Teaching/learning biology in French secondary schools

Eric Sanchez,
Institut National de Recherche Pédagogique – ACCES – e.Praxis
www.inrp.fr
eric.sanchez@inrp.fr , + 33 4 72 76 61 97
INRP ★ B.P. 17424 ★ 69347 LYON CEDEX 07 ★ FRANCE

Summary

Biology and Earth science have always been linked during the history of the French educational system. As a result, the school subject today is called “Life and Earth Sciences” in which biology represents approximately 2/3 of the content. Thus, the teacher training courses involve both Biology and Earth Science subjects. Life and Earth sciences are a mandatory core subject in secondary schools and the objectives and the content of the courses are set by a national curriculum.

In France at the lower secondary level, the main objectives of biology teaching are understanding how the human organism operates and the organisation of the environment in order to lead children to responsible behaviour in health care and environment preservation. Another main objective is that students should become open-minded and critical of the information transmitted by the media. At higher secondary level the objectives are very similar: to encourage citizenship based on scientific knowledge and methods, and to prepare the students for further science education.

Because of the decrease in the number of students who choose science studies after higher secondary school, biology teaching, like other scientific subjects, has become a priority today in France. We have to make biology teaching more attractive and more useful to help students to choose a scientific career.

In my presentation I will develop these topics and try to answer some questions about biology teaching in France: WHO is teaching biology (teacher training)? WHAT is taught (the subjects)? HOW MANY hours are devoted to biology at the different levels? WHY is biology taught (the objectives)? HOW is biology taught (the methods)?

To achieve the ambitious goals set by the Lisbon strategy (European Council, Lisbon, March 2000), Ministries of Education adopted a report in 2001 on the future objectives of education and training systems. One of those objectives is to encourage the development of a scientific and technical culture among citizens. As a science, biology is concerned with a wide range of social problems such as health care and sustainable development, and, in this way, biology knowledge participates in the development of citizenship. European educational systems show a large variety of features and objectives and biology teaching is concerned with this diversity. This paper aims at giving an overview of the situation of Biology teaching in France. We will try to outline the main characteristic of Biology teaching by answering the following questions: who is teaching biology in France? What is taught (the subjects)? How many hours are devoted to biology at the different levels? Why is biology taught (the objectives)? How is biology taught (the methods)?

Biology teachers in France

During the history of the French educational system Biology and Earth science have always been linked. As a result, the school subject today is called “Life and Earth Sciences” in which biology represents approximately 2/3 of the content.

A candidate who wishes to teach biology at the secondary level must have acquired at least a 1st University degree (Licence fig. 1). After recruitment, on the basis of a dossier or interview, future teachers must enter a university teacher-training institute (IUFM) where they receive more extensive studies of biology and Earth sciences.

At the end of the IUFM first year, candidates sit a national competitive examination leading to one of the following certificates:

- CAPES (the certificate of aptitude for teaching at secondary level),
- *Agrégation*, for candidates holding a Master's degree.

The CAPES consists of two written papers, one in biology, another in Earth science, and two oral tests. One of these taken the form of a lesson, the other is a presentation of a case study in teaching life and Earth sciences. Students passing these competitive examinations become trainee teachers for one year. The training consists of courses with their own students or the students of their tutor (an experienced teacher). Trainee teachers continue to follow educational training courses in IUFM. The Minister for National Education announces the formal appointment of candidates passed by the academic boards of examiners. In the public sector, teachers are civil servants.

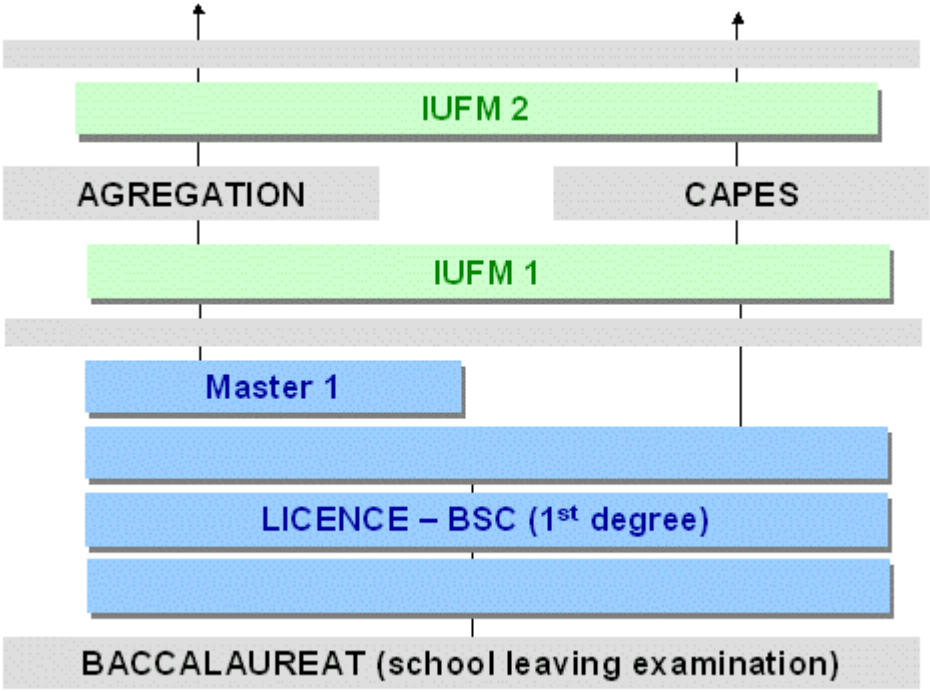

Fig. 1 : Steps in training , exams and competitive examination for a French Biology teacher

Information and communication Technology skills are considered as a priority in France. The IUFM provides ICTs courses to students. Since September 2005, an experimentation has aimed at introduce a new ICTs test called C2i (Computer and Internet Certificate). C2i evaluates the capacity of students to use ICTs for teaching. It its expected that C2i will be a mandatory test to become a teacher in 2007.

Nevertheless, the main characteristic of the biology teachers training in France is the major place devoted to disciplinary subjects studies. The selection of students is essentially based on disciplinary skills. In secondary schools teachers have acquired at least a Licence (BSC) in life and Earth sciences and sit with success a difficult competitive national examination thus they all have all a good knowledge of biology concepts. Nonetheless, only one year of the

teacher training focuses on the teaching aspects of the profession. As a result, in France, teachers are concentrate one the disciplinary aspects of their job and have difficulties in setting up interdisciplinary activities.

The place of biology in the French educational system

At primary school, biology is a compulsory core subject but the place devoted to biology in the timetable depends o basically n the interest and the ability of the teacher. In secondary schools the time devoted to teaching life and Earth science is set by an official guideline. Figure 2 shows that this time depends on the level of students and the type of courses they have chosen. The left hand column indicates the equivalent grades in Cyprus.

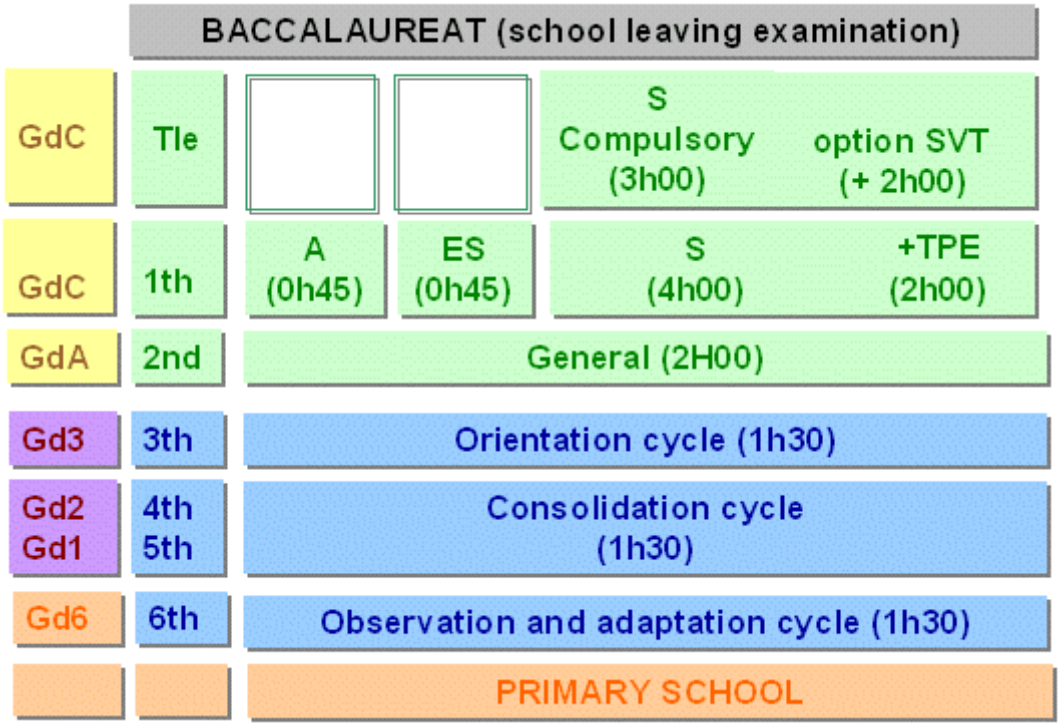

Fig. 2 : Number of hours devoted to life and Earth sciences in the French general curriculum

The *Baccalauréat* is the final school-leaving exam for higher secondary school, a key to admission to higher education. In general education, there is three types of Baccalauréat: L (literary), ES (economic and social), and S (scientific) and there is a life and Earth sciences test for all of them (at the end of the second year preparation for ES and L). But, obviously, this disciplinary subject has not the same weight for each type of *Baccalauréat*. At the most, a

student who has chosen to prepare a *Baccalauréat* S (sciences) has 4 hours of life and Earth sciences courses and two hours more if he has chosen biology and geology option. To evaluate the place of biology in each class, it must be considered that life and Earth science consists of about 2/3 of biology.

IDD (discovery trails) in lower secondary school and TPE (guided personal work) in higher secondary school are two devices that allow students to be involved in collaborative activities to carry out a project of their choice. Students often choose a topic related to biology.

The French biology curriculum

Figure 3 gives an overview of the main topics in the French biology curriculum.

One of the core features of the teaching of biology in higher secondary school is that the teaching of sciences is designed as a whole in order to give students a global conception of science. As a result, the same scientific question is studied in different science courses. Moreover, usually, if a physics or chemistry concept is useful to understand a biology concept they are taught at the same level. This is called the horizontal coherence of curricula. For example, in the final year of study (*Terminale)*, students study photosynthesis in chloroplast in the biology class and oxydo-reduction reaction in the chemistry class.

Fig. 3 : Curriculum – lower secondary school

The biology curriculum, as well as the other science curricula, is designed to give a positive vision of science to students. Some of them will choose a scientific career but it is expected that the others will continue to be interested in biology.

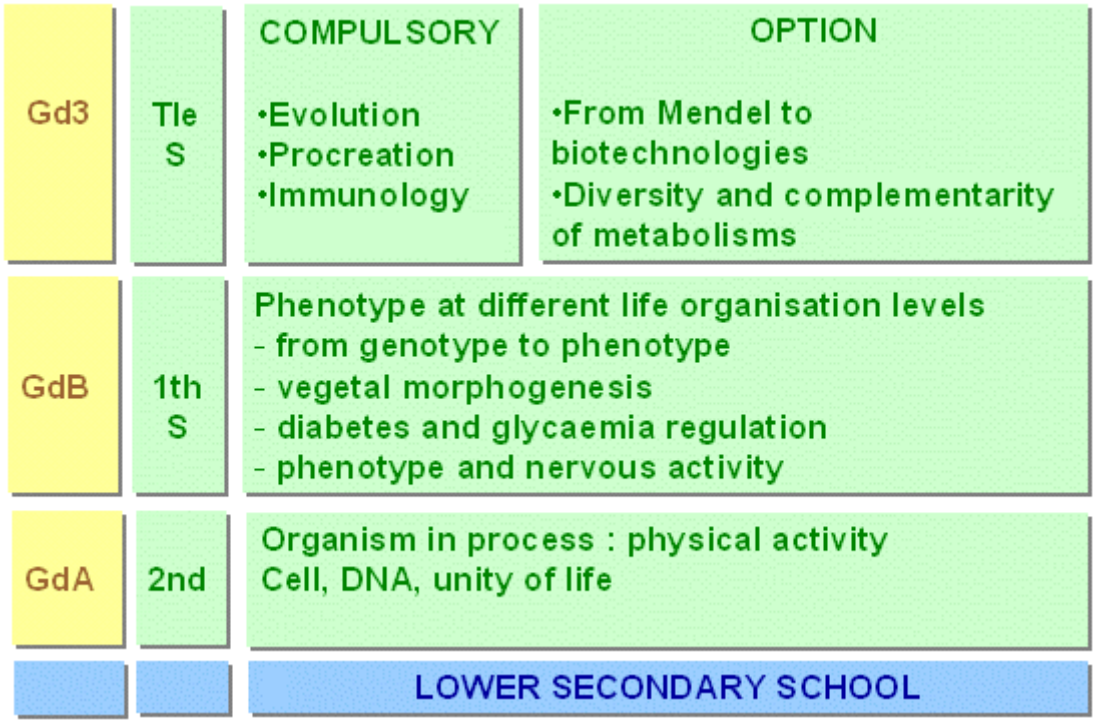

Fig. 3 : Curriculum – higher secondary school

The French biology curriculum is organized in order that students study the same concept several times. Respiration is an example described in figure 4. The degree of formulation of this concept changes during schooling. From a simple visible manifestation of life in the 1st class (6th), it is presented as a cellular metabolic process in the final year (*Terminale*). The degree of organisation studied changes from organism in the 1st class (6th), organ in the 2nd and 3rd class (5th and 4th), cell in the 4th class (3rd) and organelle in the final year (*Terminale*). The curriculum is shaped by what is called a vertical coherence of concepts.

Usually French biology teachers consider that the biology curriculum includes too many concepts and that they do not have time to organize as many experimental activities as they would like to do.

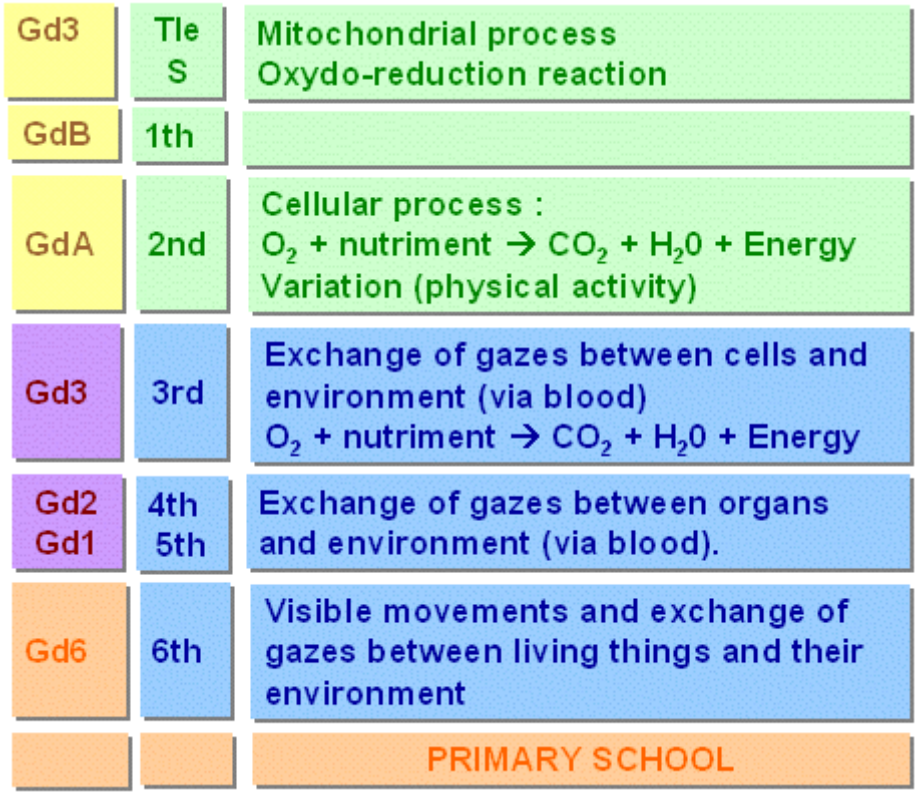

Fig 5. : Formulation degrees for the concept of respiration in the French biology curriculum

Some research teams in France, and especially in the National Institute of Educational Research (INRP) are interested in the question of curriculum. One of the main questions asked concerns the teaching of sustainable development. It is necessary to identify the key concepts of this topic and to develop educational resources. Because of the multidisciplinary aspect of this subject, it is necessary to imagine new ways of teaching. The problems we have to solve are related to the interdisciplinary approach, debate and controversy in the classroom in order to help future citizens in making informed decisions about the social implications of science and technology knowledge.

Another question asked concerns the link between the evolution of knowledge in scientific laboratories and the evolution of the biology curriculum. Some researchers are working on the problem of the dissemination of new knowledge to biology teachers – Information and Communication Technologies could play an important role – and the renewal of educational tools and practices. The use of ICTs and the place of modelling in classroom as an investigation approach are two examples of this.

Objectives for biology teaching in France

There are three types of objectives for lower secondary school in France. The first are cognitive objectives. It is expected that students, at the end of "collège" have a basic understanding of their own body, are able to identify the biological dimensions of their environment, have a basic knowledge of the history of life and of the place of man on Earth and are able to appreciate the unity and organisation of the biosphere. The second type of objectives is methodological. Teaching biology aims at developing some abilities such as : to be able to observe, to realise, to communicate and to reason. The third objective are behavioural. Biology contributes in helping children to adopt a responsible behaviour in health care and environment preservation. Thus, the biology curriculum involves information about dangerous behaviour (drugs, alcohol, cigarettes), health care (AIDS, alimentation) and ethics (cloning, eugenism). Another main objective is that students should become open-minded and critical of the information transmitted by the media.

At upper secondary level the objectives are very similar: to encourage citizenship based on scientific knowledge and methods, and to prepare the students for further science education. The experimental approach is underlined. It is expected that students are able to carry on basic scientific investigations. As a scientific method, modelling is encouraged.

Tools and Methods

Official guidelines do not prescribe specific teaching methods, but the curricula defined by the Ministry must be respected. Biology teachers select teaching materials from the range offered by educational publishers. They organize the school activities for biology in the classroom and are responsible for the assessment of their students.

Assessment

To examine the life and Earth sciences baccalauréat test can give an insight into assessment in France. Students can obtain a mark between 0 and 20 for the life and Earth science test. 4 points concern a one-hour labwork test in which students have to carry out experimentation. The students sit a written test as well (3h30, 16 points) that consist of two questions. The first question aims at evaluating student's knowledge. The second question aims at evaluating the student's capacity to carry out a scientific reasoning. This question is based on the exploitation of a set of experimental results.

Labwork and field courses

A widely shared opinion is that a student has to do things by himself in order to learn. As a result a large part of biology school work is devoted to labwork. All secondary schools possess a biology laboratory and; in higher secondary schools, a laboratory assistant helps teachers to set up labwork for students. In order to make this labwork possible, students benefit from work time in small groups in class.

Teachers are also encouraged to organize field courses. It is expected that labwork and field courses have the following effects : to motivate the students, to acquire specific biological and technical skills and to access the reality and complexity of biological phenomena.

ICTs

The relationships in the classroom are usually represented by a triangle (fig. 6). One of the vertices of the triangle is occupied by the student, the second by the teacher and the third one by the school subject. The uses of ICTs can be described using this triangle.

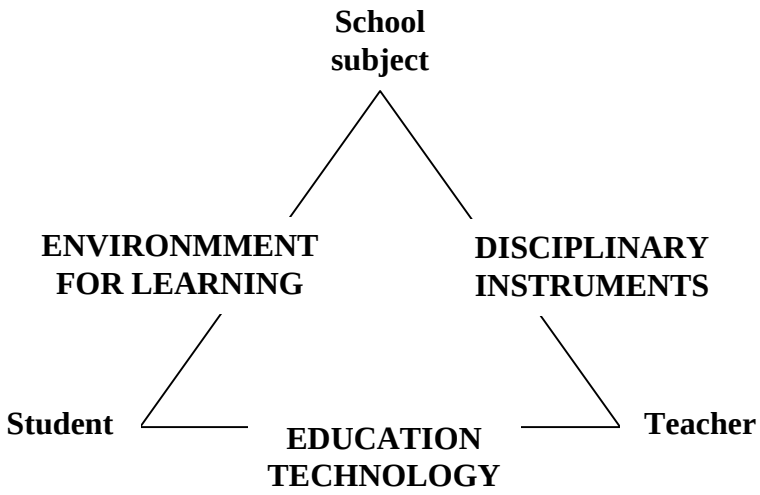

Fig. 6. The rôles of ICT in the classroom

Today, technologies facilitate interactions in this learning system. As disciplinary instruments, they allow the teacher to reconstruct the laboratory activities of the scientist in the classroom. Since 1987, an important effort has been made to generalize Computer Assisted Experimentation. Today, higher secondary schools are very well equipped and students are led to acquire and deal with data to study biological phenomena such as photosynthesis, respiratory gas exchanges, myotatic reflex or cardiac activity. As educational tools, ICTs play the role of media and facilitate teacher-students relationships. The uses of word processing or spreadsheets is very common and Videoprojectors are more and more used in classrooms. The

Internet is used to access biological data. A study, carried out in 2004 shows that a majority of biology teachers is satisfied with the equipment provided and that 60% in lower secondary school, 95% in higher secondary school use ICTs with students. As digital environments for learning, technologies can allow students to discover and explore the concepts of the school subject. There is a great choice of software applications especially implemented for educational uses. This includes a wide range of software applications which allow the simulation of biological experimentation that are impossible to carry out with students.

Conclusion

Biology teaching in France benefits from a great number of assets such as good disciplinary and ICTs knowledge for teachers, a large place devoted to biology in the timetable and good experimental and ICTs equipment provided to schools. Students benefit from motivating and interesting subjects to study. Nevertheless, French biology teaching suffers from insufficient pedagogical teacher training. Only one year is devoted to this aspect of teachers training. Another weakness is the ambitious curriculum. As a result teachers have difficulties in organizing collaborative learning in their classrooms.

What is a stake in the near future is certainly teachers training. The work of biology teachers like other secondary school teachers in Europe is going to change. Consequently, their training should be able to adapt them to the future changes. European enlargement is a good opportunity to identify good and bad practices among neighbours and to develop teacher training adapted to these changes.

References

BOEN 1997): Programmes - Cycle central de collège. N°1 HS P.321. MENESR.

BOEN (1998): Programmes des classes de troisième des collèges. N°10 HS P.3. MENESR.

BOEN (2002). Programme de l'enseignement des sciences de la vie et de la Terre en classe de terminale de la série scientifique N°11 HS P.65. MENESR.

BOEN (2002): Programme - Sciences de la vie et de la Terre en classe de première de la série scientifique. N°6 HS P.96. MENESR.

BOEN (2004). Programme de l'enseignement des sciences de la vie et de la Terre en classe de sixième du collège. MENESR.

Conseil de l'union européenne (2001). Les objectifs concrets futurs des systèmes d'éducation et de formation. Bruxelles.

http://europa.eu.int/comm/education/policies/2010/doc/10_year_fr.pdf

European Commission (1995) Structures of the Education and Initial Training Systems in the European Union, EURYDICE/CEDEFOP.

European Commission (2004). Implementation of “Education & training 2010”. Working group D. Progress Report December 2004.

Sanchez E. Jacques J-M. (2001) Préparer le CAPES de sciences de la vie et de la Terre. Vuibert.

Verdon R., Gendre R. (2004) Les attitudes des enseignants vis à vis de technologies de l’information et de la communication. Ministère de l’Education Nationale et de la recherche. Division de l’évaluation et de la prospective

http://www.education.gouv.fr/stateval