To Learn Teaching Technology and to Become Primary School Teacher:

The Question About Technology for Age Groups 5–12 in France

Joël Lebeaume
École normale superieure de Cachan, France

I hope to try to raise the question about technology for primary school and nursery school in France. But this question is linked with the question about primary schools teachers pre-and-in service training because there are no many activities in classrooms, with pupils. In a first time, I should show how is defined technology for primary schools and nursery schools and what it is as a primary school matter, as a subject matter. I shall try to give reasons that legitimate this compulsory education and reasons that can explain the little of practices. In a second time, I have to describe the new teachers training process in France. And in a third time, I should like to analyze the specific question about teachers training in order to teach at primary school.

I. Technology at School

To examine this double question, it is important to define what are subject matters at primary school in order to show the differences between academic subjects and subjects designed and organized for young pupils (5–12 years old)

a) An historical point of view

It is also essential to understand when and how technological education was born, how this new subject has been integrated in primary school curriculum, and to discern ruptures and continuities in the traditional ideas about education for young pupils.

In France, primary school had been organized in two periods. At first (1880), the primary school was the people's school, compulsory, secular and free. It was necessary to learn all things which everybody may not unknown. Primary school teach science and manual-work in order to know the reasons of things and the reasons of doing. Science was often applied sciences in hygiene, domestic economy and agriculture. Different for girls and boys handwork was an initiation in the work ethic. During this period, pedagogical ideas had promoted new teaching models and active methods and progressively defined scientifically education, first with observation lessons.

From the lee 1959, which had raised of the school-leaving age until 16years, progressively primary school has changed and has become school for children. In this second period modernity has impliqued new contents of general sciences and the question about technological education was born. The newborn stage of elementary school technological education has been linking with scientifically education. About 1980, it appeared physics technology in teachers training. During this same period, manual-work had become rather a esthetical activities than technical activities and in 1985was dead. Technology appears as a matter in junior high school and was included in science-technology for primary school.

b) An area for pupils

Today, "Technology" doesn't appear as an alone subject but is included in an area, which is called with different names in compulsory school. In the new curriculum (1994) this area is for age groups 3–5 "to discover the world", for age groups 5–8 "discovering the world" and for age groups 8–11 "sciences and technology". The overview of this curriculum is following:

- to discover the world
  discovering the world of things
  discovering the world of shape
  discovering the living world
  discovering the natural and human space
  awaring of hygiene, security, consumering
  the time which spend
  the world of pictures

- discovering the world
  the space and different landscapes
  the time and the life of men
  the world of shape and things
  water, air, using of thermometer in the daylife

using usual technical things
dismantling-reassembling, making, using tools
using electrical machines (4,5 or 9 V)
the world of living
the citizen life

- science and technology
unity and diversity of the living world
human body and health education
sky and earth
things and technological making
electrical assembling
mechanisms
objects and produces
computing

Junior high school is organized with three stages and currently ”technology” is defining with a new curriculum, which has two parts: technical project and process, and computing technology. Teaching is about 1,5 or 2 hours per week. For age groups 11–12, pupils have to discover and understand how to use machines in mechanics and electronics with making some things and have to understand how products go to customers with a trading point of view. In this class, they learn word-processing during about 10 hours. For age groups 12–14, teaching begin to learn technical process with four technical projects related genuine technical practices and with a technical significance as they refer essential elements of contemporary socio-technical processes in industry and services. Currently this curriculum is discussing by teachers, parents and different experts… Probably, for age groups 14–15, technology will be focus on one technical project designed by pupils. In this last class, pupils will interpret social-technical practices with conceptual tools progressively learn preceding years.

This organization square with a gradual differentiation of subject matters for pupils. However, at primary school the technological point of view has to be identified by teachers because they must be able to discern when they are teaching technology, physics or biology during activities that they propose at school.

Jean-Louis Martinand propose a model for this teaching (1995). For him ”technological education must provide both for practical familiarization with projects, processes and roles and for the intellectual work necessary for technological thinking”. At primary school, making is very important but alone is insufficient because pupils have necessary to build first intellectual tools to analyze technical world and technical things.

c) Aims for technology at primary school

It here is a political point of view. Politicians ascribe main aims to technological education from nursery schools to primary schools: (a) to discover practically world which is technical, (b) to aware designing, making, transforming methodically, (c) to have some capacities with computers, (d) to use and to communicate by different means (boards, graphs, drawings, diagrams…). These goals help children progressively in order to understand the world where they live and to act on it. However, in France the question about technological education is not at this level. It is at the implementation level, i.e. in classrooms with teachers and pupils.

d) Practices at school

Science and technology teaching appears enough difficult because there seldom practices at school. It is a basic truth to say that graduate of teachers, time, money, materials, tools… are some brakes. Indeed there is two levels of decision about curriculum: national level (ministry) where programs are defined and local level (classroom) which is the implementation level.

Studies carried out show also that teachers think science-technology as an illegitimate subject matter and don't always see interests for the child's education or his development. They consider then that this matter is a matter for junior high school and thus unnecessary at primary school. Nevertheless for about 1975, almost all activities for primary school have been designed and tested with pupils in a research at the national educational research institute (INRP) and at university (LIREST) and they always are interesting for primary schools.

New programs have been written in order to increase practices. They are simplier, clearer and more precise. New schoolbooks propose activities linked with most of points of these programmes even if they trend to separate matters in the school costumes and traditions. But it is too soon to estimate new programmes implementation, and probably new teachers have to grow up this school matter: to discover the world, discovering the world and science and technology.

II. Creating of University Teachers Training Institutes

a) a new process of teachers training and recruiting

In 1992, the university teachers training institutes (IUFM) have been creating in order to promote primary teachers similarly as secondary teachers. Nowadays they

have the same grade (degree: 3 years after bachelor) and when they are teachers they are played the same. An other reason is about the university training teachers as in many states today.

Creating IUFM has changed also teachers recruiting. The new process can be draw in the diagram appendix 1. The main points are:

- the competitive examination is open for graduate candidates;
- it is open for IUFM students but also for every body;
- all laureates become civil servants and there is vocational training at IUFM during one year;
- after this year of training, they are established and become primary schools teachers.

b) much people wish to become primary teachers

Every year, there are about 10 000 posts and 40 000 candidates. Among the laureates, there are about 70% of IUFM students. Among the other 30%, 10% are students, 6% have a job in education sector and often are unestablished, 7% are without job, 4% have a job in trade or industry and 3% are ”mother of three children” for example. (1994)

c) the competitive examination

It is not a national competitive examination but a regional competitive examination. There are tests in mathematics, French, sports and two optional tests-paper. One is chosen between ”arts”, ”music” or ”custom languages” and the other one is chosen between ”physics-technology”, ”biology” or ”history-geography”. Among laureates, only 10% have chosen ”physics-technology”.

This weakness can be explained by the young teacher’s graduates, as this following board:

	Graduates	% 1994	% 1993
Human sciences	3132	33,2	*37,1*
Biology-geology	1311	13,9	*12,1*
Languages	1054	11,2	11,4
Economic sciences	933	9,9	9,4
Literary	818	8,6	10,3
Mathematics, physics, chemistry	505	5,4	3,6
Politic sciences, law	439	4,7	6,0
Engineering sciences	390	4,1	1,4
Arts	249	2,6	2,9
Sports	221	2,3	3,0
Health	221	2,3	1,6
Social carreers	221	1,7	1,2
	9432	100	100

d) the physics-technology test-paper

Each test-paper has three parts with the following objectives:

in order to prove knowledge's in subject matter:
part 1: knowledge's in subject matter. The level is about at the end of junior high school
in order to show some vocational teaching capacities:
part 2: analyzing pupils results, particularly drawing or written traces
part 3: proposing activities and pedagogical organization.

Our own study (Lebeaume & Martinand, 1996) of these test papers shows what candidates must know, i.e. which knowledge and capabilities authors whom are also teachers-trainers consider essentially.

	Questions	Number	%	%		
Academic Knowledge	Application	5	11%	45%		20%
	Concepts	8	18%			
	Contents	7	15%			
Methodological knowledge	Experimental method	17	38%	55%		
	Scientific process	2	-			
	Technological process	6	13%			
Total		45	100%	100%		

Didactical Knowledge	Pre-conceptions	6	27%			10%
	Learning process	3	14%			
	Epistemology	13	60%			
Total		22	100%			

Programs	Identifying age and level in primary school	13	10%	10%	10%	70%
Theme, topics	Listing and planning Pedagogical exploitations	17	13%	21%	20%	
	Proposing implementation	11	8%			
Lessons	Describing pedagogical process, teacher and pupils roles	35	26%	28%	70%	
	Proposing material organization	3	2%			
Pedagogical purposes	Defining objectives	21	15%	18%		
	Assesment	3	2%			
Pupils tasks	Designing document for pupils	14	11%	22%		
	Choosing document for pupils	6	4%			
	Proposing pedagogical materials	10	8%			
Total		133	100%	100%	100%	

TOTAL		200				100%

Some topics are preferred in these test-papers: electricity, mechanics and astronomy, perhaps because these subjects are easier to be in a test paper but also because there are among the most numerous activities at school.

But these test-papers already train the question about teachers training because there is some distance between areas of competitive examination and areas taught at primary school.

III. The Question About Primary Schools Teachers Training

With creating IUFM, primary schools teachers training specially for science and technology teaching has been become a topical question. Ministry has organized symposium and encouraged innovations in order to increase scientifically and technological practices at school and in order to find new ideas in teachers training.

a) the components of the question about teachers training

The previous analysis shows the essential components of the question about teachers training, as it is following:

1. primary schools teachers training concerns rather the second year at IUFM
2. thus, it is a professional training
3. at IUFM, it's only a pre-service training
4. teachers professional training needs periods of training in primary schools and periods of training in the institute
5. there are only about 20 or 40 hours to train in science and technology at institute
6. in IUFM there are teachers-trainers which are either primary schools teachers, or physics teachers, biology teachers and technology teachers or didactic professors
7. there is a long tradition of teachers training in the "écoles normales" preceding IUFM
8. primary schools teachers have to teach the whole of compulsory school matters
9. the purpose of primary schools teachers training is not only training science and technology teaching but must give primary schools teachers with their specific
10. currently, there is only a few teachers which are teaching science and technology in their classroom

11. there are many available activities in school books
12. ministry is organizing new programmes to age 3–16 years and want that pupils learn science and technology before junior high school
13. the most of students say that they are afraid or don't like sciences and don't know teaching technology

b) three trends of answers

This comprehensive view is showing that question is complex and difficult. However if we think that it's possible, we have to research the best answer to design training. Generally, two answers are given.

The first one is considering that new teachers don't have knowledge in the subject matters. Thus pre-service training is designing in order to learn knowledge (in mechanics, astronomy, electricity, physics…) and trend to forget specific aspects of professional and vocational training. To learn teaching science and technology is considered only as a question for the in service training. This point of view is not really reasonable for at least two reasons:

- to learn knowledge needs a very long time and without doubt it is impossible to learn in only a few hours the whole of knowledge in the large area of science and technology even at a basic level;
- to transfer to in-service training is enough dangerous firstly because there is no much practices in classrooms and secondly because in-service training is not compulsory but only organized for voluntary teachers. Thus, this designing emphasize the idea that science and technology teaching is allowed as an optional matter.

The second one hope to give young teachers a good idea of science and technology teaching in order to reconcile them with this area that often they avoided studying during their school time. This point of view is not very good in order to satisfy teachers training for also at least two reasons:

- on one hand it is not sure that they will teach science and technology in their classroom with their pupils. Some studies about practices have shown that there was not a direct relationship between liking science and teaching it.
- on the other hand teachers training designed as training of person needs to do science and technology at a level different as primary school. Thus young teachers have to transpose activities for children and every body know that it is the most difficult.

These two answers are not sufficient. If they are necessary, they are not sufficient because each one deal with only one training aspect: knowledge or attitudes. But not any vocational skills or capabilities can only be knowledge in subject matters. Thus designing of primary schools teachers training must be essentially analyze in professional point of view.

c) teachers training in a vocational and professional point of view

The question about professional training for primary school teachers is the question about capabilities, knowledge and skills to be able to teach this area. What is a primary school teacher? He is neither a technology teacher, nor a physics teacher, nor a biology teacher, nor an history teacher… He is a specialist of educating and teaching for children 3–11 years old. In order to raise the question, Jean-Louis Martinand says ”an ignorant person but competent to teach”. Then it is possible to examine the components of training and its organization and the question about widening and depth of this vocational training.

Jean-Louis Martinand (1994) propose an answer which is only oriented by the professional training in according to three directions: the direction from the norm i.e. reglementation and prescription; the direction from the practice in the classroom and the direction to examine ”teaching science and technology” critically i.e. with didactic tools to interpret and understand either tasks or children’s difficulties. With this answer, it is easier to design curriculum for primary schools teachers training both during periods of training in primary schools and periods in the institute of training teachers. It is also easier to organized the interventions of the different experts of the training: specialist of teaching with children specialists of didactic, specialists of academic subjects and inspectors.

However, it seams necessary to examine if and how teachers-trainers are ready to change their practices of training…

IV. Conclusion

In France, currently the main question is generalizing science and technology teaching from nursery schools to junior high schools. We think that pre-service teachers training is only a professional training in order to build specifically abilities concerning science and technology teaching. Designing this curriculum of training implies to consider primary schoolteachers as specialists of educating and teaching for groups age 3–11.Thus, it is essential to raise at least three questions:

- the question about the school matters;

- the question of the place of science and technology and its relationships with the other matters in the curriculum;
- the question of the partition of the training which can not only be neither the one of academic subjects matters, nor the one of the teachers-trainers, nor the one of training in classrooms and training in institute, nor the one of pre-and-in service training.

I have been trying to give some elements to define widening and delph ofthis training. And I think that the question about technology teachers forjunior high school is enough similar.

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