



HAL
open science

Conceptions and attitudes of students and staff during the implementation of school, agenda 21

Jean Simonneaux, J.-Y. Léna, Benoît Jeunier, Raphaël Chalmeau,
Marie-Pierre Julien

► To cite this version:

Jean Simonneaux, J.-Y. Léna, Benoît Jeunier, Raphaël Chalmeau, Marie-Pierre Julien. Conceptions and attitudes of students and staff during the implementation of school, agenda 21. 8th Conference of European Researchers in didactics of Biology, 2011, Braga, Portugal. pp.325-337. hal-01513486

HAL Id: hal-01513486

<https://univ-tlse2.hal.science/hal-01513486v1>

Submitted on 25 Apr 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

CONCEPTIONS AND ATTITUDES OF STUDENTS AND STAFF DURING THE IMPLEMENTATION OF SCHOOL AGENDA 21

Jean Simonneaux¹, Jean-Yves Lena², Benoît Jeunier², Raphaël Chalmeau² and Marie Julien²

¹ENFA, EFTS, Université de Toulouse (Castanet-Tolosan – France)

²IUFM, Université de Toulouse (Toulouse – France)

jean.simonneaux@educagri.fr

Abstract

This study focuses on identifying values, specifically conceptions and attitudes towards sustainable development (SD) and implementation of Agenda 21 in a school. Data were collected from a questionnaire. Responses of 80 students and 22 staff members at an agricultural school were analysed. Students' responses highlighted the centrality of the environmental dimension of SD. The difference between staff's and students' conceptions of SD related to the categories of "responsibility" and "awareness". Related activities within school, students and staff mentioned a very limited number of actions, essentially "eco-friendly gestures". These actions are necessary but not sufficient to achieve sustainable development, and may constitute a basis for more complex actions. The factors referred to as hindering commitment to SD were both institutional and psycho-social in nature. SD redefines the boundaries between the academic subject approach/a-disciplinarity (or the cross-curriculum approach), teacher/person who educates, class/school/local surrounding territory, knowledge/values, acting/thinking. These boundaries change the modes of action and the organisation of the teaching-learning activity by introducing new players, values and relationships.

Keywords: sustainable development; conceptions; school Agenda 21; environment; education

1. Theoretical framework

The Brundtland Commission's definition of sustainable development (SD) as "*development which meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987), is one of the first and still most widely used. To complete this definition, the International Council for Local Environmental Initiatives (ICLEI, 1996), in its Local Agenda 21 Planning Guide, describes and schematizes three spheres making up SD: *environment, economy and community* (society). True SD is then development that meets the "triple bottom line" where all three spheres interact on an equal

basis. This conception of the three dimensions/pillars of SD has been widely incorporated into teaching (Summers & Childs, 2007).

However, as a legacy of former civics instruction and an initial trend in environmental education, the French school system has adopted an eco-friendly position rather than a reflexive and critical perspective. The focus is on dictating the way in which we should behave by presenting us with a series of “eco-friendly gestures” (turning lights off, sorting the rubbish, etc.). From a critical perspective on Education for Sustainable Development (ESD), it is important to define more ambitious educational goals than these simple “eco-friendly gestures”. It is about training social stakeholders to think for themselves, and to show responsibility (Jonas, 1992). According to Mappin and Johnson (2005), who analysed this transition from environmental education to ESD, the objective in the 1970s was to encourage behavioural change. In the '80s, it was to encourage personal change, i.e. an understanding of one's own personal attitudes and motivations which guide decision-making. Later, in the '90s, a change in social values and in the system as a whole became fundamental to sustainability.

However, SD has been subjected to so many different interpretations, and even economic and political appropriations, that the notion of sustainability has lost some of its real meaning. Agenda 21 is an action-plan for the 21st century adopted by the Earth Summit in Rio (1992). It proposes recommendations in various areas, such as poverty, health, housing, pollution, agriculture, etc., with 27 principles that must be followed for its implementation. At the level of the local authorities, Agenda 21 integrates the principles of SD, based on proposals from the public. In France, Committee 21 has supported this mission since 1994. The objective set out in Agenda 21 claims to be consensual but is too vague, and even inoperative, according to numerous local Agenda 21 developed in schools. SD is then analysed as “*a clever and seductive strategy aimed at the stakeholders in the politico-economic sphere. It is important to convince them to integrate social and environmental preoccupations into their economic growth agenda*” (Sauvé, 2007). The civic question of governance, currently a much debated piece of rhetoric in France, is an additional factor in the transition from environmental to sustainable. Therefore, setting up Agenda 21 programmes in schools is considered to be a project for which the collective dimension is essential (Fortin-Debart & Girault, 2005), where the importance of responsibility is a major aspect which helps us to understand implication of students and staff.

SD is a socio-scientific issue in which social values get mixed in with scientific goals, which are themselves under debate or controversial (Simonneaux & Simonneaux, 2009). Socio-scientific questions lead to the development of specific forms of reasoning (Sadler, Chambers, & Zeidler, 2004). From the perspective of critical rationality in decision-making, knowledge of science is necessary but insufficient. Furthermore, the sciences do not form a homogeneous group proposing a single analysis or single solution. The sciences are not independent of the conditions from which they emerge and they carry values within their very structure (Habermas, 2002). Setting up a SD programme in schools may be considered an authentic situation, a legacy of environmental education enlightened by socio-scientific questions.

1.2 Research questions

The aim of this research was to identify conceptions and attitudes towards SD and draw attention to the implementation of Agenda 21 in schools. An analysis of the attitudes and conceptions then allows us to discuss values of ESD.

1.3 Context

The study was carried out in an agricultural secondary school, located in a rural area near the Pyrenees, in France. The secondary school's Agenda 21 project was set up gradually by the headmaster and his team, along with a part-time project leader. Partners from outside the school, academic authorities and others, also offered their support. These external and internal factors are necessary to ensure the success of the project. Official circulars, explaining how to implement SD in a school context, were sent out to help the school and its partners (Laidin, 2007). Guidance on integrating SD issues was also given in school programmes.

1.4 Methods, participants and data sources

The sample was made up of different members of the agricultural secondary school who have been involved in the implementation of a school Agenda 21 project for several years. These included 22 members of the teaching and technical staff, and 80 students, 25 of which have "eco-delegate" status (Table 1). In each class, the eco-delegates are students elected within the framework of the Agenda 21 project. The students counted in the survey were aged 16–21 years and were either studying toward a technological Baccalaureate specialising in “science and techniques of agronomy and life sciences” or following a vocational agricultural course. Most of the students in the courses offered at the school are male and the gender imbalance was even greater in the eco-delegate group (Table 2).

Table 1. Gender and status of the sample.

	Status of the sample		Total
	Staff	Students	
Gender			
Male	11	52	63
Female	11	28	39
Total	22	80	102

Table 2. Gender distribution in the sample of students.

Group	Gender of the students		Total
	Male	Female	
Non eco-delegate	32	23	55
Eco-delegate	20	5	25
Total	52	28	80

Data were collected using a questionnaire which consisted of six closed and eight open questions. The students filled in the questionnaires during school time and the staff during their working hours. The themes in the questionnaire related to 1) the different conceptions of SD; 2) the different SD actions already set up in the school; 3) new developments in the behaviour of the person filling in the questionnaire and his/her close circle of family and friends; 4) the reasons why people do not seem concerned about SD; 5) the notion of responsibility and more precisely “being responsible” in terms of SD.

The answers to the open questions were post-coded (Altman, 1974), which generated mutually exclusive categories of our taxonomy (Table 3). Elaborate valid taxonomies impose an inter-subjectivity that is obtained by working together as a team, in four-way discussions during face-to-face team meetings. It must be faithful to the body of the data and reliable among researchers by items.

All results were analysed with SPSS-PASW18 software. We used the most appropriate statistics to evaluate the validity and inter-rater reliability of the outcomes (Crombach's alpha). After reaching the objectives of validation and verification of different alpha reliabilities ranging around ($0.852 < \alpha < 0.893$) in the test/retest and split-half correlation, we created taxonomies which could be used by teachers and researchers working on SD. These tools save a considerable amount of time when analysing open questions, but also when creating closed questions.

Table 3. Taxonomy of coding for responses to the following question: What terms are linked to SD? (categories based on 1047 initial terms).

Categories	Examples of terms used
Stakeholders	farmers; human beings
Basic needs	nourishment; food; organic food; hygiene; sanitary facilities; health
Awareness	thinking of future generations; behaviour; gaining awareness; society; man-nature relationship
Economy	consumption; enterprise; production; wealth
Environment	biodiversity; climate; ecology; ecosystem balance; nature
Damage management	reducing the greenhouse effect; fighting against pollution; new technology; non-polluting cars
Resource management	car-pooling; conserving water; recycling; sorting waste; protecting the planet
Territory management	land management; country; development schemes; territory; towns
Impact of human activities	waste; noise disturbance; household waste; motor vehicle pollution; global warming
Politics	democracy; social equilibrium; equity; fighting poverty; power
Responsibility	citizenship; collective consciousness; participation; respect; solidarity between generations
Resources	agriculture; biofuels; biomass; water; energy
Integrated production	organic production
Social	social development

2. Results

2.1 A dominant conception of the environmental dimension of SD

On the basis of 1047 initial terms, even though the social and economic dimensions of SD were also taken into account, the results highlight a dominant conception of the

environmental dimension of SD (Figure 1). The students' responses confirmed a highest frequency of this dimension (Léna & Simonneaux, 2008).

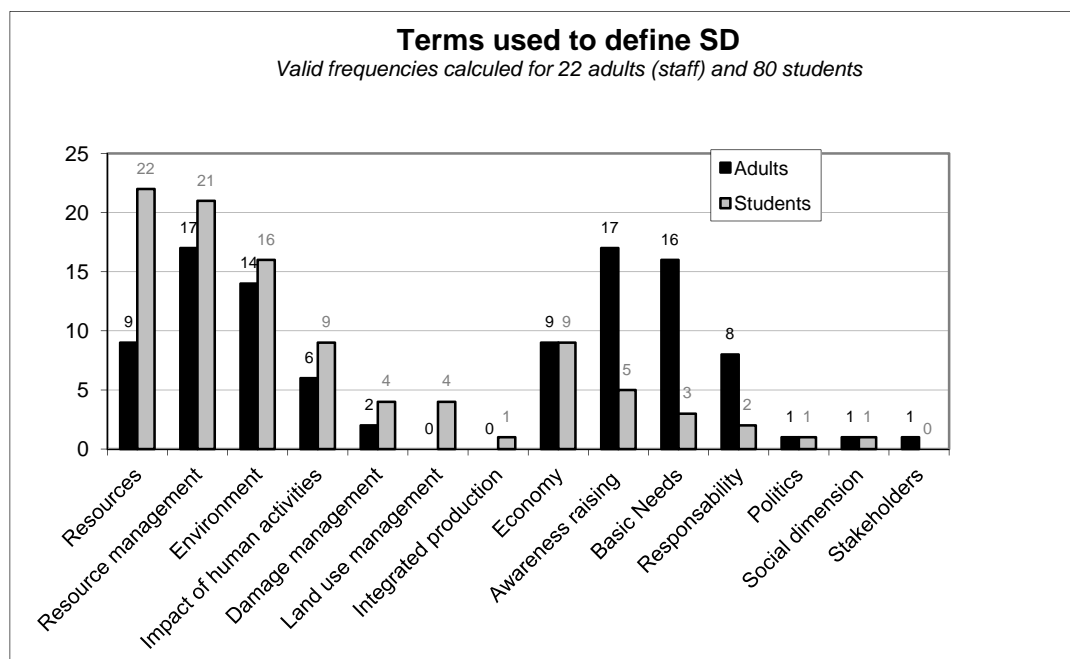


Figure 1. The most used terms by the students and staff to define SD.

Table 4. ANOVA of categories between staff and students.

ANOVA: categories of SD by staff versus students	F	Significance
Stakeholders	104.851	0.000
Politics	66.459	0.000
Responsibility	53.651	0.000
Awareness	35.732	0.000
Basic needs	8.357	0.005
Economy	8.232	0.005
Damage management	3.576	0.014
Impact of human activities	2.055	0.156
Social	1.554	0.216
Environment	0.665	0.418
Resource management	0.535	0.467
Integrated production	0.058	0.811
Territory management	0.019	0.892
Resources (In their definitions, the terms "Resources" and "Resource management" are two different categories)	0.002	0.962

Furthermore, Table 4 reveals the significant differences that can exist between the various conceptions of SD. Important differences were found for “stakeholders”, “politics”, “responsibility” and “awareness”, which are all dimensions relating essentially to staff reasoning. In contrast, categories related to the environmental dimension revealed proximity between staff and students (Table 5).

Table 5. Comparison of students and staff for categories occurring the most and least frequently.

Definition of SD	Categories mentioned first (five most frequently represented categories)	Categories rarely represented
Staff	Resource management Awareness Responsibility Environment Economy/Resources	Stakeholders Integrated production Social
Students	Resources Resource management Environment Impact of human activities Economy	Territory management Basic needs Integrated production

2.2 Differences between staff’s and students’ conceptions

We were thus able to highlight the significant differences in the staff’s and students’ conceptions of SD. In the closed question: Rank the eight statements from closest to furthest from your own conception of SD, the students associated SD, first and foremost, with the environmental dimension (Nature conservation actions; Increasing respect for and appreciation of nature; Gaining a better understanding of the workings of nature, etc.), whereas the staff gave priority to more complex goals, which we categorized as “Awareness” (Only way to protect future generations; Acting to ensure the world’s equilibrium; Commitment from each citizen, etc.).

The staff incorporated the three pillars of SD into their reasoning while the students focused on the environmental dimension. Moreover, for both staff and students, the first references concerned the management domain linking SD to “eco-friendly gestures” (Table 5). These gestures focus essentially on individual behaviour and not on collective actions identified in the “Territory management” or “Politics” categories. Staff was much more concerned than the students about aspects relating to responsibility.

2.3 Commitment of students with eco-delegate status

In the above results, we grouped together students and eco-delegates. However, more detailed analyses tended to show that eco-delegate status confers significant differences ranging from ($0.23 < F < 0.51$; $\text{sign.} < 0.005$) in the categories of: “Stakeholder”, “Basic needs”, “Economy”, “Environment”, “Territory management” and “Politics”, but no significant differences in any of the other terms given by the 80 students. Thus, the eco-delegates had conceptions which were qualitatively and significantly more varied than those of their peers.

Commitment to action was a priority for eco-delegates, whereas the students who were not so actively involved had a more global vision of sustainability. Do these differences in attitude explain the differences in the amount of knowledge they have of the actions already set up in the school? The results confirmed that values play a prominent role in the design and organisation of educational activities concerning SD, at least for the staff. This linkage between knowledge, values and action should be explored during the transition from

rationality to reasonableness. It results in a shift from optimisation of benefits to incorporation of moral and ethical values in decision-making.

2.4 Influence of gender

The high number of males among the eco-delegates was the first sign of a difference in the conceptions of SD (Table 2). However, although the body of data was quite large, we found very few significant differences linked to gender. All else being equal, the biggest difference related to gender concerned the “Damage management” category ($F = 35.732$, $F < 0.008$). Putting the differences in frequency into perspective, non-parametric tests showed that females are significantly more concerned about handling damage caused by humans than their male counterparts.

2.5 A limited vision of the actions already set up in the secondary school

The students and staff mentioned a very limited number of actions when answering the following question: What are the actions bound to sustainable development which have taken place in your school? On average, 2.12 actions were mentioned, whereas dozens of actions have been listed in this school over the past few years (Figure 2).

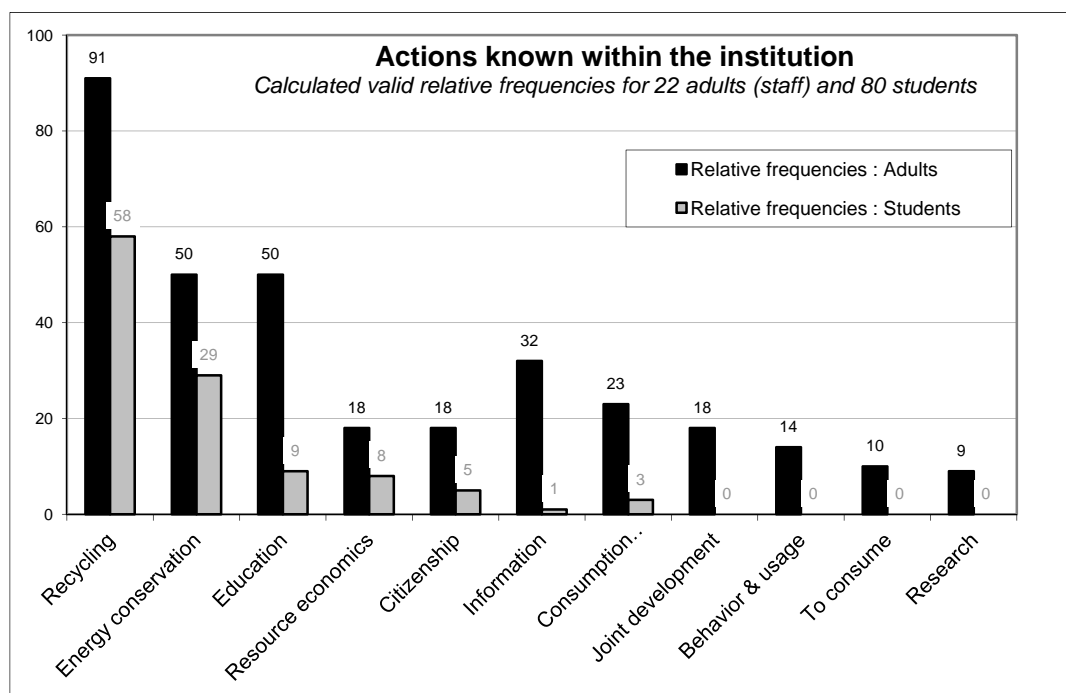


Figure 2. Actions reported by staff and students (relative frequency): frequencies are reported per 100 adults (staff) and 100 students.

In terms of their knowledge of the actions operating within the school, the eco-delegate students were less different from the staff than they were from their peers who did not have eco-delegate status (Table 6). Similarly, it appears that the information provided by the eco-delegates was not significantly different from that provided by the school staff. Therefore, although the eco-delegates were as well informed as the staff, their peers were not. Two hypotheses emerge: the first is that the eco-delegates do not pass the information on to the

other students in their class, and the second is that the eco-delegates have the same amount of information as their peers but are more committed to SD and thus better able to mobilise this information when filling in the questionnaire.

Table 6. Post-hoc comparison test between staff, students and eco-delegates.

(I) Role	(J) Role	(I-J)	Standard error	Significance	Confidence interval 95%	
					Inferior limit	Superior limit
Staff	Eco-delegate	0.163	1.879	0.996	-4.51	4.83
	Other students	-8.104*	2.933	0.027	-15.39	-0.82
Eco-delegate	Staff	-0.163	1.879	0.996	-4.83	4.51
	Other students	-8.267*	3.069	0.032	-15.89	-0.64
Other students	Staff	8.104*	2.933	0.027	0.82	15.39
	Eco-delegate	8.267*	3.069	0.032	0.64	15.89

Multiple comparisons

Action_SD_School Taxonomy level 1: Tukey test.

In addition, and very surprisingly, it appeared that the students were mentioning actions led within school Agenda 21, while the staff was not. However, after consulting with the project leader, we realised that the students considered some of their daily activities to be actions initiated by the school whereas this was not, in fact, the case. It was “simply” a question, here, of the know-how and social skills they had acquired in school rather than actions taken within the framework of a particular project.

2.6 Changes in daily life

To be considered a success, an individual's training must involve the acquisition of new knowledge and skills. In this context, we asked what had changed in the respondents' daily lives following the different training projects and actions. The changes concerned mainly the “Damage management” category (Figure 3), such as using fewer chemical products in the workplace, avoiding unnecessary pollution, disposing of waste in the proper place, or more generally fighting against environmental pollution. Priority was, once again, given to the environmental dimension of SD.

2.7 Obstacles

We asked why people do not get involved in SD actions. The aim of this question was to highlight obstacles to SD. There were no significant differences in the suggestions given by the staff, students and their eco-delegate peers (Figure 4).

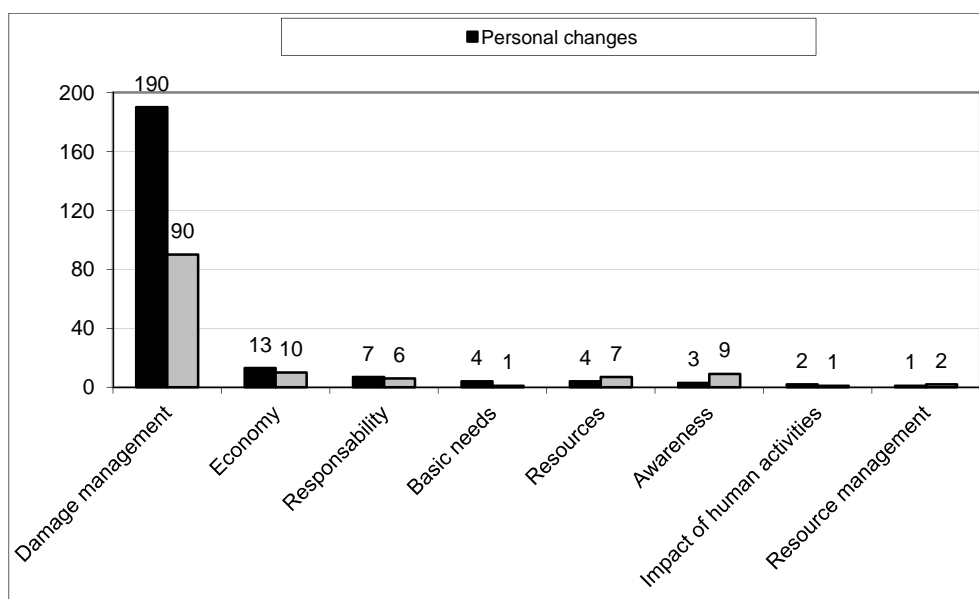


Figure 3. Changes related to sustainable development.

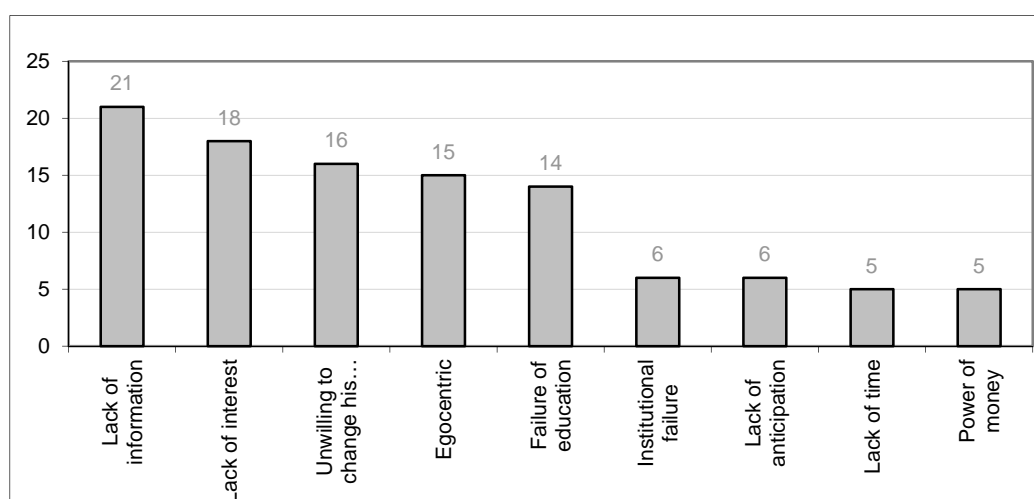


Figure 4. Obstacles to becoming involved in SD actions (valid relative frequencies).

The first obstacle to getting involved in SD is clearly a deficit of information (Figure 4). Information seems to be lacking, even within the school, as we saw earlier when we asked students and staff to list actions that were already in place. However, even the educators admit that it is a bit simplistic to think that someone who is well-informed will modify his/her behaviour. This idea is regularly challenged when setting up educational actions. The obstacles which followed were related to lack of interest; in short, we show no concern for others or for the future. This could perhaps be partly linked to a lack of education, which comes in fifth on the list. These initial reasons alone represented 80% of the obstacles to SD and consisted of both institutional and psycho-social barriers. Over 12% of the reasons for not being involved in SD actions were linked to the power of money, to imaginary additional costs or to false reasons given by industrialists to avoid spending a fortune on protecting the environment (manipulation).

3. Discussion

We found some previously proven results on conceptions of students and staff, which were related to the environmental dimension of SD (Summers & Childs, 2007; Walshe, 2008). This remains close to the analysis of Beaugrand (1990): "Students adjust and change their conceptions when they are confined in schools". Our results highlight a dichotomy between school and their daily lives outside school.

3.1 From "damage management" to "resources management"?

When the students talked about life outside of school, in terms of changes in both their own personal behaviour and that of their close circle of family and friends, the main theme was "damage management", whereas in school they referred to "resource management". The same distinction appeared in the staff's results.

These differences in perception of what happens in and out of school can be interpreted in two ways, which are potentially complementary and cumulative. We can consider them to be the effect of action, namely of the implementation of Agenda 21. The students and the educational community can act positively upon their environment. School becomes an area where things are "possible", environment is a resource and is no longer viewed in terms of constraints and degradation. Outside of school, especially when faced with sometimes over-dramatized media coverage, one may experience a feeling of helplessness and of only suffering the "damages" because individuals have no control over this larger reality. Events are presented in terms of their negative effects whereas at school, the events are presented in terms of resources and the anticipation of future needs. Is taking action conducive to learning? In vocational didactics, Pastré (1999) draws attention to the danger of confusing the outcomes of an action with the outcomes of the learning process. This confusion appears to have been kept alive in the current school context: challenges of working in a team over the long term, the division of educational sequences, culture and the syllabus, all rooted in the disciplines. Under these conditions, it seems to be difficult to go beyond the action/learning dichotomy.

3.2 Commitment of those involved in an educational approach to SD

How do the different players in the school feel about this active, quasi-militant dimension of Agenda 21? We must stress that all members of the educational community endorsed the principles and goals of SD, but not all were committed to the same extent. The answers to the questions concerning the changes induced by SD issues showed that these changes are limited (fewer than one in three modified at least one of their habits and only 20% changed more than one way of doing things), that they concern the environmental aspects (first sorting waste, then conserving electricity and water), and finally, that they noticed mainly similar individual actions in their close circle of family and friends (sorting waste, saving on water). These are "eco-friendly gestures", actions which are necessary but not sufficient, but they may constitute a basis for more complex actions. The risk of such pedagogical participation is "*the exclusion of important themes such as material growth and global social*" (Laessøe, 2010).

3.3 Areas of action

SD redefines the boundaries between the approach by academic subject/a-disciplinarity or cross-curriculum approach, teacher/person who educates, class/school/local surrounding territory, knowledge/values, acting/thinking. The educational act is put into context and therefore differs according to the given environment. The teachers commit themselves

preferentially to those who are linked to their own discipline. The conception of the three pillars of SD allows the teachers to split the actions into three groups: those relating to the environment, those relating to the social sphere and those relating to economics. They then link the different SD actions to the corresponding academic discipline. The conceptions of the secondary school teacher's job and of the learning process likely also explain the form of commitment adopted by the staff: the teacher is above all an expert in his/her field; school is a place for learning through understanding rather than through "acting". This doing/learning dialectic is probably present in the culture of this secondary school because of its orientation towards technical and vocational courses.

The redefining induced by these boundaries changes the modes of action and organisation of the teaching-learning activity by introducing new players, new references and new relationships. What emerges is a change in the teacher's role or "job" and the student's role or "job". It seems to us that since the mentioned actions are not related to all of the traditional class activities, it is more a question, for the moment, of superimposing a new teaching practice over an existing one. Indeed, since communicating these initial results to the teaching staff, an effort has been made to present all of the actions of Agenda 21 along with the main themes which structure them, integrating, more explicitly, the educational goals and the classroom activities.

The difference between staff's and students' conceptions of SD concerned the categories of "Responsibility" and "Awareness". Regarding the question on the notion of what "being responsible" is, the differential between staff and students persisted on this individualist conception, with a larger proportion (nearly 30%) of the staff linking responsibility to the societal dimension (future, consequences, future generations, etc.). This is a more reflexive stance which reveals the different way in which students and staff relate to time. The staff probably function on a very different time scale, projecting themselves beyond their own generation, whereas the students, most of them under the age of 20, are still going through the period of identity construction—a period in which any projection into the future remains much more virtual and more difficult to detach from their subjectivity. Another difference concerns the social and civic aspects, which were of secondary importance to the students. The relationship to the Other or to the World (Charlot, 1999) is still being established for the students and is more stable for the staff. Concerning projections into the future, we can see that the students have difficulty, not only in terms of anticipating future needs, but also in terms of future societal choices. A potential teaching method to develop might be work on long-term scenarios (Lloyd & Wallace, 2004).

We note that a certain number of elements which remained implicit throughout the project must nevertheless be considered as fundamental. "Act in order to understand, understand in order to act". This slogan, often used in teaching or training, including situations linked to SD, is worth challenging and specifying.

4. Conclusion

This study of the several hundred responses of 80 students and 22 staff members of an agricultural school enabled us to highlight different conceptions of what SD could be, of the way they define it, of the initiatives set up in the school but also in the students' proximal environment. We also gain better knowledge of the impact of training for SD on day to day behaviour and habits. Furthermore, this study allowed us to emphasize the potential obstacles to personal commitment.

An analysis of the players' conceptions demonstrated the difficulty the great majority have in imagining what is at stake globally in this type of action. The evaluation of such educational activities should, rather, be oriented towards understanding the dynamics involved and cannot be reduced to measuring a hypothetical level of performance or effectiveness, be it in the cognitive or praxeological domain. The evaluation indicators can only be local and determined by context.

The evolution of the secondary school's Agenda 21 project seems to have gone beyond the "eco-friendly gestures" to progressively integrating educational challenges. A second group is in the process of filling out the questionnaire used in this study, with the aim of gaining better longitudinal knowledge and observing the effects of educational actions on the conceptions of SD, over time. Finally, concerning the optimum conditions and the obstacles to setting up an Agenda 21 project, the support of an extended team composed of management staff, a project leader and external partners, whether these are from the academic authorities or others (for example, ADEME), is fundamental to broadening the modalities and the scope of the actions. This type of cooperation is one of the main conditions essential to the success of the project. All things considered, this type of cooperation must in itself be endorsed by official circulars regarding the implementation of SD in schools.

Acknowledgements

This study was based on work supported by ANR ED2AO.

REFERENCES

- Altman, J. (1974). Observational study of behaviour: Sampling methods. *Behaviour*, 49, 227-265.
- Beaugrand, J. (1990). Autoconditionnement dans l'explication du comportement de l'élève. *Sciences et comportement*, 20(3-4), 21-23.
- Charlot, B. (1999). *Du rapport au savoir. Éléments pour une théorie*. Paris: Anthropos.
- Fortin-Debart, C. & Girault, Y. (2005). Agenda 21: une approche coopérative. *Education à l'environnement de soi au monde. POUR*, 187, 124-130.
- Habermas, J. (2002). Valeurs et normes. A propos du pragmatisme Kantien de Hilary Putman. In R. Rochlitz (Ed.), *Habermas, l'usage public de la raison* (pp. 199-236). Paris: PUF.
- ICLEI (1996). *The local Agenda 21 planning guide: An introduction to sustainable development planning*. Toronto, Canada: International Council for Local Environment Initiatives.
- Jonas, H. (1992). *Le principe responsabilité*. Paris: Les Éditions du Cerf.
- Laidin, C. (2007). *L'enseignement agricole en marche le développement durable*. Dijon: Educagri.
- Laessøe, J. (2010). Education for sustainable development, participation and socio-cultural change. *Environmental Education Research*, 16(1), 39-57.
- Léna, J.-Y., & Simonneaux, J. (2008). Représentations, enjeux et modalités didactiques de l'éducation au développement durable : Une recherche en cours sur l'EPLEFPA de Pamiers, Colloque "Le développement durable de l'école au campus : enjeux pédagogiques et pratiques sociales dans les établissements d'enseignement". 25-27 Jun 2008, Albi.

- Lloyd, D., & Wallace, J. (2004). Imagine the future of science education: The case for making futures studies explicit in student learning. *Studies in Science Education*, 40(1), 139-177.
- Mappin, M., & Johnson E. A. (2005). Changing perspectives of ecology and education. In E. Johnson & M. Mappin (Eds.), *Environmental education and advocacy. Changing perspectives of ecology and education*. Cambridge: Cambridge University Press.
- Pastré, P. (1999). La conceptualisation dans l'action: bilan et nouvelles perspectives. *Education Permanente*, 139, 13-35.
- Sadler, T., Chambers, F., & Zeidler, D. (2004). Student conceptualisations of the nature of science in response to a socio-scientific issue. *International Journal of Science Education*, 26(4), 387-410.
- Sauvé, L. (2007). L'équivoque du développement durable. *Chemin de Traverse—Revue transdisciplinaire en éducation à l'environnement*, 4, 31-47.
- Simonneaux, L., & Simonneaux, J. (2009). Students' socio-scientific reasoning on controversies from the viewpoint of Education for Sustainable Development. *Cultural Studies of Science Education*, 4, 657-687.
- Summers, M., & Childs, A., (2007). Student science teachers' conceptions of sustainable development: An empirical study of three postgraduate training cohorts. *Research in Science & Technological Education*, 25(3), 307-327.
- Walshe, N. (2008). Understanding students' conceptions of sustainability. *Environmental Education Research*, 14(5), 537-558.
- WCED (World Commission on Environment and Development) (1987). *Our common future*. Oxford: Oxford University Press.