

Fostering Sustainability to Promote Sciences in High Schools of Cote d'Ivoire

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Abstract

While researching on sciences acceptance in high schools of Cote d'Ivoire, we discovered its approximate knowledge by students. This reality highlights an alarming situation of sciences teaching in Ivorian high schools. Responsibilities are shared between teachers, students and policy makers and can be summed up in terms of ignorance or lack of willingness of students, issue of teachers' charisma and failure of the national education policy. Our study then came to the conclusion that science will only recover its real value at school if students are aware of its usefulness for their own benefits. For that, it would be an important stimulus to promote sustainability for which they have to play the main role, mastering technical and technological innovations. But this also is only possible in a significant improvement of sciences teaching environment.

Keywords: *Sciences Teaching; High School Students; Practical Experiments; Sustainability*

I - INTRODUCTION

The need to create the appropriate framework for a sustainable development is the priority of any country. Every single individual and organization have to play a role. Education as a social institution is a platform where intelligence, imagination, thoughts, etc. are nourished and behaviors, beliefs, characters, etc. are modified or influenced, but also where knowledge is molded, transmitted, accepted or rejected. In general, psychologists assert that the educational background of a person affects his/her current behavior. In the same way, a student's attitude in a classroom towards a subject depends mainly on the charisma of the teacher and the interest the student himself has in what is taught. Nevertheless, whatever the interest is, if a teacher is not "attractive", the course will

not be understood and even accepted. The behavior of a teacher during a class is the first source of motivation for the attendees. Here we perceive motivation as the driving incentive boosting students' reactions. That motivation is based on emotions and achievement-related goals leading to success. Helping students liking what they are learning and striving to attain mastery and demonstrate superior ability at schoolwork affects their behavior both in class and out of the courses.

This short picture of the link between teacher, class and student aims at emphasizing the importance of those in charge of transferring knowledge to young people in their learning process. Two major reasons justified the choice of conducting a research on the acceptance of sciences by high school students: on the one hand, the weight of science in the development of new technologies that have profoundly changed people's daily life and on the other hand, the need for a new pedagogic strategy. Such a reflection on the relation between pupil and science has already been led in developed countries and has shown successful results in terms of reception level within the framework of school programs improvement. It is not exclusive but completes other disciplines and is presented as a search for talents in order to develop students' individual abilities and to prepare them for current and future challenges brought about by scientific and technological revolution. This study asserts a scientific and educational legitimacy. The survey carried out in schools in Cote d'Ivoire depicted a not very glorious picture of the situation. However it helps us proposing a new way to promote sciences in high schools and colleges of the country. This pedagogic approach, which announces and prepares to a different environment of teaching sciences, requires renewed efforts of authorities and science teachers.

II – SITUATION OF SCIENCES IN IVORIAN COLLEGES AND HIGH SCHOOLS

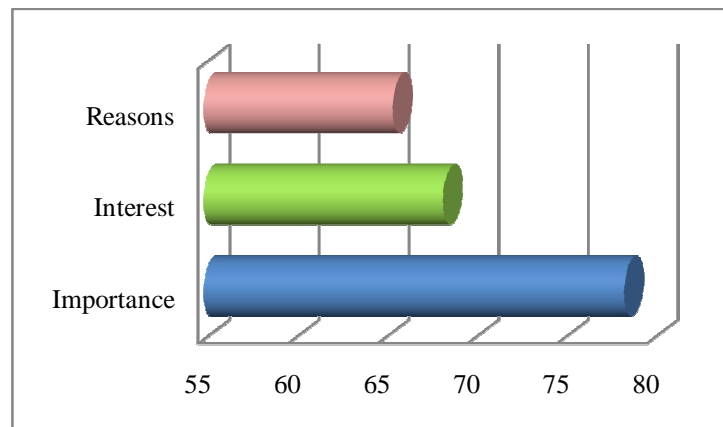
In a world in rapid change, Cote d'Ivoire has to undertake a reform of its education system to fit new social realities. This need for adaptation takes its roots in the fact that sciences teaching environment has become theoretical and practical problems. Theoretically the students' awareness of sciences is mostly very approximate. Practically schools lack of teaching materials and labs for experiments. Some empirical evidences will help us appraise the situation.

2-1 Empirical Evidence of Sciences Teaching Environment

From February to March 2013, we conducted a survey in some high schools of Cote d'Ivoire. A questionnaire has been answered by 148 pupils from different schools. This paper neither tends to evaluate or compare schools, nor to deal with pupils individually. It will take students as a whole, without any distinction as the situation is quiet similar from the first year of study to the last. Another research will concentrate on gender and study categories. We also benefited from the precious contribution of teachers from different disciplines. For the data analysis, we used SPSS 17.0 and Microsoft Excel 2007. In addition, we used some secondary data from electronic sources and from our own teaching experience.

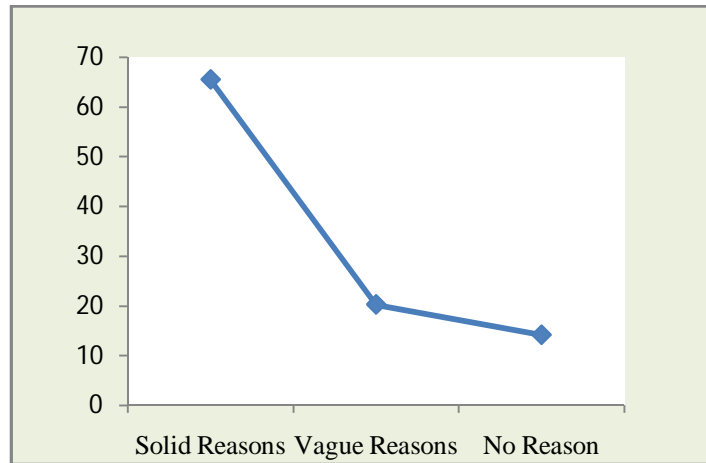
2-1-1 Students Awareness of Sciences

In general, many pupils see school as a constraint, with no possibility of escaping from it. Their parents force them into it and they undergo imposed activities which have no meaning for them. When it come to sciences, the truth is more obvious. According to Charland (2006-2007), different professionals of sciences and some scientific organizations revealed the crisis of scientific education and sciences teaching in the Nineties. Fourez (1994), for example, reported that courses in scientific disciplines were often seen by both pupils and teachers as a simple process of contents transmission. Consequently this passivity generates a fall of motivation and interest for scientific questions. For Hewitt (1995), if the gap between the knowledge and it usage in real situation is too wide, pupils will always think that sciences they are learning at school are useless. In the framework of a study named “Relevance of Science Education” conducted by ROSE project, Mottot (2008) reported that the poorer a country is, the higher the pupils’ interest for sciences. The situation is not different in Cote d’Ivoire as we’ll show later, but some observations need to be taken into account.



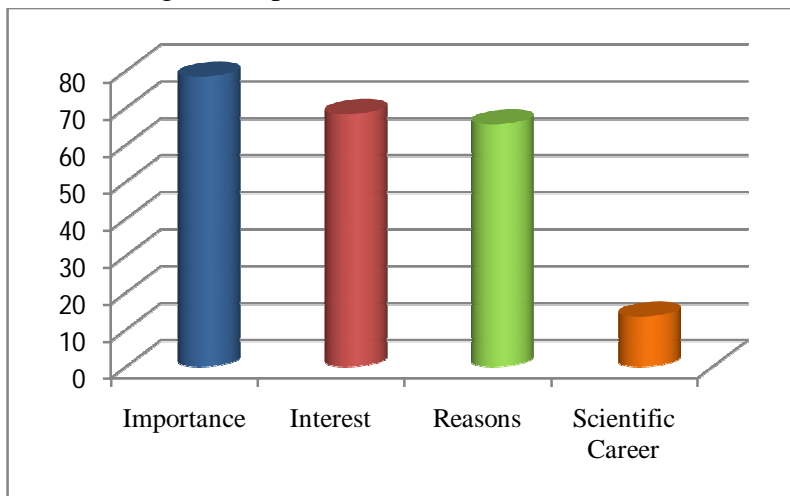
Picture 2.1 Awareness of Sciences

As given by picture 2.1, 78.4 percent of respondents pointed out the high importance of sciences in daily life, whereas 19.6 percent minimize that importance. From the amount of those praising sciences, only 68.3 percent expressed their interest for them. That gives a difference of 10.1 between the importance and the interest. Our attention was also drawn by the missing value of 2 percent related to the importance which will be very meaningful in the final analysis. 26.4 percent of respondents expressed no particular interest because for them, sciences are just disciplines like others in the teaching program, whereas 3.4 percent have no interest at all for them. The percentage of all the students who gave some solid reasons to justify their interest is 65.5 as indicated in picture 2.2 below. From picture 2.1, we see a decreasing trend from the recognition of the importance to reasons supporting interest. This drop would have not been remarkable if the rate of pupils targeting a scientific career was high.



Picture 2.2 Reasons Supporting Interest

A detailed analysis of reasons supporting pupils’ attention to sciences shows that 13.5 percent of them justify their interest by their desire to make a career in the sciences in the future. For 14.2 percent others, sciences are linked to technologies driving the world. 27.7 percent are also motivated by the possibility of conducting researches and discovering the secrets of the world. 10.1 percent appreciate the preciseness of sciences. Beside those who have solid reasons to love sciences, 20.3 have only vague opinions and 14.2 did not give any reasons for the rejection or acceptance of sciences. The reality is that, except from the above mentioned 13.5 percent, none of the other students envisage working on science-based fields. A comparative approach of importance, interest, reasons and scientific career is given in picture 2.3.



Picture 2.3 Comparative Approach of Values

As shows picture 2.3, the different between the importance and the will to build a career in scientific domain is abyssal. The explanation is simple: students recognize the importance of sciences just to follow the trend, to feel updated. In reality, their relatively acceptable understanding of sciences hides an immense field of ignorance and uncertainty. For the large part of pupils, sciences are merely a mystery or sources of curiosities. The main question that can emerge from this fact is: why are school boys and girls so confused when talking about sciences?

2-1-2 Analysis of Students Behavior towards Sciences

The resistance of high school students to sciences is not a specific case of Ivorian pupils. In the education literature, many authors reported the complaints of some developed countries regarding the level in scientific subjects of their high schools students. As far as our research is concerned, the relatively acceptable approach of sciences by students covers a bigger challenge hidden behind the reasons they gave to support their attitude. Because it's hard to believe that someone recognizes the usefulness of an action and has no valuable reasons to justify his/her judgment. This is why we tried to decrypt the data given by the statistical tools. Put together with some cases observed during our practical experience in teaching and the opinions of some teachers, we came to some conclusions summarized as follow.

Data Analysis

The decision to do something or not depends on an individual's own choice. In the case of a school boy or girl, that decision is mostly motivated. Here we want to point out the crucial role of parents and educators who have bigger responsibility in assisting children. In this analysis, it would have been simpler to concentrate just on the 78.4 percent of pupils who recognized the importance of sciences. Unfortunately the voices of the remaining 19.6 percent are worrying enough. What should be understood from such a situation? If we agree that science is present in all sectors of the life, then that category of students has to be seriously taken care of. Even if the missing value of 2 percent is also expressive, the interpretation is more flexible because it could have been intentional or a mere forgetting. In the first case, it means that the respondent has no idea of what could sciences stand for or they simply didn't want to answer. This truth is another reason why decision makers regarding education have to rethink sciences teaching issues. And as mentioned earlier, the decrease of 10.1 percent between the recognition of the importance and the interest shows that even if some students know the usefulness of sciences, they are not really attracted by them. They are part of those seeing scientific classes as opportunity to have good scores for annual transcript. It is maybe better than the 3.4 percent for whom sciences could be deleted from school programs without compromising anything.

As far as reasons given to support their positions are concerned, students are more governed by the possibility to conduct researches. We noticed that despite the solidity of their reasons to love sciences, only 13.5 percent plan to embrace a career in a scientific area. The consequence is that the country will not have enough scientists as it's not sure that the totality of those 13.5 percent will fulfill their noble dream. Socially we see in real life the consequence of the lack of enthusiasm for sciences that makes many young people in the country find in politics, sport and songs the best places to make money. They have not been taught enough on the beauty of sciences and the opportunities resulting from their good implementation. And sometimes, the future of the country has no place in their program. The 20.3 percent who have vague viewpoints, really don't see themselves involved in sciences. For them, others are more concerned but not them. Some also find them too complex to understand and to assimilate because looking like treasures which keys are extremely hard to get. This is the reason why we think it's the duty of schools actors and parents to take steps forward to initiate and inoculate scientific germs in the children's mind and behaviors

from the early stage of their education. Our conviction is reinforced by the rate of 14.2 percent of pupils who have no reason to justify their attitude towards sciences.

Teachers Viewpoints

While asking for educators' opinions on pupils' issue regarding sciences, their responses were very clear. For teachers, students have changed a lot within two decades. They are less hard workers and more consumers. They don't regularly attend classes and don't show interest in personal work. Students nowadays lack of interest and motivation for deepening in general and singularly for physics, chemistry and other scientific disciplines. Their concentration in class lasts a particularly short time and become talkative and dreamers so that once they learn and soon they forget. School boys and girls tend to take concepts as a whole, without analysis. To a question, they give an immediate response without reflection and especially without trying to give some reasons by using their own knowledge. Some teachers are astonished by the absence of culture, curiosity, maturity of many pupils who, besides, are not responsible for themselves. In general, students care less of time schedule. They belong to a generation of Internet and rapid solutions. Some behaviors have not changed since past generations: getting up early, bus, long day of classes. But now, pupils' timetable is mainly organized around extra activities and not based on their schoolwork. Those activities are amongst others video games, email, chat and phone, sleeping very late in the night, etc. Sports are generally better organized than the working time. Everybody follows the movement. They just revise in the night the lesson they will have the next day. They don't work hard unless there is an evaluation in program and revere teachers who don't give homework. They hardly accept time constraints. Another non-negligible observation is that students are more and more young, overwhelmed by personal problems and disconnected from the education world. They don't support psychological pressure. School appears today more as a meeting place. They are often happy to be there and develop an intense social life.

As many pupils are not convinced that studying is useful, school appears to them as a necessary pain from which they derive no pleasure. They endure them and many do not measure the impact they may have on the choice of their future. For the majority of them, studies are a painful phase to attain a goal. Some are just happy to discover new things and this is their reason to attend classes. They are afraid to engage in too difficult studies and show great difficulty in assessing their desires and the magnitude of opportunities available to them. In college, even best students are afraid of scientific fields.

In such a situation, the contribution of parents could have been a good support. Unfortunately most of them are sometimes "too busy" to closely assist their children, so that homework and daily activities, for example, are not regularly controlled. In that case, the child becomes his own master. Some parents are even troubled when it comes to decide for their progenies' orientation because they have not been used to discuss the issue with educators before.

Fear of Intellectual Work

Many students have lost the excitement for learning that requires an intellectual effort. Manipulations are usually performed, but the interpretation hardly attracts them. They mostly think

that intellectuals are part of a class to which they should not and cannot belong. They do not want intellectual efforts and sciences are interesting if during the class they can just talk and not work on them. They are more comfortable when others can do the work for them. The reasons they give is always the same: it's too hard, too complicated, and tiring, etc. This category of students gets discouraged when they don't know how to produce an effective intellectual work. The work is superficial with very little depth, probably because they have to do a practice they do not know.

Definitely, every abstract and theoretical work must go through an oral, personal and subjective explanation. Every intellectual work must be part of human history, with a motive, a purpose, efficiency, a perceptible progress. If it's far from the real world, it loses any chance of being taken seriously. The student can only accept it at that condition. For a big number of pupils, the intellectual effort is repulsive, but they are interested by its teaching. They attend class but do not learn anything. They always do their homework, but they don't learn.

Myth of Science

For some pupils, the choice of a scientific discipline is often linked more to the positive image they have than to their love for science. They gradually lose interest year after year from the first to the last level. They are not confident and research does not excite them. Students are interested, but a few want to continue because there are too many calculations and too much intellectual work to provide. Students from upper classes seem less attracted by science-based fields. In college, younger pupils are easily fascinated, curious, careful observers, etc. This fascination drops off and physics, for instance, appears as a topic not to be taught. Scientific sessions are empty. Students choose other orientation than sciences because they require too much work. In scientific classes, some students carry real personal questions when others are passive because they are in scientific classes to do something else later in the future. We note that sciences' study is still not required by interest for science, but because it offers a lot of opportunities. Science is scary and must remain a hobby. Some pupils are interested in sciences but don't want to devote the necessary time to learn the specific language, the methods needed to understand it. A large part is interested in physical phenomena of daily life, in astronomy, but is not always willing to learn how to solve physics problems, especially since it requires carefulness. They are interested in biology because it is much more exciting to know how a living being functions. Chemistry still has a pretty good image with practical experiments. College students like manipulations and are very interested in topical documentary studies such as weather, greenhouse effect. They want to observe, manipulate but less want to deepen, think and write.

Those who are curious and interested, see science as necessary and positive, but are worried because poorly informed. They are frustrated because they see themselves unable to build an argument or to take an objective position. In fact, they often do not have basic tools to understand and build their own opinions.

As the picture of science is worsening, it urges to highlight its good sides. Drugs, medical examinations are most promising arguments, even if medias often emphasize its negative side: pollution, risk, skids, massive destruction weapons, etc. Sciences seem to be far from pupils, without any familiar relationship with daily life. The limits of sciences are not well defined. It is

true that in the twenty-first century, everything became scientific. Science is source of technological comfort, but progress is still insufficient or questionable. It is even dangerous. The sciences are to earn money or to have international recognition. Here the scientist is seen as a mad, criminal and sadistic person. They don't seem convinced that what they are learning today will make them understand their life and the world. In addition, it is sad to note the weight and moral pressure of final exams. Parents and teachers focus on the diploma. Teachers preparing for exams always have in mind that they have programs to finish and percentages of success to maintain. This situation of pressure also gives them a little time to teach their discipline in the best way.

Despite the above depicted picture, we also discovered that pupils' resistance to or ignorance of sciences has another origin strategically destructive and demotivating: the lack infrastructures and didactic materials in schools. Teachers recognized that this situation discourages even those who are very interested in experimental activities.

2.2 Difficult Learning Environment

Teachers of scientific programs are concerned by the under-equipment of public schools. Most of classrooms for experiments are closed. Not only the existing laboratories are no longer functional, but there is also no center outside to receive students. There are virtually no libraries in schools and in cities. If there are, they are under-equipped. The materials' problems encompass the lack or absence of novels, books of documentary research and encyclopedias, inadequacy of the classrooms, lack of equipped laboratories, tables and benches, absence of multimedia rooms, lack of computers, etc. Unfortunately Ivorian schools did not benefit from enough infrastructures due to ten years of social and political instability in the country so that classrooms are overloaded because of the increase in the number of pupils. Besides, the scientific high school of Yamoussoukro, the biggest school dedicated to the promotion of sciences, is no more operational a long ago. Even if authorities claim that education engulfs 40 percent of the national budget, equipments and their operating costs seem to be non-budgeted. In that way, chemistry, physics and biology for example remain theoretical and useless for pupils. Improving the work conditions of teachers and learners will help promoting practical scientific activities.

To address the issue of sciences in high schools teaching programs, students should be aware that they are the stake, the main goal of their learning. In this approach, we assume that fostering sustainability can have a significant impact. Indeed, populations in Cote d'Ivoire in general and young students in particular don't understand the concept of sustainable development. Making them take over that project could positively impact their behavior towards scientific questions.

III – PROMOTION OF SUSTAINABILITY

School is the education place par excellence but also a platform for collective life. The individual monitoring, health and social actions, promotion of arts and culture, sport development, etc. falling within an educational policy, are part of the organization of school life. These actions work towards the personal development of the student, aiming at giving him a sense of responsibility and at

arousing the desire to engage in a project and to have a personal cultural life. Besides teachers, they involve external partners. The educational action of a school is another dimension of the learning. A common vision of societal values is transmitted at school. That means education has an important role to play in the divulgation of sustainability and this can influence students' behavior towards science.

In fact, education, putting together with environment, sustainable development and sciences, is not a new discovery. Moreover, the 80th Congress of ACFAS (2012), for example, devoted to the issue the seminar 521 which insisted on the need to take into account all controversies surrounding the question. The only difference with regard to our research is the goal we want to attain. Indeed, the need to teach sustainability at school responds to the need of decision makers to prepare young generations for the protection of environment and the preservation of life. Our contribution then is to add to that objective the vulgarization and promotion of sciences as bases of this noble mission. This promotion is only possible if infrastructures and materials are made available to teachers and students. The teaching of sustainability cannot be just theoretical. It needs experimentations so that learners can perceive advantages deriving from such knowledge.

As stated by the French National Institute of Pedagogic Research (2005), sustainability however raises numerous issues of didactic, pedagogical, organizational and ethical order. Therefore, discussions on the concept required an opening to multiple fields, humanist, civic and scientific. Those talks were based on disciplines' complementarities provided by school programs. That interdependence increased the awareness of environment, energy, dwelling issues for example. The pupils in Cote d'Ivoire should be sensitized on sustainable development through projects and concrete actions. The dimension of sustainability in school programs must be fully integrated in the state policy. Sustainable development addresses different temporalities that take into consideration present and future generations' needs.

This section of our study is not trying to define or to demonstrate what sustainability stands for. Our intention is to draw attention on the fact that emphasizing the understanding and deepening the knowledge of sustainability will motivate pupils in taking over the means to ensure it. School boys and girls should be taught that the appropriation of sciences through the promotion of sustainability can create big work and career opportunities. As most of individuals' goals are incentive-based, all of human behaviors, actions, thoughts, and beliefs are influenced by the inner drive to success resulting from skills and competence. And the case is not different with students. The challenge is, for example, to make it clear to them the link between environmental threats and the global warming, the relationship between individual, society and nature. This clarification will highlight the relation between knowledge built at school and its usefulness and effectiveness in daily life. The awareness of the harmony between school knowledge and social practices can bring about a deep change in individual and collective behavior towards sciences, especially when training is given in real time. This can also improve their performance in class, enhance their transcripts and open door to success in their final exams.

CONCLUSION

Fostering an emergence of a strong generation of scientists and technicians require well educated and skillful pupils and students. Such a performance cannot be achieved if learners are taught in an inappropriate environment lacking of minimum infrastructures and learning materials. Practical training is another equation to solve. Education as well as health is a vital sector falling into a state's priority and responsibility. Decision makers therefore have to provide all necessary means to ensure health care and good education to all. For that reason, actors of education, including parents, should look deeply in the issue of learning in high schools at a national level. If a country guarantees the right to education to his young people, the contribution of private donors will be an additional support. Ivorian schools have to stand and address the challenge of declining trends in mathematics, for instance, because the development and applications of mathematical sciences are the starting point of technological innovations today. To attain this objective, students should be convinced that the protection of the environment is their own duty. They have to play a role and this responsibility relies on the mastering of scientific tools.

❖ Note on Figures

- 1 – Figure 2.1 gives an overview of the general understanding of students regarding sciences.
- 2 – Figure 2.2 exposes reasons lying under students' opinions.
- 3 – Figure 2.3 shows a comparative board of students' different attitudes.

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References

- Acfas (2012). Rapport aux savoirs, éducation relative à l'environnement et au développement durable. Colloque 521. *80th Congress*. Retrieved from <http://www.acfas.ca/evenements/congres/programme/80/500/521/c>
- Charland, P. (2006-2007). La triade science, technologie et environnement: nouveaux enjeux théoriques curriculaires et pédagogiques. *Éducation Relative à l'Environnement*, Vol. 6, p. 63. Retrieved August 30, 2013, from Université du Québec à Montréal (UQAM) database.
- Fourez, G. (1994). Alphabétisation scientifique et technique: essai sur les finalités de l'enseignement des sciences. Bruxelles: De Boeck Université, p.127-128
- Hewitt, J. (1995). Giving voice to the practising professional. *Orbit*, 26 (1), 10-14.
- Mottot, F. (2008), Les élèves des pays riches snobent la science. *Sciences Humaines. Inégalités: Le Retour des Riches*, Mensuel n° 191. Retrieved August 5, 2013, from Sciences Humaines database
- National Institute of Pedagogic Research (2005). Generalization of education on environment for sustainable development. *Synthesis of EEDD 2005 / INRP Report*, p.4