CHANGES IN THE CONCEPT OF TECHNOLOGY OF ELEMENTARY SCHOOL TEACHERS AFTER THE TECKIDS PROJECT

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Abstract. *This paper presents the results of a project named teckids applied in a group of eight working teachers of Elementary School in the cities of Americana and Leme in the State of São Paulo. It had as objective to classify, through a qualitative analysis of case study, the opinions that they present on what it comes to be technology. The results show that after the application of the project, the teachers had started to accept the innovations presented and the activities developed with the students were in accordance with many Inter and multidiscipline proposals presented in the Parâmetros Curriculares Nacionais -PCNs. Therefore, the project mobilizes in the students same individual abilities and competences shared with the group in the way to search for a solution of the presented problem.*

Keywords: Teckids Project, technological education, elementary school.

1. Introduction

In the past decades, many countries have made affords to introduce Technological education onto the scholastic programs, either with a customized approach or by adapting international programs en vogue. This attempt has been gaining strength and followers, as well as broadening its scope of action. Nonetheless, despite all that has been discussed about inserting Technology as an element for curricular innovation, there is still a lack of concrete attitudes in the classroom aimed at putting students in contact with it (Solbes & Vilches 1997; Garcia de Ricart, 1999; Gustafson, et al, 1999; Silva e Barros Filho, 2001; Barros Filho *et al*, 2003; Veraszto *et al*, 2003a; Silva *et al*, 2003). What can be observed is that the initiatives proposed so far is the mere contact of students with state of the art technological products manufactured for commercial purposes, in order to make students learn how to use them or how they work. (Lion, 1997; Silva *et al*, 2000).

Another characteristic, which is evident, is that technology teaching is sometimes disguised, and technology is treated as a mere application of mathematical and scientific concepts (Valdés y Valdés *et al*, 2002; Maiztegui, 2002; Gordillo e Galbarte, 2002; Acevedo Díaz, 2002, 2003), in which students are induced to simply repeat the experiences shown in manuals, but which by no means constitutes real Technological Education.

As an attempt to bring some contribution to this area, the present work was developed initially with the aim of filling in the gaps left by a countless number of proposals. It is an effort to put into effect, in a concrete manner, Technological Education that would put these interaction tendencies into practice in our academic community. In our earlier work (Barros Filho *et al*, 2003; Silva *et al*, 2003; Veraszto *et al*, 2003a, 2003b, 2003c) we sought to develop and apply technological activities onto Elementary School as a means of educational innovation, that would make possible for the students to have a more critical view, pointing into the right direction for the insertion of technology into the classroom. We came to realize that that for the work to be comprehensible in the way we expected, we must not forget about the teachers. In order to do that, a course was created, in which besides the fundamental objective of capacitating teachers working with Technological Education in Elementary School, we would be able to establish a dialogue and negotiation with the teachers. Since the activities developed and presented in earlier papers are of an open nature, and very different from the Natural Science and Technology syllabus of Elementary School today, we tried to eliminate any possible insecurity, which may arise.

When the elaboration of the course took place, we also had to take into consideration that the misconceptions about what technology is could only be lessened if we respected the necessity of such teachers to develop their formation, as they have shortcomings in the area of Science and Technology. Because of that, the course was conceived in a way that would not disturb the routine activities of the schools, nor interfere in the student's teaching/learning process.

2. A Course to Capacitate and Improve the Skills of Elementary School Teachers

As an attempt to avoid the repetition, by the teachers in their classrooms, of situations in which technology is wrongly introduced in the educational context, we adopted the course structure, which is described in this paper. As this is still a proposal that is being applied and improved, we decided to present here only the general structure of the course, with emphasis on some objectives which are relevant for the capacitation of Elementary School (ES) teachers, as show in exhibit 1.

3. Methodology

In order to analyze the data, we shall pursue a content analysis following an intrinsic referential, under the light of the theoretical formulation aspects of Bardin (1991) in which we try to: 1. organize the material collected and make a "fluctuating" reading, in order to obtain a categorization of the data obtained; 2 codify the data obtained, transforming raw data, through aggregation (choice of categories) and enumeration (choice of counting rules) in order to achieve a representation of the contents, or its expression, prone to the clarification the characteristics of the data; 3. distribute the analyzed data components by item or category, classifying by differentiation and regrouping around either pre-established or new criteria. (Bardin, 1991).

4. Classification and categorization of the opinions of teachers about what Technology is.

Due to the fact that the term Technology is interpreted in so many different ways and, most of the time misinterpreted, it was essential to begin the course by asking the teachers to answer an open questionnaire, which was aimed at gathering their impressions on technology. This was done with the objective of conforming the course according to the conceptions and beliefs of teachers on technology and promote discussions in order to eventually reach a consensus that would then direct the activities.

The course was initially conceived for seven teachers working at ES in the cities of Americana and Leme in the state of São Paulo, of which, only four completed the course. The number was small because we wanted to follow the application of the activities suggested during the course in each classroom, with the students. Initially the teachers were

asked to write comments on a list of Likert assertions (Exhibit 2), developed from modifications introduced on the work of Silva e Barros Filho (2001).

Thus, all the posterior analyses will be based on the whole development of the course, as well as the written material collected. We have selected some excerpts of the teachers' accounts, which are relevant to our objective of investigating the views of teachers on what technology is. Along with the opinions of teachers, we have chosen to start classifying, in the same exhibit (Exhibit 2), each of teachers' accounts, also based on some factors, which will be explained on the next topic (Exhibit 3), defined by Silva e Barros Filho (2001) in their previous work.

Exhibit 1: structure and objectives of the capacitation course for teachers working in Elementary School

Steps/ Hour load	Course steps	Data	Data collection instruments
Step 1 (4h)	- Listing participant's conceptions about science and technology participants - Reading of a text about Science, Technology and Society - Presentation of open practical problem situations	- Teachers' pre-conceptions about what technology is - Teachers' pre-conceptions about how one can teach technology in Elementary school	- Likert scale assertions (Silva e Barros Filho, 2001) to which teachers will respond in written form; - Transcription of film or sound recording
Step 2 (4h)	- Development of practical activities with the teachers - Presentation of solutions - Teachers are asked to work in small groups to conceive problem situations	- Adaptations of problem situations to the reality of each school;	- Film or sound recording
Step 3 (4h)	- Discussion of results obtained - Preparation for classroom activities with ES students	- Results of the application of the activities in class.	- Self-evaluation of the process (course, development and application of activities in the classroom). - Transcription of film or sound recording
		- Results of the application of the activities with the teachers.	- Written activities with teachers Transcription of film or sound recording.
Step 4 (14h)	Application of problem situations in the schools (work presented in Barros Filho *et al*, 2003; Silva, Veraszto *et al*, 2003; Veraszto, Silva *et al*, 2003a, 2003b, 2003c)		
Step 5 (4h)	- Discussion of results obtained - Final evaluation	- Results of the application of the activities in class.	- Self-evaluation of the process (course, development and application of activities in the classroom). - Transcription of film or sound recording

Exhibit 2: teachers' opinions about technology and previous classification of the answers

Statements	Pi	teachers' opinions (Pi)	Factor	Classification of Factors
If I could, I would have a home with all modern technologic available, I'd choose those (equipments and devices) that have more functions and	P2	*"More comfort and less worries about cleaning (specially in relation to the time consumed)."*	Factor 2	Hope for improvement through technology
			Factor 4	Mastering technology
	P3	*"a different house – film, I love it, I 'd like to live in a house like that."*	Factor 7	Accessible technology
Technology makes relationships democratic.	P1	*"We can see the dynamics of the world and the relationships."*	Factor 1	Indications on what technology may be.
Technology is the application of scientific laws and theories and models.	P1	*"Moreover, it organizes human life."*	Factor 1	Indications on what technology may be.

Understanding Technology is not hard, because it is part of our daily life.	P1	*"I believe that the first thing is to understand its reason."*	Factor 8	No knowledge about the production of technology
Today there are technologies which can be acquired by many with accessible prices, such as cell phones, sound systems, microcomputers, etc.	P1	*"We see many people with mobile phones, even when they do not know how to use them, as many other equipment."*	Factor 3	Confusion between technology and technological artifacts
	P2	*"We can see clearly the families of students, who most of the time do not have money to buy school supplies but have CD collections and often watch movies in video."*	Factor 3	Confusion between technology and technological artifacts
	P3	*"Yes. When people seek more quality of life."*	Factor 2	Hope for improvement through technology
More problems will be solved with the advances in technology .	P2	*"We save time [...]"*	Factor 2	Hope for improvement through technology
Products manufactured with advance technology have bold or innovative form or design (style, shape).	P2	*"I agree, they are the majority in store windows."*	Factor 7	Accessible technology
			Factor 3	Confusion between technology and
	P3	*"Manual crafts are very important and combined with technology can complete one another."*	Factor 8	Does not know about Technology production
The manufacturing of products, with new technologies makes those products cheaper.	P1	*"I don't believe they are budget-accessible. I think that most of the time people invest out of a fad".*	Factor 3	Confusion between technology and technological artifacts
			Factor 8	Does not know about Technology production
Human being have control over the evolution of technology .	P2	*"It is the contrary."*	Factor 6	Negative view of technology
Modern equipment manufactured with the latest technology are more attractive.	P1	*"I believe its more a question of marketing than of beauty."*	Factor 3	Confusion between technology and technological artifacts
			Factor 8	Lack on knowledge know about Technology production
Today we live in a society that suffers constant impacts due to the presence of new technologies.	P1	*"Because for many people technology is about HAVING rather than BEING."*	Factor 6	Negative view of technology
	P2	*"Proof of that is the speed with which they become obsolete."*	Factor 6	Negative view of technology
			Factor 3	Confusion between technology and technological artifacts
	P4	*"In the classroom you can feel the presence of new technology, that is, we have students that have modern electronic devices[...]"*	Factor 3	Confusion between technology and technological artifacts
It would be better to give a more humanistic background than to teach children technology.	P1	*"It would be better to have a balance between technology and*	Factor 6	Negative view of technology
	P4	*"We can give a humanistic education through technology, when we make our students reflect about the use of computers, [...] what is good and what is bad about it."*	Factor 1	Indications on what technology may be.
Environmental pollution and destruction of the environment are a consequence of technology.	P1	*"I think that nature suffers the consequences of an imbalance between technology and ethics"*	Factor 6	Negative view of technology

Regardless of the price, if I had to buy a new mobile phone, I would look for one that had more technological resources and	P1	*"According to marketing this equipment should make life and use easier."*	Factor 3	Confusion between technology and technological artifacts
			Factor 7	Mastering technology
Inventors (people or groups who work out of their own necessities) produce technology and companies find applications for it.	P1	*"I think inventors seek for creations to facilitate and organize companies."*	Factor 8	Lack on knowledge about Technology production
We can teach technology by dealing with modern equipment (mobiles, computers, etc) in the classroom.	P4	*"Yes; one example is the microwave oven. We can work with mathematics: time."*	Factor 3	Confusion between technology and technological artifacts
Technological development brings greater leisure periods.	P1	*"Technology makes life easier, more organized and dynamic, but leisure to me is linked to the pleasure of experiencing the world".*	Factor 3	Confusion between technology and technological artifacts
			Factor 4	Mastering technology
	P2	*"I am talking about the moments of pleasure with my son. We go to the beach where there is no TV or cds."*	Factor 3	Confusion between technology and technological artifacts
	P3	*"O.K. we need leisure. Not stress."*	Factor 3	Confusion between technology and
			Factor 4	Mastering technology
	P4	*"No, but makes people study more in order to keep up-to-date with the latest technology."*	Factor 3	Confusion between technology and technological artifacts
			Factor 8	Lack on knowledge about Technology production
The development of technology increases the offer of jobs.	P1	*"Maybe one day this will happen but, at present, I think that the companies are not more interesting in decreasing labor."*	Factor 8	Lack on knowledge about Technology production
			Factor 6	Negative view of technology
	P2	*"Not all the population has access to this type of education, and is not prepared for the market."*	Factor 6	Negative view of technology
	P3	*"Yes. More options in the job market."*	Factor 8	Lack on knowledge about Technology production
The development of technology is at the service of the improvement in human life.	P2	*"We can point out Medical science."*	Factor 5	Neutrality of technology
	P3	*"Ok. Makes our lives more viable."*	Factor 4	Mastering technology
			Factor 3	Confusion between technology and technological artifacts
Technology makes people more isolated.	P1	*" Technology is just another aspect to be understood in the life of a human being."*	Factor 1	Indications on what technology may be.
	P2	*"I can give you as an example the hours I spend in front of the computer and my friends who trade parties for chat rooms."*	Factor 3	Confusion between technology and technological artifacts
			Factor 6	Negative view of technology
It is not important to teach technology.	P3	*"very important. Or do we want to be alienated?"*	Factor 2	Hope for improvement through technology

Technological knowledge is more and more inaccessible to common people.	P1	*"Evolution is constant and understanding is something we experiment."*	Factor 8	Lack on knowledge about Technology production
The environment will only be conserved if we develop technology.	P1	*"The environment will only be conserved when humanity sees it as their own."*	Factor 2	Hope and Neutrality
Our students "come" to the classroom with a greater knowledge about technology than people from our generation.	P2	*"Due to their electronic toys for which they trade for more traditional (folkloric) games and tovs."*	Factor 3	Confusion between technology and technological artifacts
	P3	*"That's for sure! Today the options with games are endless."*	Factor 3	Confusion between technology and technological artifacts
Technology provokes the destruction of the environment .	P4	*"No, provided it is well directed."*	Factor 4	Mastering technology
The more technology involved in a product or equipment, the better its quality.	P1	*"The more it facilitates human life the better its quality in life."*	Factor 4	Mastering technology
We live a moral and ethical crisis in the world due to the excess of technology in our lives.	P2	*"young people are distanced from their families, due to the lack of communication , there is an impression of an easier world."*	Factor 3	Confusion between technology and technological artifacts
			Factor 6	Negative view of technology
We can have access to new technologies through the purchase of adequate and modern equipment	P1	*"Buying is no use, it is important to understand it in our lives."*	Factor 8	Lack on knowledge about Technology production

5. Analysis of results

We have decided to add a new factor (factor 1) to the others defined by Silva e Barros Filho (1991), in a previous work conducted to classify the opinions of each teacher about the statements. Starting with the frequency count observed on Exhibit 2, we will now present a brief analysis of how teachers viewed technology at the time of the capacitation course (Exhibit 3).

In the light of the data presented before and in beginning with an analysis conducted according to the criteria defined in Exhibit 1, we were able to find that, when the course started, the majority of the participants did not know the meaning of the term technology, and many times related it with industrialized products. This is evident in the frequency count. We can observe that the greatest incidence of answers (18) shows great confusion between technology and technological artifacts.

Exhibit 3: Frequency count and classification of the opinions of teachers about how they relate to technology in their daily lives

Factor	Name of factors	Characteristics of each factor	Frequency
Factor 1	Indications on what technology may be.:	Based on our bibliographic review, during the preparation of this paper, some important points were enumerated and supplied a direction for the actual notions about the concept of technology. In some of the accounts, we could observe, even superficially, some considerations, which are pertinent to the true meaning of technology in our present society.	4
Factor 2	Hope for improvement through technology	Beliefs that the most recent products, technology wise, are better and that technology offers better conditions for human life. By analyzing the data, we also observe a possibility of increase in the job offer, with the development of technology running side-by-side with the needs of highly specialized professionals.	5
Factor 3	Confusion between technology and technological artifacts	Technology is believed to be something material or materialized in equipments and artifacts. And, since it is already available in artifacts, it can contribute for the democratization of social relations.	18
Factor 4	Mastering technology	It is believed that by dominating technology one can have more leisure. The mastering of technology, and here also, almost always combined with factor 3, i.e., the possession of sophisticated products, may bring benefits and make human life easier.	6

Factor 5	Neutrality of technology	The fact that technology is considered as a mere application of scientific elements also reinforces the idea that technology is neutral in the sense that it is applied science and produced by inventors who are not linked to any context of development demand.	1
Factor 6	Negative view of technology	Technology is harmful to the environment and isolates people. Several authors recognize this concept (Iglesia, 1997) as being a "satanic" vision of technology, i.e., associated to the intentional and destructive will of humanity.	9
Factor 7	Accessible technology	In a sense, also related to factor 3, this item reveals a certain tendency to consider technology as cheap products and easy acquisition, due to its great variety, which is available to society.	3
Factor 8	Lack on knowledge about Technology production	Inventors, generally stereotyped as alienated from society, whose objective is the greater good, such as Einstein, produce technology and this way solve problems. Furthermore, similarly to other factors (mainly factor 3) there is a generalized confusion between technology and its products, which are reduced to possible "applications" of Science.	10

With these results one might expect that another factor of great incidence would be the factor related with the lack of knowledge about what technology is (10), closely followed by the factor which points towards technology as malicious to society (9 occurrences).

Such results show that the trends shown by data described in previous works are confirmed in the most varied strata of society, even among teachers. And this proves that Technological Education can only be effective if conducted in a parallel and conjunct manner. Finding ways of integrating technology into the curriculum is not enough if we forget the capacitation of the teacher, the professional directly responsible for the formation of individuals. If the misconceptions, which have been perpetuated for so long, continue to exist, innovative activities conceived to educate students for a technologically advanced society will not solve the problem, since they will be applied from a distorted point of view.

Nonetheless, one of the basic objectives of the course was attained, precisely when the teachers were able to observe closely how the activities were developed with their respective students. From the whole inference process, we could reach the conclusion that all the discussions and practical activities conducted, during steps 1 e 2 of the course, were better understood by the teachers at the moment when they saw the process happening in the classroom. Thus, in our final meeting (Step 5), we were able to observe that the teachers finally began to understand the evolution of technology as a historical dynamic process. Therefore, it was only after the realization of how their students reached concrete solutions, after exchanging information, opinions, and conducting negotiations that the whole course started to make sense for each one of the participants.

This is made clear in the excerpts transcribed below, which were taken form the self-evaluation of two participants:

T1: "Working with this activity made it evident, once more, that such proposals allow much more global and enjoyable development and learning. [...] From a teacher's standpoint, I came to believe, even more, that we must let students be proactive in their actions and the teacher must also be active in his observations, in order to conduct possible interventions. [...]"

T2: "[...] An important point that I want to emphasize is the fact that such activities equip higher abilities for the performance in other areas of knowledge, as in the case of logical reasoning in face a problem situation, by giving opinions about any problems that my occur. Another aspect that I noticed very clearly, was the thrill of working concretely, leaving ready-made textbook concepts behind, as with this kind of work (in which nothing is imposed as absolutely correct), they were able to make choices and give opinions freely, according to their own reasoning."

6. Final Considerations

The course finished in a very satisfactory manner, as we were able to notice this evolution on the part of the teachers towards a greater understanding of how technological processes are directly related to intricate social relations. This way, it was evident that a certain "taboo" had began to be overcome, at least in the group of teachers involved in this course, and an "atmosphere" of prejudice, in relation to the term technology, which surrounded the group in the beginning, was beginning to clear up and gave way to a greater acceptance of the introduction of elements that are typical of the technological production process into the daily school routine.

Therefore, we believe that if we can use technology as an integrative and integration element in the syllabus, from the very early grades of the education process, significant contributions can be introduced in Elementary Education. However, for this to occur in order to optimize our intentions, it is fundamentally important that the teachers working in classrooms from grade 1 to 4, are apt and conscious of the benefits that Technological Education can bring.

In the attempt to establish a tangible link between academic research and classroom reality, and thus fulfilling the university's social role, we developed this course which is undergoing its final analysis phase, but whose preliminary results were presented in this paper.

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