

# AN EDUCATIONAL EXPERIENCE ON THE TRANSDISCIPLINARY ANALYSIS OF ENVIRONMENT

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## Abstract

We, the “Grupo TRANS”, are a collective of university professors, as well as a couple of experts in environmental education working in Occupational Professional Education and/or Secondary education. Individually, each of us is integrated in a different university department and involved in teaching and research in law, geography, health sciences and biological sciences. As a group, since 1994 we have promoted the reflection and the practice of transdisciplinarity in the context of the University of Málaga.

In this communication, we will present our experience in the incorporation of our reflections and practice of transdisciplinarity to the context of a short, 30-h course for undergraduate students, named *Introduction to the Transdisciplinary Analysis of Environment*. In this course, the direct co-participation of both teachers and students was continuously stimulated through several group dynamic procedures, as well as discussions, comments and practical exercises. A half-day field practice was included. Part of the working time was through the virtual space created for the course. The second edition of this course was adapted to become an ECTS experience.

According to the records of the tests filled by the students at the end of the course, this experience was highly stimulating for them, who scored as very positive the course on the whole. Students gave a special value to their engagement in the evolution of the course and to the opportunity (unfortunately, not very frequent in the context of our University) they had to share opinions with professors and other students coming from different specialities and to work in the practice of transdisciplinarity with the help of information and communication techniques.

## Keywords

Innovation for higher education, transdisciplinarity, environmental analysis, ECTS

## 1. TRANSDISCIPLINARITY AT THE UNIVERSITY: A NEED

The University, an institution with more than seven centuries of history, is itself the highest knowledge transmitter. However, its endeavour should not be a repetitive, acritical transmitter of well established knowledge. On the contrary, University is expected to stimulate the criticism of any kind of knowledge and, at the same time, to produce new knowledge. Unfortunately, University is at the present moment far from these goals, due to a deep structural crisis in which University has been immersed for the whole XXth century, a crisis with no known end. Crisis? What crisis?

### 1.1 The crisis of ultraspecialization

One main reason for this long-lasting crisis of University is the compartmentation of knowledge. The progressive and accelerated accumulation of knowledge has been accompanied by an increasing degree of specialization, not only due to a theoretical background justifying it, but also due to operative and practical causes, as well as power fights within the professional world. This requirement is not intrinsically negative. Specialization causes a compartmentation in which each discipline has its own professionals, its own language, and its own procedures of analysis, as well as its own validation rules. All disciplines evolve and during their development they not only change, but they also tend to subdivide, giving rise to smaller and smaller disciplines. This evolution towards ultraspecialization has proven to be extraordinarily productive and has contributed to an impressive increase in the rate of

knowledge accumulation. However, this should be counterpointed by the very negative fact of an increasing fragmentation of knowledge in smaller and smaller and more and more isolated compartments. This process of endless fragmentation has led to an actual situation in which even close specialities ignore each other. This situation represents a deep rupture between the reality of the academic and scientific knowledge and the ideal knowledge, which should be one and integrated.

## **1.2 First steps to surpass ultraspecialization: from pluridisciplinarity to interdisciplinarity**

In parallel to this tendency towards segregation, there is an effort to synthesize and unify disciplines under a functional and interrelated perspective. This has been the case with Ecology, Geography, Theoretical Physics, Health Sciences, and Economy. In fact, the huge technological progress that contributed to ultraspecialization is currently making advisable (when not directly requested) the integration of dispersed knowledge. The University, a pioneer in the genesis and development of compartmentalized specializations should be now a pioneer in this return way backwards to the integration of knowledge. Pluridisciplinarity represents the lowest level of integration. In fact, the association (either horizontal or vertical) of disciplines provided by pluridisciplinary approaches leads to no actual integration.

As a second level of integration, interdisciplinarity means that the cooperation among several disciplines leads to actual interactions with actual interchanges and mutual enrichment. To approach a common objective for several disciplines, such as trying to test a theory or to discuss properly the obtained results and observations, these disciplines need to find ways for cooperation. Therefore, interdisciplinarity implies a will of commitment to develop a wider frame in which each of the interacting disciplines is modified. In this scenario, disciplines begin to be interdependent. Interdisciplinarity is a goal never completely reached, so that it should be pursued permanently. It is mainly a practice, rather than a theory.

## **1.3 Breaking the frontiers: Transdisciplinarity**

Transdisciplinarity is the highest level of integration among disciplines. In fact, it represents the construction of a whole system without solid frontiers among disciplines. The origins of this concept can be found in the classical 1955 article of Niels Bohr on the unity of knowledge [1]. Although Bohr does not mention the word, the concept is clearly expressed. The first documented usage of the word "transdisciplinarity" is found in a text written by Jean Piaget in the context of a workshop on interdisciplinarity (1970): "*Enfin, a l'étape des relations interdisciplinaires, on peut espérer voir succéder une étape supérieure qui serait 'transdisciplinaire', qui ne se contenterait pas d'atteindre des interactions ou réciprocitys entre recherches spécialisées, mais situerait ces liaisons à l'intérieur d'un système total sans frontières entre les disciplines*". Therefore, it represents a general systems theory, including operative and regulatory structures and probabilistic systems, linking these different possibilities by means of regulated and defined transformations. The integration occurs within a comprehensive system, pursuing common goals and an idea of epistemological and cultural unification [2]. The main aim of transdisciplinarity would be the construction of this kind of models usable and transferable among disciplines, thus avoiding a loss of efforts with unnecessary repetitions within each separate discipline and leading to the unity of knowledge. Although Edgard Morin forecasts the possibility and necessity of this unification of knowledge [3], we still lack an optimally developed transdisciplinarity model. By the turn of the century, this unity of knowledge has been claimed with the name of *consilience* [4,5].

## **2. ORIGINS AND MEMORY OF SOME PREVIOUS ACTIVITIES OF "GRUPO TRANS"**

### **2.1 The origins**

During the academic season 1994-95, a group of professors from the University of Málaga, together with the Environmental Education Association (EDUMA), started a process of reflection, analysing the transdisciplinary approaches applied to the teaching-learning related to the environment at the university. This process became a research framed into the Educative Innovation Projects supported

by the University of Málaga. In the period 1995-97, we carried out a project entitled "Reflection and transdisciplinary action on the environment". The aim of this first project was to create a forum for the discussion and critical reflection on environmental topics. Product of these discussions and reflections, we felt compulsory to carry out a survey to know the position of the students at the University of Málaga. The survey, its results and their critical discussion (briefly commented in the next section) were included in the published monography entitled "University Students and Environment. A Transdisciplinary Essay at the University of Málaga", edited by the Environment General Office from Andalusian Government and the Publishing and Scientific Exchange Service from the University of Málaga [6]. Since then, the group has evolved and grown maintaining clear signs of identity. EDUMA became Ecotopia and it is currently devoted to environmental education and educative actions to promote attitudes and commitment towards sustainability. Each university professor is involved in a different, specific research area, including health science, ecology, biophysics, biochemistry and molecular biology, geography and law. In spite of this diversity of specializations, all the components of the group share the conviction that transdisciplinarity is required to make possible the end of the secular crisis of the university. Therefore, our common goal is to apply transdisciplinarity in both the two main tasks of university: teaching and research. In the last ten years, we have become the "Grupo TRANS". As such, we have been involved in several new Educative Innovation projects, supported by the University of Málaga and the Andalusian Universities Quality Unit. Furthermore, the group has taken part actively in national and international events, organised seminars, round tables, encounters and courses with specific application of transdisciplinary methodology. One of these initiatives is our course on environmental transdisciplinary analysis commented in the section 3.2. We, as the Transdisciplinary Group of Environment of the University of Málaga ("Grupo TRANS"), are currently involved in new transdisciplinary projects.

## 2.2 Our survey on university students and environment

The first aim of the survey was to know the relationship of the students at the University of Málaga with the environment, with a triple approach: 1<sup>st</sup> Their degree of knowledge of the environment and environmental problems. 2<sup>nd</sup> Their opinions and theoretical attitudes in relation to the environment. 3<sup>rd</sup> Their level of compromise with the environment, that is, their effective attitude in their daily activity. A second aim of the survey was to get insight on the influence of undergraduate studies on the environmental formation of the studentship. To reach this goal, we compared the results obtained with students in the first and in the last course. The sample space covered a total of 1049 students from a population of 21852 students. Sampling was stratified by Faculties and Colleges and, inside each one, by degree course. Summarizing, we used stratified sampling by conglomerate blocks with proportional affixation, with an error lower than  $\pm 3.012\%$ . In a pre-survey, we had tested the questionnaire to take shape of the questions. The definitive survey contained 59 questions concerning the three approaches we followed, as well as some additional questions related to the teaching-learning of topics concerning the environment at the University.

The main results of the survey can be summarized as follows. In general, the students showed a level of knowledge of global environmental problems higher than their level of knowledge of local environmental problems. Concerning their opinions and theoretical attitudes, they were mainly skeptical concerning their view of the environmental future and the role of social organizations. Nonetheless, at the same time, they were mostly in favour of recycling, as a really valuable option. In general, they were not able to detect the important influence of an excessive consumerism on the damage of the environment. Concerning the use of transports, the answers were not encouraging: a half of the sample preferred to use their one vehicle (mostly, cars) to go to the university.

Concerning their effective action level, or compromise level, we could detect the existence of behaviours and attitudes scarcely respectful with the environment, in contrast with their own opinions.

Concerning the differences between the subsample of students in the first course and that of student in their last course, we could detect that they, in fact, occur. In general, there were slightly higher levels of knowledge and compromise in students in their last course. In contrast, students in the first course were more skeptical, more pragmatic, and much more consumer individuals.

Finally, concerning their opinion on the treatment given to the teaching of environmental topics at the university, more than 75% of those polled thought that the university does not treat the environmental problems properly, and more than 70% of them thought that it would be necessary to introduce global approaches in the teaching of environmental topics at the university, mainly through the use of free-configuration credits with professors and students from different Faculties.

In our opinion, the results of the survey reinforced and confirmed the need of a transdisciplinary approach to the problem.

### **3. OUR EDUCATIONAL EXPERIENCE ON THE TRANSDISCIPLINARY ANALYSIS OF ENVIRONMENT**

#### **3.1. The transverse concept of environment as an optimal choice for an transdisciplinary approach**

Our work as a group has focuses mainly on environment as a study topic. The choice of this topic was based on the complexity implied in the concept, which includes aspects related to both natural and sociocultural environment. In fact, the idea of environment has evolved from a first identification of the concept with the natural context (with the physical and biological -but not human- aspects of the environment) towards a more comprehensive view, which considers that the environment is the result of both natural and human forces and processes. In this technological age, the human modifications of the environment, the increasing urban sprawl and the human overcrowding are facts talking of a constructed environment that not only adds to the natural conditions surrounding the human being, but many times substitutes them. As a result, many new interrelationships between the human being and the environment arise. To understand this more and more complex environment, it is necessary to turn to causes and explanations that go beyond the limits of natural laws and enter the social, psychological, and cultural fields, as well as human constructs, as Economy and Politics. This comprehensive concept of environment that takes into account both the natural and the human-modified environment is a complex notion integrating aspects usually treated by different disciplines. Therefore, the environment is an especially rich and interesting topic to be treated from a transdisciplinary viewpoint.

All these reasons led us to propose transdisciplinary approaches from and for the environmental education. The methodology of environmental education should not be mixed up with the knowledge of the environment, since that means a much greater affective implication. The work should be not only intellectual; instead, all the senses and affects should cooperate and the primary source of learning should be observation and experimentation. In words of Steve van Matre (Chairman of the Institute of Education for the Earth): we must learn to walk on tiptoe on Earth.

Our closest environment, the city, has become a space full of contradictions and ever-increasing social differences, an unsustainable place from an ecological point of view. The humanized Biosphere is in a global crisis, with deep historical roots, caused by our own special way to interact with the Earth. Hence, a transdisciplinary environmental education is required as a global education immersed in criteria of ecological ethics. Since the Stockholm Conference (1972), where an "environmental moral" was proposed, to the Rio Conference (1992), there has been no congress on the field in which there is no reference to the citizenship compromise with its environment, and to the responsible use of attitudes, behaviours and values. The Belgrade Charter (1975) coins the term "new world ethics". The Tbilisi Conference (1977) decides to reinforce the meaning of values in all the programs in favour of the environment. The International Congress of Moscow (1987) includes awareness and values. The 24-05-88 Resolution of the European Union on Education concerning Environment has as a goal and driving principle "the way in which every individual can contribute with his/her behaviour to the protection of the environment". The Datebook 21, in its chapter 36 on the promotion of education, mentions in one of its points the need to increase the public consciousness, to reinforce the attitudes, values and measurements compatible with a sustainable development.

In conclusion, the environment shall be considered comprehensively, as a whole, both in its natural and sociocultural aspects. A change of attitudes and behaviour at all the scales of our society will be required. We are aware that a global (and, hence, transverse and transdisciplinary) education will be the only lasting solution to both current and future environmental problems.

#### **3.2. Our course on environmental transdisciplinary analysis**

Based on our previous reflections and experience and on our conviction that the environment is an optimal choice for a transdisciplinary approach, we decided to prepare a course on the transdisciplinary analysis of environment. Its preparation took a long time, including preparatory sessions with the presence of all the components of the group spreading two whole academic seasons, and continuous contact through e-mail and the virtual space created for the course.

The preparatory phase of our work included: 1) Discussion on the actual contents and their spatio-temporal distribution. 2) Selection of the methodological tools and approaches to warrant a continuous

interaction teachers/students and teaching/learning, maximizing the level of implication and participation of students. Different group dynamics were assayed and selected for their implementation at the course. 3) Preparation of a web space for the course, by using the virtual Moodle platform available at the virtual campus of our University. 4) Design and elaboration of the specific didactic materials to be used in the course. 5) Design of the specific methodologies of partly virtual (telematic) work. 6) Training of the methodology, tools and materials to be used. 7) Elaboration of the specific criteria to be used for the selection of students to be accepted to the course and for the evaluation of their performance. In the selection criteria, we sought to obtain an as wide as possible representation of students with different academic backgrounds. 8) Burocratic work to apply for being included and accepted as an official Own Title of the University of Málaga directed to undergraduate students.

The course was assigned 3 ECTS credits and, in its second edition, it was completely adapted to the ECTS methodologies and goals. It was structured as follows:

- An introductory, classroom session with the assistance of the whole group. This session begins with a “meet-each-other” group dynamics, to “break the ice” and to favour the integration among students coming from very different academic curricula and between students and teachers, with the aim of getting an integrated class (students + teacher + classroom) as a whole. Afterwards, transdisciplinarity is introduced to students in a very dynamical way with short collective exercises. Finally, the actual contents of the rest of the course and the use of the telematic tools are explained.
- Seven workshops, with online and presential sessions of work. The specific topics selectable for the different workshops (as well as the actual number of specific workshops) can be changed from edition to edition of the course. However, for the three first editions of our course we have maintained the following topics: “*Residues*”, “*Urban Environment*”, “*Environmental Risks*”, “*Changing Climate*”, “*Environment and New Technologies*”, “*Environment, Health and Culture*”, and “*Environment and Development*”. For each workshop, several online exercises are proposed to be carried out by students previously and after the in-classroom session. The resource used in the telematic sessions include chats, tutorials, inner e-mail and links to documents, materials and web pages of interest. Students are allowed to download selected material and they can upload their homework. Each session is coordinated by a different professor with the presence of, at least, another one. These sessions include short initial theoretical introductions, a number of short practical exercises and comments and discussion of the exercises previously carried out telematically.
- A field practical session consisting in a participating observation of rural and urban environment in Málaga and its surroundings. During an excursion with stops at specific points, students are asked to carry out several exercises concerning their own observations under the framework of the topics developed at the workshops. The session and the course finish with a shared lunch-time at the Natural Park Mountains of Málaga, commenting on the course. Finally, students are requested to fill an anonymous survey to give their evaluation of the course.

### 3.3. Concluding remarks

Up to the moment, we have carried out two editions of the course, and the third edition is expected to be offered during the 2007 spring season. According to the very positive evaluation of the course by the students, the successful evaluation of the work of the students and the own impressions of the teachers, we think this kind of courses and the application of a transdisciplinary approach has been a complete success. Students gave a special value to their engagement in the evolution of the course and to the opportunity (unfortunately, not very frequent in the context of our University) they had to share opinions with professors and other students coming from different specialities and to work in the practice of transdisciplinarity. Students also evaluated very positively the implementation of ITC (information and communication technology) tools. Furthermore, this experience has allowed each of the members of the group to apply new methodologies and tools for the improvement of the specific and disciplinary subjects in which each one is involved as a professor of a different university department.

In conclusion, we are a group involved in the awareness of environmental preservation, as well as aiming to reach a great level of quality in education. We, as a group, propose a transdisciplinary approach able to integrate the new lines, and the new challenges that our society demands. The experimentation and study of this innovative methodology has characterised our work during these

years, as teachers and educators. We desire to joint our efforts with those who are involved in changes in the education system as we are, since we think the only way to get better results is to share experiences at the university. We think that the only way to reach our goals is to develop activities designed to improve armonic relationship with the environment, paying attention to the level of quality in education that we, as teachers, offer to the university and, at last, promoting a better quality of life.

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