The Challenges of Interdisciplinarity in Graduate Graduation

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Abstract— This article aims to raise discussions about interdisciplinarity, particularly in teacher education, in order to present a critical view of the need to develop interdisciplinary actions present in theoretical references and in official normative documents consulted that dialogue with the topic today. Through a bibliographic review, the importance of interdisciplinary training for teachers was brought to light, with the aim of deepening the different types of knowledge in higher education, more specifically in postgraduate courses in public universities, based on the assumption that interdisciplinarity is a concept under construction. The analytical approach of the information collected was qualitative and content analysis was used to interpret the speeches.

Resumo— O presente artigo tem como objetivo levantar discussões sobre a interdisciplinaridade, particularmente na formação docente, de modo a apresentar uma visão crítica sobre a necessidade de desenvolver ações interdisciplinares presentes nos referenciais teóricos e nos documentos oficiais normativos consultados que dialogam com o tema na atualidade. Por meio de revisão bibliográfica, foi trazida para reflexão a importância da formação interdisciplinar para os docentes, com o intuito de aprofundar os diferentes tipos de conhecimento no ensino superior, mais especificamente nos cursos de pós-graduação nas universidades públicas, partindo do pressuposto de que interdisciplinaridade é um conceito em construção. A abordagem analítica das informações coletadas foi qualitativa e utilizou-se a análise de conteúdo para interpretação dos discursos.

Resumée— Cet article vise à susciter des débats sur l'interdisciplinarité, notamment dans la formation des enseignants, afin de présenter un regard

critique sur la nécessité de développer des actions interdisciplinaires présentes dans les références théoriques et dans les documents normatifs officiels consultés qui dialoguent avec le sujet aujourd'hui. À travers une revue bibliographique, l'importance de la formation interdisciplinaire pour les enseignants a été mise en évidence, afin d'approfondir les différents types de connaissances dans l'enseignement supérieur, plus spécifiquement dans les cours de troisième cycle dans les universités publiques, en partant de l'hypothèse que l'interdisciplinarité est un concept en construction . L'approche analytique des informations recueillies a été qualitative et l'analyse de contenu a été utilisée pour interpréter les discours.

I.   A LITTLE HISTORY: from disciplinarity to transdisciplinarity

The movement for interdisciplinarity in the teaching-learning process in educational institutions emerged in the mid-1960s in Europe as a reaction of teachers and students who, uncomfortable with the specialization and fragmentation of knowledge, defended a teaching connected with social reality, based on a curriculum that had as main objective the social transformation and the critical formation of the collective subject, autonomous and concerned with the problems of society.

From this perspective, the disciplines and their contents should integrate and interact with each other, to give meaning to what is taught and learned, considering that in today's world the priority function of the teacher is to help the student to think, to question, to read the reality of the world and build their own opinions, exploring with them other learning environments with other teachers from other areas and with non-academic professionals. This is called interdisciplinary behavior, idealized by the Frenchman Georges Gusdorf (1952).

On curriculum, an important contribution is made by Menezes and Araújo (2008:14), who approaches the theme in a contextualized way, where information related to regional and local issues that were obscured throughout history, come to have greater prominence, in the understanding that it is from the knowledge of the social, economic, political and cultural needs of each space, that it is possible to improve the situation of the people who live there.

Such views coincide with that of the National Curriculum Research Center – CENPEC – in stating that the university needs to "teach the contents and skills necessary for the individual's participation in society. [...] lead the student to understand the reality of which he is a part, situate himself in it, interpret it and contribute to its transformation" (CENPEC apud SILVA, 2018:44).

In Brazil, interdisciplinarity was first discussed in the 1970s by the researcher Hilton Japiassú (1976: 74-75), through his book "Interdisciplinarity and Pathology of Knowledge," whose work indicated interdisciplinarity as a tool capable of overcoming the disciplinary boundaries, combat the fragmentation of knowledge and contribute to the solution of difficulties related to teaching and research. Subsequently, as his disciple, Ivani Fazenda (1979:39), began to stand out for the numerous productions on the subject, defining interdisciplinarity as "a relationship of reciprocity, of mutuality, a regime of co-ownership capable of enabling dialogue among those interested" For her, a work that is interdisciplinary requires an engaged team that can dialogue and contribute with information about the different contents of the disciplines and assumes a reciprocity between its participants, that is, it depends on attitudes of humility, openness, collaboration, solidarity, because:

a) interdisciplinarity leads to an exercise of knowledge: asking and doubting;

b) interdisciplinarity develops from the development of the disciplines

themselves.

Another author who has dedicated herself to this discussion is Heloísa Lück (2008:14), in whose work "Interdisciplinary Pedagogy: theoretical-methodological foundations", states that interdisciplinarity presupposes more than the interaction between two or more disciplines. She says:

> (...) interdisciplinarity intends to overcome the fragmentation of knowledge and, for that, it needs an overall vision to establish coherence in the articulation of

knowledge (...) In fact, this awareness is not restricted to teaching. It manifests itself in multiple areas of human activity (LUCK, 2008:14).

From these considerations, it is easy to conclude that the University, in its graduate courses, needs to adopt a more dialogic posture between individuals and the various areas of knowledge, which increasingly demand interdisciplinary knowledge. More specialized knowledge has contributed a lot and still contributes to a better quality of life, but they need to advance in procedural innovations, transferring information from one area to another, generating new knowledge and thus, training professionals with holistic profiles.

CAPES, through the evaluation committee of its programs, unfavorably recommends those that present:

• proposals that show a simple juxtaposition of two or more areas of knowledge;

• a meeting of researchers who remain working in watertight compartments;

• curricular structure containing subjects that cover different subjects, in a

 superficial and isolated way, evidencing an encyclopedic training (AVALAÇÃO,

 2003; 2016;2017;2019).

On the contrary, according to the Multidisciplinary Committee (ASSESSMENT, 2019:4), an interdisciplinary program must:

• be characterized by an integrative proposal, with areas of concentration

 indicating the focused objectives;

• present a faculty with diversified disciplinary training, but consistent with the

 areas of concentration, lines or integrative research projects;

• present a curricular structure appropriate to the students' training, with subjects

 coherent with the areas of concentration, evidencing the construction of

 integrative lines of research;

• present a faculty with experience, competence and scientific productivity in their

respective disciplines of origin, with experience in multidisciplinary research,

 while respecting the parameters of academic production in each of the areas.

As can be seen, interdisciplinarity does not reduce the importance of disciplinary knowledge, nor does it give up its theoretical-methodological basis, however, when the disciplinary language is no longer able to provoke the interaction between the knowledge of the various disciplines created by modern science, multidisciplinarity, pluridisciplinarity, interdisciplinarity and transdisciplinarity emerge gradually (FAZENDA, 2008:37).

In Multidisciplinary, a subject is studied from the perspective of several disciplines simultaneously. For example, a painting by Tarsila do Amaral can be studied by the history of art, by modernism, by colors, by geometry, and, in this case, the scholars are not together, therefore, it is a multidisciplinary study, not an interdisciplinary one. , because the conclusions that each scholar arrives at are their own, there is no collaboration between them and the information is not modified or enriched. The theme territorial development can be approached by geography, by economics, by anthropology, by sociology, by the sciences agriculture and others, however if such approaches are made in isolation, it fits into this modality, as it does not change the logic that each professional in each of these areas has on the subject.

In Pluridisciplinarity, cooperation between the disciplines involved in the study of an object is already observed, although the views of each participant remain unchanged. In this case, Magalhães (2005), does not differentiate between multidisciplinarity and pluridisciplinarity. For the author, disciplinarity is considered multi or pluri, when more than one teacher works on a common theme at the same time. It exemplifies the fact with the theme "the great navigations", which can be worked by the mathematics teacher, the geography teacher and the literature teacher. The first "can show how important the use of geometry is for the construction of caravels or even for the practice of navigation"; the second can show "the evolution of cartography"; and, the last one, can "deal with the vast literary production on the subject." Therefore, there is multi and multidisciplinary when several disciplines work "together" for some time (MAGALHÃES, 2005:29).

It is important here, for greater understanding, to bring some conceptualizations of discipline. The word discipline comes from Latin and can be translated by at least three meanings, according to "Le Dictionnaire du Français" (HACHETTE apud KORTE, 2000:26):

• particular domain of knowledge; teaching subject;

• set of rules imposed on the members of a collectivity to ensure the proper

functioning of the social organization; obedience to these rules and

• rule of conduct that the individual imposes.

For Maheu (2000:2-3), discipline – from an epistemological point of view – means:

> "Structured domain of knowledge that has its own object of study, a conceptual scheme, a specialized vocabulary, and also a set of postulates, concepts, particular phenomena, methods and laws. A specific set of knowledge that has its own characteristics in terms of teaching, formulation, methods and subjects" (LEGENDRE apud MAHEU, 2000, p. 2-3).

Interdisciplinarity takes a step forward in the process, producing knowledge through theoretical and methodological exchanges, generating new concepts and methodologies, with the objective of understanding complex phenomena, "being, therefore, the convergence of two or more areas of knowledge, not belonging to the same class, that contribute to advancing the frontiers of science and technology [...]" (CAPES, 2017:1).

In the same direction, Araújo (2014); Nisenbaum; Pinheiro (2016), define interdisciplinarity as "dialogical doing", where concepts from other areas are re-signified and dialogues allow the construction of knowledge, which can be both individual, when the researcher works in different areas, and collective, when researchers from different areas of knowledge develop studies and research in collaboration to provide answers to society's problems.

The term interdisciplinarity should be used to designate "the level at which the interaction between various disciplines or heterogeneous sectors of the same science leads to real interactions, to a certain reciprocity in exchange, leading to mutual enrichment". The interdisciplinary approach seeks original concepts, methods and theoretical structures through the agglutination of concepts, methods and theoretical structures from different disciplines (ROGERS and RIZZO, 2006).

The interdisciplinary approach, therefore, depends on the theoretical-methodological progress of each of the sciences involved and on the preparation of professionals in the domain of their area of expertise. Without this, there is a risk of the superficiality of the approach, without reflection and without the due contribution to the formulation of new concepts and new knowledge. Since the 1990s of the last century, Santos (1995:38) has already pointed out that, in Education, interdisciplinarity should be seen "as a cooperative form of work to replace individualistic procedures", since the integration of knowledge between the different areas responds to the demand of today's society, which requires – from students of higher education and postgraduate courses – the search for knowledge that goes against a fragmented knowledge, employed by separate disciplines.

For the Paulo Freire Institute (2005), the methodology of an interdisciplinary work implies: "1st - content integration; 2nd - move from a fragmentary conception to a unitary conception of knowledge; 3rd - overcoming the dichotomy between teaching and research, considering study and research, based on the contribution of different sciences; 4th - teaching-learning centered on a vision that we learn throughout our lives."

It is the search for universal knowledge, which is not divided into several fields, as Fazenda (2005: 26) rightly states. With the same understanding, Nicolescu (2005:18) states that if there is interdisciplinarity, there is a transfer of methods from one discipline to another, and this occurs in the following degrees:

Degree of application: the methods of nuclear physics are transferred to medicine and this leads to the emergence of new treatments for cancer, through nuclear medicine;

Transdisciplinarity, on the other hand, is concerned with what is between disciplines, across different disciplines, and beyond all disciplines. Its goal is to find the unity of knowledge, within a total system, without any boundary between disciplines (NICOLESCU, 2005:8). According to this author, transdisciplinarity is fueled by disciplinary research and its pillars are:

A. The multiple levels of reality;

B. Middle logic included and

C. Complexity, which determine the methodology of transdisciplinary

research.

It is a form of self-transformation that allows the creation of a new art of living in society (NICOLESCU, 2005:9).

As Santos (1995) explains in the Interdisciplinary Letter:

> "(...) transdisciplinarity brings out, from the confrontation of disciplines, new data that articulate them among themselves and that give us a new vision of nature and reality. Transdisciplinarity does not seek the domination of several disciplines, but the opening of all disciplines to what crosses and surpasses them."

II.   THE CHALLENGES OF INTERDISCIPLINARY EDUCATION IN HIGHER EDUCATION

If in the 20th century the specialization and fragmentation of knowledge was the keynote in the academy, in this 21st century there is no room for the continuity of such a procedure and the trend that presents itself is the application of interdisciplinarity in the teaching-learning processes. Interdisciplinarity, not just as a combination of two or more disciplines to better understand or address a particular issue or problem, but as an approach that allows the emergence of new points of view that go beyond the limits of the disciplines themselves (AUGSBURG, 2016; REPKO, 2008).

The search for knowledge in the wake of time has produced successive fragmentations, and this dismemberment of science and knowledge has generated a distance from totality, without respect for human indivisibility, resulting in researchers and scholars who know almost everything about almost nothing. Breaking with the traditionalism of higher education in Brazil is not an easy task, as it implies understanding, as stated by Freire (2007: 47), that "teaching is not transferring knowledge, but creating possibilities for its production or construction", which requires an interdisciplinary behavior and the connection of knowledge.

The academic world is the world of disciplines, where the process of division and stratification in the scientific field is expressed by two worldviews: scientific knowledge and common sense knowledge, with widespread inferiority to popular knowledge, generated by non-schooled traditional populations. This dichotomous view is a mistake, since interdisciplinary knowledge must be a communication between knowledge and knowledge, not a way of neutralizing all the meanings of other disciplines. An interdisciplinary attitude will lead the specialist to know the limitations of his discipline and welcome other disciplines, in an attempt to replace fragmented knowledge with more global knowledge. This gives validity to the knowledge of common sense, because it is through everyday life that we give meaning to our lives (FAZENDA:1996:38).

It is also clear that universities have shown themselves to be fragile in the treatment of interdisciplinarity, as they treat it in a fragmented and non-comprehensive way, which ends up resulting in a waste of financial resources directed to the theme and energy of researchers dedicated to this cause, since they do not able to accomplish what they could or should (RHOTEN, 2004).

The worrying point of this fragmentation is the lack of integration of the content of the various curricular components, in addition to the disarticulation of the academic environment with the social environment, where the student will be inserted as a market professional and the holistic vision to solve socioeconomic issues (SEVERINO, 2008).

For Santos (2005: 28), in this model of rationality, knowledge advances through the specialization and disciplining of scientific knowledge, which makes the scientist a "specialized ignorant", causing negative effects, since knowledge must seek universal totality, without isolate the place. From this perspective, it is necessary to appropriate several fields of knowledge to answer questions that cannot be answered by a single form of knowledge, and interdisciplinarity is capable of breaking with this fragmentation.

In the view of Fazenda, one of the most respected theorists on the subject (1994:22), "university education should demand an interdisciplinary attitude that

would be characterized by respect for teaching organized by disciplines and by a review of the existing relationships between disciplines and between disciplines. the problems of society", where interdisciplinarity would not only be a panacea to ensure the evolution of universities, but a point of view capable of exercising an in-depth, critical and healthy reflection on the functioning of the university institution, allowing the consolidation of self-criticism, the development of research and innovation. (FAZENDA, 1994:22).

Within this vision, the author states that interdisciplinarity is not a category of knowledge, but an action that develops from the disciplines themselves, making it evident that it is impossible to reach the propositions listed by her without dealing with the training of educators, considering that the great most teachers come from a disciplinary background (1994:23).

In Gaudêncio Frigotto's analysis (1995:26), interdisciplinarity is imposed by the very way in which "man produces himself as a social being and as a subject and object of social knowledge". It is based on the dialectical character of social reality, guided by the principle of contradiction, by which reality can be perceived, at the same time, as one and diverse. Something that requires us to delimit the objects of study by demarcating their fields, without, however, fragmenting them. It means that, although the problem to be studied is delimited, we cannot abandon the determined multiplicity and the historical mediations that constitute it.

For interdisciplinary learning to occur, teachers and students need to identify, incorporate and value different perspectives and recreate their own knowledge, understanding and practices on a given topic from the learning acquired with each other, establishing a sense of community to build a final product. (BRADBEER, 1999).

On the relationship between interdisciplinarity and higher education, Isaía (2006:68) points out the challenges of teaching, which are increasingly complex, in the sense of interpellation between the areas of knowledge, which impose on the teacher the need for constant updating and require, above all, interest and motivation on your part, with didactics being the flagship.

However, upon entering higher education, many teachers without training for teaching assume full responsibility for the subjects from the beginning, without the support of more experienced colleagues, nor with institutional spaces aimed at learning to be a teacher, developing many sometimes a feeling of pedagogical loneliness, due to helplessness and unpreparedness, not technical, but pedagogical.

The situation worsens when the same professor develops the same subject for different courses, for which he has no specific training and the question that arises is: how to make the didactic transposition of scientific knowledge to the academic and from this to the professional, when does he not know the field for which he allegedly forms? (ISAIA, 2006:77).

A ready answer to this question does not exist, however, if the anxieties and difficulties in the training and monitoring of professors at the university were in fact resolved, the interdisciplinary experience in different courses could be of fundamental value for the improvement of their teaching. It is also important to consider, as Santos (2004:76) states, the ecology of knowledge, which consists of the production of dialogues between scientific knowledge produced by the university and popular, urban and rural knowledge that exist in society.

If such an understanding is valid for the academy, it is also very relevant for the pattern of economy of this century, where modern high-tech corporations no longer consider Taylorism-Fordism as the only production model to solve their management problems. On the contrary, they are seeking in society, together with the consumers of their products, how to act more effectively, understanding that their organizations are part of a systemic and multidimensional whole, where everyone depends on each other, influencing and being influenced by them, which is why which higher education institutions should use interdisciplinarity in the training of their students (CEZARINO et al, 2019). It allows solving problems and answering questions that cannot be satisfactorily answered by unique approaches or methods (ASHBY; EXTER, 2019).

Interdisciplinarity in management education is a social system that requires the development of complex thinking. Therefore, students should be introduced to a critical and systemic way of thinking, avoiding approaches based on a single discipline (ASHBY; EXTER, 2019). Authors such as Nascimento; Feather-See; Silveira (2008), since 2008, already argued that higher education in universities should be inserted not only in the interdisciplinary discourse, but also in the transdisciplinary one, facing the demands that demand transformations in society. However, building an interdisciplinary team requires effort and dedication, as well as a period of personal adaptability (JACOB, 2015:32).

As Jacob (2015:33) rightly states:

> (...) disciplinary approaches are considered islands

of knowledge on certain topics and fail to address larger issues and broader contexts, although they are essential, within specific fields of study, for understanding particular forms of knowledge (JACOB, 2015).

Globalization has determined an inversion in the flow of knowledge. If before, the meaning was from the school to the community, today it is the outside world that invades the school. There is, of course, no need (or possibility) of making a reconversion (CHASSOT, 2000:82).

Closing this topic, we bring Japiassú (1976:74), stating that interdisciplinarity presents itself in the form of a triple protest: against a fragmented knowledge; against the distance between compartmentalized universities and society as a whole; and against the conformism of acquired situations.

For him, the term interdisciplinarity does not have its own concept, because it has several understandings and meanings, but the fundamental thing is that it is characterized by the intensity of exchanges between specialties and by the degree of real integration of the disciplines within the same teaching project. and/or research (JAPIASSÚ, 1976:74). His mentor Georges Gustorf, quoted by Fazenda (1978:8), informs us that the theme of the unity of knowledge already existed among Greek philosophers, patriarchs of pedagogy or paideia, the oldest form of teaching and learning. For the quantitative accumulation of information, the price paid is the dismemberment of intelligence, named by Japiassu (1976:77). of Knowledge Pathology.

III.   CONCLUSIONS

In this article, the main point of reflection was the role of interdisciplinarity in the teaching and learning process and its implications in the current world of extreme complexity, whose solutions to problems require connections of the most varied natures, from the most basic to the most complex contents. of the sciences, be they exact, natural, social, human or others, taking care to clarify that interdisciplinarity does not constitute the negation of disciplinarity nor does it advocate its end, as it essentially depends on it.

Therefore, it is necessary for the teacher to acquire an interdisciplinary training, improving attitudes such as humility, cooperation, sharing, opening up to the other, and building with him the foundation of knowledge, not only to serve society, but to enhance life. The university, as a legitimate place of learning, production and reconstruction of knowledge, is also an environment of life and an instrument of access to democracy and autonomy, but it increasingly needs to accompany the transformations of the interconnected, interdisciplinary and complex society, in order to to exercise a critical reflection on its functioning, to seek viable alternatives for its innovation, which is a great challenge, considering the traditionality that still remains in most public institutions of higher education. In any case, even facing the multiple difficulties, the teacher needs to become a professional with an integrated view of reality, understanding that a deeper understanding of their area of training is not enough to handle the entire teaching process. He also needs to appropriate the multiple conceptual relationships that his area of training establishes with other sciences, making sure that the assumptions of his discipline will always be valued. Increasing dialogue between disciplines is an essential step for the advancement of contemporary knowledge and it is a barrier that needs to be overcome within universities, still very attached to the structures of the past centuries that organized them and which, in a way, still restricts them until today.

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