

Interdisciplinarity Implications in the Graduate Educational System

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Abstract:

The role and importance of interdisciplinarity in finding a solution to the most complex problems in science and research, in the practical activity of any economical and social aspect of our lives, with special interest in education and graduate education, is one of the most frequent academic topics today. Although rather discussed than applied, more in theory than in practice, interdisciplinarity is guiding the efforts of the university programme and research coordinators, being part of the guidelines of almost all of today's innovative projects.

Having some of the essential coordinates of interdisciplinarity as a starting point, this paper aims at discussing interdisciplinarity in today's context of society governed by knowledge and change in the graduate educational system, a domain where interdisciplinarity has been and should be among the most important objectives.

Keywords: interdisciplinarity, higher education, research, science

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Being the key to problem solving in our knowledge and technology-based society, science is dependent on our society problems. In this context, the boom of science demands an interdisciplinary approach of science, in order to promote all the objectives of our society. Such an approach offers a variety of abilities which can focus on a certain topic, the different points of view offering a balance to this system. In other words, quoting Claude Bernard, “art is I, science are we”, we need to be more open, to accept the diversity of thought and approach, but keeping our attention on the primary goals. In this context, interdisciplinarity fits perfectly as “collaboration between different disciplines on a certain topic whose complexity can only be obtained by an objective combination of several points of view”.

Although derived from scientific research, and given the strong interrelation between education and research, interdisciplinarity is found more and more in education, which in many cases appears as the latest acquisition in this field. But interdisciplinarity is much more than a recent upgrade in education. It is a new way of thinking which aims, as final goal, obtaining a greater quantity of information, in all the educational and social levels (Tamara Swora & James L. Morrison).

As it is well-known, the disciplinarity connection has a four-level approach: multidisciplinarity, pluridisciplinarity, interdisciplinarity and transdisciplinarity. Among these levels, interdisciplinarity is the most discussed, if not the most used. This can be due to the fact that it implies interrelations between operations and languages, in order to eliminate the differences that normally appear between the classic educational disciplines.

In order to correctly evaluate interdisciplinarity we need to briefly examine the notion of academic discipline. The traditional view of an academic discipline is that of a study area” with its own theory, methods and content.... which are institutionally recognized by the existence of distinctive departments, positions, courses” (Squires, 1992). Becher

defines disciplines as “cultural phenomena”, incorporated in human collectivities that share the same values, ways of behaviour and intellectual tasks. Other authors describe the academic discipline as the provider of the “structure of knowledge” that binds and socializes the members of a faculty. This includes both the capacity to complete the necessary tasks in teaching, research and administration and the volume of research, the retrospective processes and an awarding system in relation thereof (Beyer & Lodahl, 1976; Reich & Reich, 2006).

The disciplines are not defined using only one attribute; the various aspects of these characteristics may vary from one discipline to another, and even in the same discipline. Therefore, the academic disciplines can have substantial differences in the justificatory levels, the degree of certainty in relation to what knowledge means and what is understood by the structure of knowledge.

The problem of the classic notion of academic discipline is the fact that it is not historically-based; it evolves and it changes from time to time, more or less rapidly. For this reason, there have been various attempts to define the academic discipline

Squires redefined the academic disciplines using a three-dimensional system: their field (field of activity, actual problems); their position (actual epistemological concerns, what is considered to be their methodology and their area of knowledge) and the point of view regarding the discipline (the self-identifying with the discipline, in the normal, mature and revolutionary vision of Kuhn). Many disciplines are evolving from “normal” sciences (which use unquestionable notions and common theoretical aspects) to “revolutionary” sciences, when these notions are questioned or replaced, as the Newtonian physics have been replaced by Einsteinian physics (Kuhn, 1962). In this context, we can accept the conclusion that all disciplines are “multidimensional spaces in which they define, interconnect and develop in any dimension, coming to the point where they cooperate or become conflictual with other disciplines” (Squires, 1992). At the boundaries between disciplines there may appear interconnections and friction phenomena and the influences can spread back in the disciplines. One such example can be the empiric methodology of the exact sciences; this had a dramatic and persistent effect on other disciplines, which classically are away of the scientific concerns – (as humanistic sciences).

All of the above presented disciplinarity features describe in a certain way the traditional vision of the academic territory, where the disciplines are autonomous and distinctive study domains, in which the independent academic communities rarely cooperate or coordinate their academic efforts. From this perspective, academic disciplines can easily be considered as distinctive “boxes”, but with permeable walls. The history of disciplines suggests that certain disciplines’ specialists are searching for interdisciplinary relationships only when their topics need it, not before. Therefore, in order to assure a real progress, some of the conceptual aspects require new values and perspectives. These aspects can certainly arise from different disciplines.

History offers many examples in which disciplinarity’s disciplines use interdisciplinarity relationships. Biology needs physics in a certain level of development. The ecologists use mathematics whenever the situations are requesting it. Philosophers tried to develop relationships with neurologists and computer scientists when their ideas concerning the “internal representations” led to the need of understanding what the “internal representation” meant. There are lots of examples where the essence of a problem necessitated searching for elements in another discipline, interdisciplinarity appearing in a natural way among discipline specialists (Petrie, 1976).

Even this short overview underlines that the classic notion of academic discipline does not manage to reflect the constantly changing context of the education in general and the higher education in particular. From this perspective comes the necessity of establishing relationships between several disciplines, another way of disciplinarity, interdisciplinarity respectively. Knowing the subtleties of academic disciplines, interdisciplinarity implies a certain degree of integration between various knowledge domains and different approaches, as well as using a common language which allows changes in concepts and methodology.

The transition from disciplinarity to interdisciplinarity, as well as the need of a higher interdisciplinarity level in education is received with great interest, but if these acknowledgements can easily be obtained in theory, the practical aspects are not alike. The former assertion comes from the presumption and objective reality that the academic and educational work are based and largely practiced today on disciplinary grounds. Against interdisciplinarity act a great number of factors: traditions and scientific community norms, recognizing and granting systems of the research outcome, the disciplinary paradigms, etc. Overcoming such obstacles requires sustained efforts, because critical situations will always appear on the road from disciplinarity to interdisciplinarity, in science, education, economic and social life. Subsequently, those who stand in favour of interdisciplinarity must be able to successfully approach the complex problem thereof and consequently, their approach must enrich in consistency and coherence, notwithstanding the theoretical, methodological or practical activities.

The first problem to be discussed is the concept and definition of interdisciplinarity itself, because in today's literature, its content remains unconcerned and in many cases, fuzzy. Therefore, some light is needed concerning the fundamentals of interdisciplinarity (natural, social and epistemological), the shape, factors, limits, difficulties and the field of interdisciplinarity. The second problem regards the internal structure of the respective interdisciplinary process, meaning the interdisciplinarity subgroups (interdisciplinarity of the domains, of problems, methods and concepts). The third problem emerges from the necessity of having some convincing answers to a set of questions, namely: Interdisciplinarity is the transfer of concepts and methodology from a discipline to another or the application of a discipline in another? Is interdisciplinarity nothing but a coordinative synthesis of human knowledge or it is a necessary scientific complex, which can be used in studying complex problems of global interest?

Beyond these problems described above, there are at least two fundamental realities that step forward in any discussion regarding interdisciplinarity. One is represented by the fact that there can be no interdisciplinarity without the existence of scientific disciplines. Therefore, interdisciplinarity can only develop from scientific disciplines, which can take different, unpredictable directions. Interdisciplinarity can, however, modify the disciplines, by unifying a certain quantity of knowledge, even only temporarily into a new discipline, as another fundamental characteristic).

Interdisciplinarity has many ways of expression. A simple form of interdisciplinarity occurs when topics from a variety of disciplines are in some way connected to a general domain – such an example can be the global warming (Garkovich, 1982). Another point of view implies “reinforcing the disciplinary boundaries” and “the possibility to further have a critical angle of view” (Davidson, 2004, Rowland, 2001). This point of view could imply changing critical opinions, and in the same time maintaining the powerful disciplinary integrity. Another perspective of interdisciplinarity suggests the need of “more or less integration or modification of disciplinary collaboration during an activity

or research; therefore, in order to bring their own contributions, the participants should consider the previous findings of their colleagues" (Petrie, 1976). More exactly this kind of interdisciplinarity – sometimes also known as pluridisciplinarity (Max-Neef, 2005) – necessitates two or more disciplines which combine their expertise in order to focus on a common goal. It aims at great areas of interest, far too complex for only one discipline, such as the AH1N1 pandemics, AIDS, global warming and climate changes, etc. Such problems request the coordination of efforts for many specialties, having a different perspective on the economic, geological, medical or environmental aspects (for example: an important social interest, like obesity, requests the integrated vision of behavioural sciences, molecular biology and mathematics) (Aboelela et al., 2007). It is a situation that can be obtained by making use of an interdisciplinary approach and which can not be as differentiated and autonomous as the classic vision. In addition, some of the graduate educational system problems are far too complex to be investigated using only one traditional discipline. The developments of interdisciplinary relations, traditional discipline structures are maintained and interdisciplinary relations are created for the teaching and learning process. These relations could, in some way, promote critical dialogues between disciplines, on various topics, beyond the individual disciplines' resources.

In education, the teaching process could be synthesized from the interdisciplinarity's points of view, from two aspects:

- Concentrating the information in an interdisciplinary perspective;
- Planning and organizing the educational process in an interdisciplinary manner.

From these perspectives, one can consider, even more than in other fields of activity, that academic education has or should have the strength and will to sustain and promote interdisciplinarity in the educative and research process. This is even more important when teaching a discipline has the disadvantage of using sequential and insular perceptions of a unique reality thereby making it artificial. It is therefore necessary to create connections between certain academic disciplines, in order to obtain a unified and coherent perception of the existential phenomenology. "The future student will be an explorer" – says Marshall McLuhan. In order to do so, he must be aware of the importance of learning through research, discovery, of the importance of making connections and relations between different disciplines. In the context of today's society, any scientific conquest must be transposed in educational terms. Interdisciplinarity is helpful not only for the teacher but also for the student. The student will thereby obtain proper information, which can be used in various activities, and the teacher can count on the student's participation in teaching a new topic, already knowing some information from other disciplines.

What are the advantages of interdisciplinarity?

- Individualizing the educational process – the study topics are the same for all students, but the process and the results will be different from one student to another;
- The possibility of eliminating the boundaries between disciplines, thus dissolving the students' idea that disciplines have nothing to do with each other or even nothing to do with their field of study;
- Developing general information about phenomena which will help applying different notions in studying different disciplines, but also in their work;
- Stimulating the interest for one's own education, the motivation for learning.

A central element necessary for interdisciplinary success in education and research, though of less importance is the main idea, a key idea, because without it, failure would become certain. The key-idea must be accepted as important by all the parties included in the process, thereby becoming the centre of the investigations and teaching that appear in research and education. These dominant ideas are correlated with achieving the goal set by all the parties included, offering a certain degree of intellectual progress.

Pedagogical problems that create the concept of a dominant idea are kind of critical for interdisciplinarity success. In this context, it is necessary for the graduates to have a clear vision of what a dominant idea means in the disciplines they studied. The graduates must have the capacity to differentiate the dominant ideas from the less important ones, and to differentiate, within a discipline, the interdisciplinary ideas from the others. They must be capable to ask adequate questions (from the point of view of the studied disciplines) in order to criticize ideas both from a disciplinary and an interdisciplinary point of view, if that is necessary.

Practically, equilibrium between disciplinarity essence and interdisciplinary relationships is hard to achieve, demanding a careful judgment both from the student and the teacher. In order for interdisciplinarity to occur and to be successful, there should be no domination, nor from the interdisciplinary relationships, nor from the essence of disciplinarity: “if any of these is missing... there is a risk of the project to become interesting and adventurous, and the rewards from the disciplinary competence could take out the individual from the interdisciplinary effort or people with broader angles of view but with less disciplinary talent can feel that things are going well, instead they are only beyond its superficial boundaries” (Petrie, 1976). For these reasons, in order to obtain success, the universities must have access to dominant ideas from each discipline. The graduates should have a broader access to key ideas in every discipline in order to be able to learn these ideas. But in the same time, they should go beyond the discipline boundaries to gain interdisciplinary assistance.

Another important aspect is the institutional environment where the interdisciplinary activities take place. Implementing interdisciplinary exchanges within an institution which is not ready for this may result into big problems. Achieving the goal and directing the interdisciplinary actions are actions that require not only an adequate institutional support, but also systems for the reward and promotion of the phenomenon essence, as well as an adequate reward system; these rewards should be directed towards interdisciplinary actions. As a consequence, the university teaching staff shall naturally direct the efforts thereof towards areas that enable rewards. Currently, in most universities, the main rewards for the university teaching staff get materialized through the disciplinary channels (promotions within the discipline, publications in local and global recognition magazines etc.); these aspects can be perceived as the fundament of a new approach (an example being represented by the increasing number of the interdisciplinary journals/magazines).

Considering the above mentioned typical rewards, there still is the possibility for the interdisciplinary activity not to expand. We may add once more that students acknowledge that the outstanding activities are being performed within the disciplines and not at interdisciplinary level, which enables the interdisciplinary projects, courses and basic requirements to be considered parts of the educational experience that bear the risk of being disregarded. On the other hand, the inclusion within a programme of the interdisciplinarity in general and the multidisciplinary expectations in particular, makes the students approach subjects they cannot deal with accordingly and do not have innate

affinities for. Therefore, the students should be included in the academic discussions of the disciplines they're studying (interactive and educational process). An important aspect is when students choose topics totally apart from the main disciplines. Therefore, certain strategies are required, such as: making and using check-lists or glossaries of key-terms for each discipline, on each study level. In this respect some strategy may be useful, such as: the development and use of glossaries of key terms specific to each discipline and each level of study, the design and synthesis of minimal levels of disciplines concepts in cognitive maps necessary to promote each discipline in part, in order to have the possibility of building these maps through a gradual process, the introducing in the curriculum of correlating elements or some intensive training programs. Certainly, a special attention should be given to the way the evaluating systems will support and sustain the requirements and will determine the students to understand and evaluate the study levels. These strategies might be useful to both students approaching more or less to interdisciplinary elaborate subjects, and to students focusing only on the basic disciplines. In certain education institutions, special courses have been developed, aiming at synthesizing knowledge not only within certain interdisciplinary programmes, but also within the general curricula. Nevertheless, synthesis is responsible with delimiting the disciplinary and the multidisciplinary from the interdisciplinary concept. Synthesis is being achieved in various manners, despite the fact that the most used methods are the basic seminars, individualized study, workshops, colloquiums, projects and theses.

In order to encourage interdisciplinarity, implementing a naturally interdisciplinary exchange evaluating mechanism might be useful for universities, especially when this becomes necessary; due to disciplinary problems (interdisciplinary exchanges normally occur and must not be required by the universities). These exchanges can take place between students, teachers, and both, encouraging these exchanges to be of great use. In order to create and maintain an environment in which such changes should occur, certain processes must be introduced, to allow the students to earn enough experience to recognize the value and need of interdisciplinary study, such as: official programmes, experience, organizing certain job situations, taking part in courses and conferences and other similar activities.

Regarding the training and support of the continuous development of the academic staff in the multidisciplinary and interdisciplinary environment, the permanent upgrade of academic programme is required. These can focus on the development of the academic decentralization, allowing multiple points of view. Thereby, interdisciplinary dialogues would be promoted in a critical manner, maintaining the integrity of the disciplines, such a programme encouraging teaching and learning in a manner that will not destroy the disciplinarity values (Davidson, 2004).

From many points of view, universities are already working in the field of interdisciplinarity; there is still a need to stimulate the interactions between researchers from different disciplines, which still have different points of view. The interdisciplinary interactions may lead to important findings, creating new fields of research. The development of materials as an interdisciplinary field was created many years ago, from the interaction between researchers in material sciences and medicine researchers. Implant research has gone beyond a lot of boundaries. Recent studies of lasers are another excellent example; being a topic of interest for many study groups, laser research in medicine requires collaboration with multiple-field experts in order to scientifically define the interaction of lasers with other materials, soft and bony tissues. Molecular biology is also pointing out new horizons, having a major impact on organ and tissue,

growth and development, and therapeutic procedures-related research. The list is endless in any domain, especially in medicine.

Considering the above mentioned issues, in order to benefit from the practical advantages of interdisciplinarity, there are certain requirements:

- a common language, even though the initiation of the process often takes place in different institutional environments;
- common social habits;
- the possibility for the universities to collaborate in academic projects;
- to negotiate the practice of power and eliminate the differences between subject and object in the educational process.

In the end, even based on this summary analysis, we can agree though with Eniko Demeny, Clare Hemmings, Ulla Holm, Paivi Korvajarvi, Theodossia-Soula Pavlidou, Veronica Vasterling, members within the project “Travelling Concepts in Feminist Pedagogy: European Perspectives”, an editorial undertaking supported by ATHENA 2 network (an advanced thematic network in the European women studies), who are stating the following: “In a certain way, the interdisciplinarity’s difficulties are much alike the European integration, in the political sphere. Not only are they both new experiences which receive only a rhetorical support and a very real opposition, but also the disciplines and the nations implied in the European integration act alike. They both have traditions, customs, methods and borders, obsessively defended when criticized or when there is outside pressure upon. Therefore, it is the authors’ point of view that both interdisciplinarity and European integration should be understood as rather overt and inclusive than closed and exclusive practices”.

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