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Think forward, act now : training young researchers for sustainability Reshaping the relationship between PhD student and adviser

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INTRODUCTION

In Europe [1][2], in the United States [3] doctoral studies are being questioned and dissatisfaction is being expressed by both students and faculty, who criticize the relevancy and the efficiency of the training and call for a rethinking of graduate degrees that pays attention to the world. It is commonly argued that the role of science in society must be better taken into account and that a new mode of production of knowledge incorporating the needs and viewpoints expressed by the different stakeholders is emerging which calls into question the adequacy of familiar knowledge producing institutions, whether universities, government research establishments or corporate laboratories [4]. Universities are urged to identify and sponsor new opportunities by which graduate students can employ their learning and abilities to benefit segments of the society beyond the academy. Reasons for dissatisfaction are also found in the attitude of research supervisors : the academic profession is blamed for not meeting professional responsibility in upholding the norms and traditions of their profession through a responsible and ethical conduct [3]. And researchers in general are encouraged to seek a “re-shaping of their mutual relationships”. Lastly, the fact that, currently, PhD theses tend to be oriented more toward the production of tools than the exploration of concepts generates more doubts about the possibility to qualify researchers' training as scientific.

Regarding the production of scientific knowledge, the need for cross-disciplinary cooperation is widely acknowledged and emphasized, and scientists agree that historically drawn boundaries of disciplines have to be re-examined and that strategies which lead to fragmentation of knowledge building have to be replaced by practices of integration [5]. To overcome the limitations imposed by the fragmentation and segmentation of social scientific knowledge, new competencies are needed, particularly the ability to debate about one's work, to situate it in a collective, collaborative or concerted approach and to build on complementary experiences, competencies, methodologies and viewpoints. Some authors even call for a “re-engineering of our scientific thinking (.....) to overcome the limitations that have become evident during the disciplinary and interdisciplinary stages”¹ [6]

Pressure to change is also exerted through the 5th and 6th European Framework Programmes : building and structuring the European Research Area imply reconsidering, rethinking the role and nature of training through research or for research. Quality and traceability, mobility are matters of extreme importance, the training of young researchers being a key element in the evaluation of both integrated projects and excellence networks. Researchers must assume responsibility for the changes in practices inevitable if they want to achieve these objectives.

In this context, incorporating sustainability into higher education for us means training young researchers who will be able to break new ground in Europe on transdisciplinary issues. It means introducing changes not so much in the teaching (curricula) than in the learning processes. Considering that more than tools, learning abilities and capacity building are sustainable, the issues which must be addressed concern the definition of what can be termed “sustainable training for young researchers” and more generally the representation we share

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of what being a researcher will mean in the coming years ; they concern the core skills that need to be developed and the criteria to be proposed to assess the sustainability of such training, namely in terms of quality and relevancy. We believe these questions must be addressed and dealt with at the European level, through a joint effort from various places of knowledge such as universities, research institutions, corporate laboratories [7].

To contribute to the debate and also to the much needed “re-shaping of the relation” between supervisor and student researcher, we present here a training programme developed at INRA, the French National Institute for Agricultural Research. It is based on a cooperating approach between research student and thesis supervisor, who are encouraged to work specifically on the process during which the idea that is born in the supervisor’s head is transformed into the student’s personal scientific project ; epistemology, heuristics and linguistics are among the tools used to generate situations of exploration, dialogue and debate, where participants confront their visions, prejudices or pre-judgments, discover their standpoint and mutually push their “horizons of understanding” [8]. Training also focuses on the communication competencies expected from researchers.

INRA, a multidisciplinary institution naturally attentive to the nature and quality of Ph.Ds

Let’s briefly outline some of INRA’s assets in developing and testing a programme that could contribute to a collective reflection on sustainability in graduate and post-graduate education. INRA is a place where agriculture, health and diet, and environment domains converge : it comprises several disciplinary fields (among which agronomy, animal science, animal and plant genetics, microbiology, physiology, economics and sociology), so that the PhDs which are prepared in its laboratories naturally tend to be multidisciplinary. Besides, historically, INRA has forged close links with society, so that again, many PhDs are directly connected to the social demand. Lastly, the Institute with its 8 500 employees, trains about 1 000 PhDs over three years and contributes to thousands of teaching hours.

Reshaping the relation between supervisor and student researcher using epistemology, scientific debate, group learning

We first decided to explore the relation between supervisor and student researcher during the phase of elaboration of the student’s research project (first year) to contribute to solving well identified communication difficulties [9]. In the process, we realized that this collaborative relation could be seen as a model for larger scale situations in the laboratory and became convinced that working with both parties together was essential.

1. Too little time and space is devoted to exploring the scientific and societal issues at stake in the young researcher’s project

The student researcher’s training suffers from the fact that for the past years , research has been turned more toward the “*how’s*” than to the “*why’s*” of scientific activity : briefly, little space and time is devoted to exploring the long- and medium-term scientific and societal objectives of a research project while attention focuses on the methods and tools to be used, tested or designed. Our research on scientific writing practices [9] confirms that, despite existing writing standards [10] and editors’ and referees’ comments and recommendations, a

large majority of scientific papers, and more generally a large amount of the scientific written production, concentrates on what was done and observed and not on the issues at stake or the questions addressed.

No wonder therefore that the student researcher is often considered as a highly qualified technician and does not always share the objectives of his supervisor and of the research team he belongs to, let alone the objectives and scope of the larger project (European, regional or other) which finances his own project. Moreover the oral or written exercises he is frequently asked to do inside the laboratory consist in presenting the results of his work, which very seldom leads to debating the “*what’s*” and “*why’s*” of the research and the relevancy of some choices. Oral presentations like written reports will most of the time focus on tasks, experiments, methods and tools.

2. We need to create “ideal speech situations”

Habermas defines what he calls an “ideal speech situation” [11] as a situation where each participant has an effective equality of chances to take part in dialogue ; where asymmetry is limited, where dialogue is unconstrained and not distorted. What the idea of an ideal speech situation does is to provide us with some ways of identifying and exploring the distortions that exist.

In the scientific community, communication is hindered by the extreme specialization of research activities, and particularly by the fact that researchers “learn their trade” in the laboratory and that much of the knowledge and know how, which are transmitted and acquired through a process of socialization, will remain tacit and implicit. Communication therefore must be fostered. Concepts and terminology in particular must be debated and clarified, researchers must be encouraged to produce informative rather than descriptive statements : going through these mental, intellectual activities, researchers question their own discourse, its relevancy, the relevancy of the knowledge and know how they are transmitting and eventually they will improve and enhance their relevancy. The process is certainly difficult and costly in terms of self image and authority but researchers will gain in objectivity and capacity to convince.

At INRA, because of the multidisciplinary research environment, PhD research projects tend to be situated at the frontiers of disciplines and research fields. So we create such speech and communication situations by inviting several research department members, who are keen to build a shared vision and want to identify new questions, to participate to seminars : *Réflexives* are usually organized with three or four scientific departments, outside the laboratory, which means that participants (supervisors and their PhD students) are allowed to work together outside hierarchy. This condition is essential to the process.

The seminars are organized in workshops with 4 to 5 supervisor/student pairs, the debate being mediated by facilitators : the facilitators are researchers from several departments of the Institute who believe in fostering dialogue between disciplines and re-structuring the training process of student researchers. They have received a special training : first they have taken part in *Réflexives* sessions as participants and experienced debating their own work ; then they have acquired facilitation techniques and they regularly meet to share experience, discuss facilitation strategies and methods as well as analyse the impact of *Réflexives* on student researchers’ training. Their role is to encourage fundamental communication activities like listening - paying attention to what is said and how it is said -, questioning, re-formulating to limit the use of jargon and specific codes, to make one’s ideas explicit. Their role as facilitators is reinforced by the fact that they belong to other disciplinary fields, thus bringing with the other participants multi-disciplinary point of views in the debate. To facilitate the whole process, they use several techniques, among which that of mind-mapping [12] specially

adapted for a public of researchers. *Réflexives* focus also on the other major activity which requires creativity, rigor and relevance, that is communication in writing : workshops are organized where participants' written productions (abstracts, scientific papers or reports) are criticized using linguistics tools and methods, under the guidance of a linguist. The participants, analyse their texts through a process which includes reading, questioning the concepts or the value of statements and examining language . This analysis process generates scientific debate of course, and discussion of scientific practices - writing practices, mimetic conduct, training practices, etc.

Providing a model for formulating research questions or research problems by working with the pair supervisor/Ph.D student

Working with the pair supervisor/student researcher on the elaboration and communication phases of the student's research project is certainly the major innovation brought by *Réflexives*. We shall consider here first what both parties – supervisor and student - gain from working together through a structured process including reflexivity and group learning, how innovative the activities proposed in *Réflexives* are, before discussing their sustainability.

1. The Ph.D student's research activity, method and objectives are clarified by having him explain his work in simple words to people from various disciplines.

Jargon obstructs clarity and threatens quality. It also contributes to those distortions which hamper dialogue [11]. Surrounded by colleagues from various disciplines or lay persons, the student researcher is forced to formulate what remains tacit in the laboratory : his research problem, research question, research strategy, etc. This process is very often a difficult one because it requires reflection on one's own work and choices and requires also to assume a well defined point of view [13][14] ; that's when the student comes very close to "experiencing" epistemology . The presence of colleagues from other disciplines and of facilitators guarantee also to both student and advisor an effective equality of chances in dialogue . Freed from most hierarchical ties and competition, the debate is very open : new approaches are suggested or explored, concepts are confronted, arguments developed, logical sequences and relations enhanced, terminology discussed. The student realizes that knowledge is not a fixed thing or commodity to be grasped. It is not something "out there" waiting to be discovered. Rather, it's an aspect of a process [8] [15]. *Réflexives* contribute to broaden participants' scientific culture and leads the Ph.D student to position his work in a broader context than usual.

Although the objective of the exercise is not to influence the participants into modifying their point of view and their objectives, it often happens that the research question is not only clarified but modified .

2. The supervisor becomes learner

The presence of the supervisor is crucial. In the interaction with his student, he will realize how much the apprentice researcher knows, has understood of what he has tried to convey ; he will also realize if key information is missing, has never been given or has been taken for granted, and realize also that misunderstandings are plenty. He will identify and explore the distortions that exist and be better prepared to remedy them.

Beyond this analysis, he will reflect on the relevancy of the question proposed, of the adequacy of the methods and tools chosen and *in fine* he will reflect on his own scientific

project, assess its relevancy and probably think of elements he had consciously or unconsciously set aside or ignored, imagine new paths to be explored and new collaborations to build. Like their students, supervisors experience epistemology and reflexivity.

3. The Ph.D student is at the center of the debate

Physically speaking first, the student researcher is the one being questioned, interest focuses on him, and at the center of the mind-map is his research question or scientific objective. Then *Réflexives* provide him with the opportunity to formulate his own, personal vision of his project using his own words . Working with supervisor/student researcher pairs, we very often realize how mimetic, even symbiotic the relation can be. The words are the same, the sentences are duplicates one of the other, there is no real dialogue. Similarly, evaluators will confess that it is very often difficult to identify a candidate's contribution (PhD student at a thesis presentation or researcher in scientific papers or project). Therefore it is crucial to allow the student researcher to use his own terms, build his own discourse about the research he is doing. As noted by T. Gaudin [16], the supervisor's mission is to accompany the student researcher through a crucial process of changing status, i.e the latter must "turn away from a passive role, which has consisted in absorbing established knowledge to a pro-active role which consists in transforming knowledge into creations."

Lastly, placed in a central position, the student reflects about his own choices during the research and beyond ; he tries to explore relations : how does his present research activity in a particular field relate to his own personal project ? Can he figure out the competencies he will acquire ? Has he gained autonomy ? How does he relate to the research team ? He is challenged to think beyond his everyday activity, and to reflect about his motivations for action, the meanings and value of his research and of course to consider the limits of fragmented knowledge.

4. The sustainability of the training is guaranteed through situations of reflexivity and group learning, and reinforced by the institution

As indicated before, the structured process at work in the seminars presupposes that advisers are considered not as teachers but as learners, but that in all cases they identify themselves as group members. Thus conditions are favourable for all participants to think critically about the re-structuring of the training process, and to decide to embark on new ways of working together : they have been given the opportunity to re-learn their way to interact, to re-think and re-shape their mutual relationships.

Let's now consider how sustainable the innovative activities of *Réflexives* are, and how the sustainability of the training is reinforced by the Institution itself. As Holen & al. remind us, "the material conditions and staff engagement prevailing at the institute are crucial factors for the practical implementation of alternative ways of teaching and the integration of interdisciplinary forms of teaching in courses"² [17]. The US report "At Cross Purposes" came to the same conclusion : " No real gains can be accomplished unless the performance of instructors, both graduate teaching assistants and faculty is exceptional and focused squarely on the needs of students to acquire an education that will prepare them for the 21st century" [3]. *Réflexives* started as a means to meet the communication needs identified by a scientific director within his research department. But it very quickly drew the attention and participation of a growing number of scientific departments within INRA : three years later, in

1999, 15 out of the 17 departments had participated at least once to the workshops proposed. Throughout the process, we were careful to make heads of departments “co-owners of the innovation”. As for the administrative body, they obviously support this collaborative approach : first considered as a pilot pedagogical experiment by the institution, the project has taken a new dimension when the Board of Directors recently decided that it was crucial for the much needed renewal of competencies in the Institute. Yet among the 15 departments who acknowledge the need for such places of debate and exchange and sponsor *Réflexives*, only three so far have developed an internal organization to provide support for their student researchers and accompany the work of supervisors. More implication could be expected that would allow for experience sharing, for the development of tools and methods and would reinforce the existing dynamics ; hopefully, we can see things evolving : researchers in charge of policy-making and of the training of young researchers are more and more involved and keen to promote changes.

CONCLUSIONS AND PERSPECTIVES

Réflexives already contribute to identify and enrich transdisciplinary issues as well as to build collectively the new competencies the institution needs to tackle those issues. Other collective arenas of debate and interactions must be imagined and opened, to develop new modes of scientific communication. We believe the pedagogical set up, functioning and methods of *Réflexives* can be used to work on larger scientific projects : we have already worked with scientists from many disciplines and from government and corporate laboratories to design and build the projects of teams within the Institute and to build large European projects, and more generally to develop understanding between communities and elaborate new scientific questions or objectives.

But among the questions which must be addressed now because of the changes brought in terms of professional development, that of the criteria is crucial : first to give student researchers means to assess their training because, as noted in the report “At Cross purposes” [3] “many students do not understand the criteria used to determine when they will be ready to graduate. Most disciplines indicated 40-50 percent of respondents being clear on this point, but lab sciences scored the lowest, with molecular biology and chemistry both less than 25 percent”. Second, to define and evaluate the sustainability of young researchers’ training: so far the surveys and proposals for a re-thinking of the missions of supervisors have been based on the criteria presently available (scientific excellence, relevance and quality of the research methods, project construction, etc.) : but are such criteria sustainable ? do they need to be reconsidered and new ones formulated ? Collaborative work at the European level is necessary if we want to enhance quality, traceability of research activities and mobility within the European Research Area ; it is also necessary if we want to bring places of knowledge production or creation closer to the surrounding society in order to contribute , in D. Mebratu’s words [6], to “achieving civic competency”. Innovation in students’ training will benefit all spheres of society.

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