to plan their lessons according to IBSE
 - With IBSE, students are more active in class, and can experiment scientific processes. They learn better and are more interested in science.
- Another evaluation was led by a Lamap trainer in 2013 and concluded:
 - Good use of IBSE in schools and in teachers' training
 - Activities could be better prepared and thought through to consolidate students' learning. Teachers should be better trained on how to prepare such activities, and should receive specific training to improve their knowledge on sciences.
- Overall, the teachers tend to appreciate the IBSE methodology, and keep using it even several years after their training.

COLLABORATION WITH LAMAP

Since 2008, Lamap has organized six professional development workshops in Venezuela, an international seminar (2010) and has conducted an evaluation.

Lamap should help other small countries that are interested in implementing IBSE, for example in Central America. It would be useful to develop a Spanish version of the Lamap website so that more Spanish-speaking teachers could have access to the resources. More collaborative programs could be carried out between countries (exchanges of practice between teachers via videoconferences).

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

- Academic support and help in the conception of the training modules: Academia de Ciencias Físicas, Matemáticas y Naturales; Lamap; La Ciencia en tu escuela (Mexican Academy of Sciences)
- Financial support from Empresas Polar Foundation, Francisco Dorta A. Sucesores C.A and Total
- Inter-American Network of Academies of Sciences: provided the opportunity to exchange with other countries.

FEEDBACK

Difficulties and/or obstacles encountered during the programme's implementation :

- The Ministry of Education knows about the programme but does not finance it, while they could expand it to many other schools
- Most of the classrooms do not have the facilities needed to develop experimental activities. Although schools do have access to the internet, connections are poor, which is an impediment for the pupils to carry out some researches.

Solutions used to overcome the difficulties and/or obstacles :

- Provide materials to schools to improve facilities for science classes, provide science books for the library, etc., thanks to the support of private partners and of the Academy of Sciences. Three resource centers have been created in the regions of Valencia (Carabobo), Miranda and Caracas to simplify the delivery of materials especially to rural schools.
- Adapt the strategy according to the needs of the schools: the training is organized according to the teachers' needs.

Suggestions for future improvement :

- Strengthen the relationship with the Ministry of Education to get academic and economic support
- Establish a stronger cooperation with Colegio Francia in Caracas to exchange experiences, resources, etc.

Summary of factors responsible for the programme's success :

- It is crucial that the headmaster and the teachers of the schools involved in the programme are interested in it.
- The quality of the materials given to the teachers.

TO KNOW MORE

-With IBSE, students progressively develop key scientific ideas through learning how to investigate and building their knowledge and understanding of the world

Experimenting with science in Cambodia!

Summary : Since 2002, the "La main à la pâte" Foundation has helped Cambodia to develop and implement a new method of science teaching based on an investigative approach. Initially only intended for bilingual franco-khmere primary school classes, the program then spread out to all primary schools on a voluntary basis for levels 4, 5 and 6.

AUTHOR(S)

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PROGRAMME

Start date : 2002
Implementation site : Cambodia
Budget : 18000 €
Source and details on funding : Charles and Rodolphe Merieux Foundation

ORGANISATION(S)

Institut National de l'Education
123 Boulevard Norodom
Phnom Penh
<http://www.moeys.gov.kh/ine/fr/index.html>



Employees : 3

Volunteers : 0

Report written by :
Alice Balguerie

EDITORIAL COMMITTEE

Date of proofreading : 2015/04/19

Opinion of the Committee : *High impact !*

Solution(s) : *Education*

Participant : *Public institution*

Beneficiaries : *Pupil, students*

Domain : *Science, Education, Training*

Country : *Cambodia*

Stature of the programme :

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*To reference a document published by RESOLIS : Khim, « Experimenting with science in Cambodia! », **Journal RESOLIS** (2015)*

BACKGROUND TO THE PROGRAMME

As part of a French cooperation with Cambodia, the La main à la pâte Foundation (Lamap) method has been applied since 2002 in bilingual franco-khmer classes at the request of the University for Francophones. This method promotes the learning of science through an investigative approach: students learn by experimenting, just like scientists. For the purpose of rolling out the project, the National Institute of Education took over the project in July 2006 which then became a national program of the Ministry of Education, Youth and Sports (MOEYS), for all primary schools on a voluntary basis (initially only for grade 6). Since then, a work plan is written each year in order to follow the further development of the program and the training of teachers.

OBJECTIVES OF THE PROGRAMME

- To allow children to learn by experimenting. Traditionally, science is normally taught like reading.
- To adapt the Lamap method to the context of Cambodia.
- Objectives have developed: initially, it was to increase the quality of the teaching of sciences in bilingual primary schools (6th grade), then it developed across schools on a volunteer basis and was extended to grades 4 and 5 in primary schools.

IMPLEMENTED ACTIONS

- Between 2002 and 2004, 5 Cambodian primary school inspectors received a week of training per year by trainers from La main à la pâte (Lamap): to control teaching methods, train teachers and develop suitable teaching resources.
- 2005: training of teachers in 9 schools in the bilingual program (only grade 6 of primary school)
- From 2006: extension of the programme to voluntary non-bilingual classes. The 5 trained inspectors have developed educational resources with the help of Lamap trainers in French, then translated them into khmer. The idea was to develop activities and resources which correspond with the Ministry's programs. The trainers present the program to schools, and if the school wants it, they receive training with other schools. Teachers are trained for four days, for 7 hours per day. All the teachers are trained together (regardless of the level they teach) because they are brought together to have a variety of levels. The schools together make up a group and one of them is responsible for the management of the teacher tool kits.
- Priority is given to rural schools because schools in urban areas have more tools and support available.
- From 2010: extension of the programme to the 5th grade of primary school (development of new teaching resources)
- From 2013: extension of the programme to the 4th grade of primary school (development of new resources) and training of new trainers in 10 provincial Educational schools.
- January 2015: Evaluation of the program by 2 Lamap trainers

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

- 11 teacher tool-kits created for grade 6 of primary education; 6 for grade 5. 2000 educational guides produced for each of the grades.
 - 22.694 students have benefited from this approach since the beginning of the programme, in 140 schools
 - 590 teachers trained since the beginning
 - 10 Provincial Educational Schools trained according to Lamap pedagogy.
 - The teachers are satisfied and find that children learn science better. They are all continuing to use the educational resources.
 - The trainers at the educational schools already knew the IBSE method (Inquiry - Based Science Education), but the resources developed with Lamap are more practical.
 - Results of the assessment conducted in January 2015 are still forthcoming
-

COLLABORATION WITH LAMAP

The "La main à la pâte" Foundation have strongly supported this program in Cambodia: training of trainers, help for the development of educational resources, support with the preparation of funding applications and annual work plans. The trainers from the pilot centre in Bergerac (France) have been very involved since the beginning.

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

- Laos and Vietnam are to develop the program regionally. Laos: have been given the modules and educational resources developed so that they can be inspired to develop their own resources
 - 10 provincial Educational Schools (25 in total in Cambodia)
-

FEEDBACK

Difficulties and/or obstacles encountered during the programmes implementation :

- Difficult to find funding. The Christophe and Rodolphe Mérieux foundation has provided financial support since 2005 but the grant ended in July 2015.
- Number of children per class is sometimes very high: around 40-50 on average (it is rare to have only 30), and in isolated schools there are up to 70 pupils due to a lack of teachers.

Solutions used to overcome the difficulties and/or obstacles :

- Chose to work with schools where there are only 30-40 students per class, since otherwise it is not possible to apply the pedagogy
- Look for new funding, and seek the help of Lamap in this process

Suggestions for future improvement :

- Continue the generalisation of the program in the country. Extension to other grades and other groups of schools.

Summary of factors responsible for the programmes success :

- Need to have funding. In Laos, there is no specific subsidy for the program, the program has difficulties in developing properly.

Experimenting Inquiry-Based Science Education in South Africa

Summary : The Academy of Sciences of South Africa has launched a pilot project to implement Inquiry-Based Science Education in primary schools, in collaboration with the French Foundation "La main à la pâte".

AUTHOR(S)

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Report written by :
Alice Balguerie

PROGRAMME

Start date : 2012

Implementation site : South Africa

Budget : 10000 €

Source and details on funding :
Gauteng Department of Education,
French Embassy

ORGANISATION(S)



Académie des sciences d'Afrique
du Sud (ASSAf)

De Havilland Crescent

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<http://www.assaf.co.za/>

Employees : 40

Volunteers : 0

Members : 433

EDITORIAL COMMITTEE

Date of proofreading : 2015/05/11

Opinion of the Committee : *Should be generalized !*

Solution(s) : *Education*

Participant : *Academic, research Institute*

Beneficiaries : *Pupil, students*

Domain : *Science, Education, Training*

Country : *South Africa*

Stature of the programme : *National*

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To reference a document published by RESOLIS : Mpiyakhe, « Experimenting Inquiry-Based Science Education in South Africa », ***Journal RESOLIS*** (2015)

BACKGROUND TO THE PROGRAMME

In 2012, policy makers in South Africa wanted to increase students' participation in science education, and after a benchmark of the existing programmes, discovered the French Foundation "La main à la pâte" (Lamap). The Academy of Science of South Africa designed a strategic plan to adapt Lamap pedagogy (Inquiry-Based Science Education) to the South African context. A three-year pilot project thus started in 2013 to implement IBSE in 10 primary schools in one district in the North of the country, first for the 4th grades and then also for the 5th and 6th.

OBJECTIVES OF THE PROGRAMME

Pilot project's objectives:

- Improve science education
- Implement IBSE, using the French materials and adapting it to the South African curriculum
- Improve teachers' training
- Monitor and evaluate the pilot project and extend it if the results are conclusive.

IMPLEMENTED ACTIONS

- Visits of a French school in Johannesburg to observe Lamap pedagogy. This pedagogy promotes Inquiry-Based Science Education: students progressively develop key scientific ideas through learning how to investigate and building their knowledge and understanding of the world.
- November 2012: first training session of South African trainers (volunteers) by French trainers from Lamap
- 2013: first year of implementation of Lamap pedagogy in the 4th grade in the pilot schools
- Training of teachers: at the beginning of each school term, a topic from science curricula is chosen, and teachers are trained on this subject for half a day. Teachers are given the needed materials. Trainers then visit the schools during one week to help the teachers implementing the new methods.
- 2015: extend the program to 5th and 6th grades in the same pilot schools. Teachers will still be trained all together as they often change levels they are teaching in.
- In other districts in the same region as the pilot district: provide lessons to science facilitators and science teachers to present IBSE (just an introduction to incite them to attend the next training).

QUANTITATIVE AND QUALITATIVE RESULTS FROM THE IMPLEMENTED ACTIONS

- 5 trainers trained by Lamap (not all of them are now involved in the pilot project as some work in other districts). For the moment, no training of trainers by South African trainers.
 - In 2014, an internal evaluation made thanks to questionnaires given to trainers and teachers revealed:
 - An increased level of commitment from the trainers and teachers, compared to 2013
 - The scheduled school visits after each training session seemed to have boosted the teachers' confidence as they felt supported
 - Not all the teachers are equally dedicated to the programme
 - Students enjoyed the new methods, but need to be guided and taught to think critically
-

COLLABORATION WITH LAMAP

In contacting Lamap, the Academy of Science of South Africa expected help for the training of trainers, for the development and the implementation of the pilot project, and key advice to find partners. Lamap trainers came twice for 10 days, and helped to find funding allowing the project to go on after 2015 (proposal made to the European Union). But the Academy wish they had more advice for the establishment of a pilot centre and to find relevant partners.

In order to improve its international cooperation, Lamap could send the trainers for a longer period (instead of a week) so that they can help the trainers when they first train the teachers to IBSE.

PARTNERSHIP(S) DEVELOPED IN THE CONTEXT OF THE PROGRAMME

- University of Pretoria: teacher's training and research
 - Gauteng Department of Education: financial support, chose the pilot schools, monitoring
 - French embassy: financial support, put in touch with Lamap and the French school
 - French school: welcomed trainers to observe
-

FEEDBACK

Difficulties and/or obstacles encountered during the programmes implementation :

- Trainers were not confident enough after the first training.
- Teachers needed more than one training: they lacked of experience, and did not feel fully prepared and trained
- Large number of pupils per class (35-45). It is very challenging for the teachers; they would need an assistant, but it is not possible.
- Shortage of funds

Solutions used to overcome the difficulties and/or obstacles :

- Instead of extending the program to 5th and 6th grades as planned, the same teachers were trained to help them gain confidence.
- Find new funding (e.g. European Union)

Suggestions for future improvement :

- A greater involvement from the Gauteng Department of Education
- Extend the programme to other districts and provinces

Summary of factors responsible for the programmes success :

- The trainers have had the will to improve the programme continuously, and have therefore been attentive to remarks and feedbacks from the teachers
- The availability of Lamap trainers, even after the training.
- The strong partnership with the French embassy and the French school
- Dedication of the trainers



FONDATION

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