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Between the Possible and the Not Possible: Interdisciplinarity in Teacher Training

Patricia Figueredo of Jesus Maia

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Abstract

This article presents the obstacles and possibilities for the realization of interdisciplinarity from the perspective of a group of teachers from Teacher Training degree course. Data collection was carried out by a form that could be filled on Google Form (2018, 2019) and on links sent via email and Whats App. Based on the content analysis proposed in Bardin (1997), the data were analyzed based on the context and significance units identified by the authors from the bibliographic study that accompanied the research highlighted in Fazenda, (1994), (2002), (2008); (2011), Morin (2000), (2003) (2006) and Ramos (2004), (2016). The results revealed the major obstacles to be of epistemological, instructional, psychosociological and cultural nature.

Index terms— interdisciplinarity. higher education. teacher training.

1 Introduction

nterdisciplinarity is a topic that has been widely discussed and also used in the educational context as a proposal whose main purpose is oppose to the fragmentation of knowledge and, consequently, of teaching. The concepts that defend interdisciplinarity as a possibility to enhance the teaching and learning processes as a way to avoid the fragmentation and compartmentalization of knowledge have been the object of study of several researchers such as: **??**azenda (1994 **??**azenda (, 2002 **??**azenda (, 2008Fazenda (, 2011)); Morin (2000Morin (, 2003)); Santomé (1998); Frigotto (2008); Pombo (2008) and **??**amos (2004;2016), among others.

In the last decade, Teacher Training undergraduate courses have been called upon to review their Pedagogical Course Projects (PPCs). Among the legal bases for these guidelines, the necessary adaptation of the National Education Guidelines and Bases Law (LDBEN) n. 9.394/96, the National Curriculum Guidelines (DCNs) of November 6th , 2001 and the CNE /CP Resolutions of February 1st and 2nd , 2002.

More recently, the Common National Curriculum Base (BNCC) also calls on the higher education community to rethink their curricula to ensure, among others, the change in the curriculum organization proposed by the base.

In teacher education, interdisciplinarity is included in the main debates agenda since it considers a formation based on creativity, dialogue, relationships and process complementarity as a way to develop learning beyond reason, which is, through intuition, sensations, emotions and feelings, finally, also based on sensitivity.

Given this context, this study aims to discuss from the perspective of higher education professors, what obstacles and possibilities for the realization of interdisciplinarity are presented at this level of education.

2 II.

Overcoming Obstacles: What Are They?

The development of interdisciplinary practices requires a break from the historically established models in teaching, including conventional classes, traditional teaching, and compartmentalized curriculum. For this overcoming, it is essential to invest in an institutional change that privileges integrative processes, curriculum organization that prioritizes dialogue and the interconnection of knowledge **??**KLEIN, 2001). Naturally, the disciplines must still compose the organizational framework, since interdisciplinarity does not eliminate disciplinarity; on the contrary, it is a condition of effectiveness.

Overcoming obstacles that make interdisciplinary work difficult requires first its acknowledgement. We understand here, an obstacle as an action or situation that causes an impediment, forms a barrier, creates a difficulty, a nuisance or a disorder to achieve concrete goals. Some obstacles to be overcome by teachers were categorized according to Japiassu and were socialized in the literature by scholars interested in the subject (FAZENDA, 2011; POMBO; GUIMARÃES; LEVY; 2006). (i) epistemological and instructional obstacle, refers to the elimination of barriers between disciplines; (ii) psychosociological and cultural obstacle, it is linked to a more specific formation, the accommodation to an already installed situation and the fear of losing personal recognition in more dialogical and open teams in a workplace devoid of hierarchies. (iii) methodological obstacle that refers to the difficulty in reviewing teaching methodologies that promote greater interaction between curriculum components; (iv) formation addresses the need to overcome the individuality characteristic of an unilateral formation; (v) material obstacles refer to the lack of planning, spaces and times that allow interdisciplinary work.

In order to better systematize the ideas posed by the obstacles of interdisciplinarity, Table 01 summarizes our interpretation. Other obstacles to overcome for the realization of interdisciplinary identified in the literature: The fragmented evaluation often without proper planning; the implementation of educational innovations that are not reflection inductive; repetition of methods learned in the formation process and repeated throughout the professional lives.

And from this study, some concerns arise: When they enter the higher education teaching career, are specialists aware of the difficulties and challenges to face in the daily life of academic life? Do their trainings prepare them to work together to promote the exercise of integration and interaction between areas of knowledge? And paraphrasing Fazenda (2011, p.150) How is interdisciplinarity defined when the intention is to train teachers?

The same author tells us that "it would be necessary, above all, to eliminate barriers between disciplines, in order to facilitate disciplinary interrelationship and prevent any science from seeking to impose its sovereignty over others" (IDEM, 2011. p. 140). This would perhaps be one of the obstacles that resisted to the present day and prevented the realization of interdisciplinarity, since "the disciplinary developments of the sciences not only brought the advantages of the labor division, but also the disadvantages of over-specialization, confinement and the shattering knowledge " **??**MORIN 2003, p.11). The segregation of disciplines and knowledge applied by educational and research institutions even today, can prove an institutional and epistemological obstacle. And the maintenance of this obstacle can in turn create a wave of compartmentalized movements, making room for conflicts and barriers between specialists, thus impeding scientific progress and knowledge. That is why in order for "to really take effect, it would be necessary to eliminate barriers between people" (Fazenda, 2011. p. 140). These are the psychosociological and cultural obstacles.

What would be the biggest obstacles? Transforming educational institutions or transforming mental and social structures? Would it be clear to say that this transformation would be a necessary condition for the demolition of the other barriers that hinder interdisciplinarity? According to Fazenda (2011) "more difficult than transforming institutional structures is to transform mental structures, and obviously this transformation would be a necessary condition for the transformation of the former" (p. 91). And this leads us to reflect on what is taught and what is learned within universities. What makes teachers repeat the same methods in their classes? The same form of assessment? Lacking motivation? Lack of time? Aversion to areas other than theirs? Or lack of attitude for a change that transforms the environment in which this expert works? According to Ramos (2016).

It is clear that the desire to change is a motivation for the teacher, enabling him to overcome obstacles such as the departmentalization of the institution, the indifference of colleagues and the lack of time to build a more globalized knowledge. (p. 198).

So "What is intended, therefore, is not to propose the overcoming of education organized by disciplines, but the creation of conditions to teach in function of the dynamic relations between the different disciplines, allied to the problems of society" (FAZENDA 2011. p. 89). That is why a critical analysis of the system and organization of the disciplines is important, and not only that, it is also necessary to create necessary means that lead the specialists to reflect on their methods used in practice and theory.

Fragmented teaching can have consequences for learning, given that such a proposition isolates the subjects in a distinct and compartmentalized way as if

3 Type

Main Aspect

Epistemological and Instructional It evidences the organization of the curriculum in disciplines, which respects the hierarchy.

4 Psychosociological and Cultural

Barrier between people and resistance from the team that develops the curriculum. It can generate prejudice or aversion.

5 Methodological Different methodological propositions applied by the curriculum development team

Training Team consisting of expert professionals -fostering hyperspecialization.

6 Material

Lack of economic and financial resources for both teacher and material resources.

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knowledge had no connection, which hinders the understanding of knowledge in an integrated way.

Concerning the prevailing hyperspecialization in the higher education teacher's training "these systems cause the disjunction between the humanities and the sciences, as well as the separation of sciences into hyperspecialized, self-contained disciplines" (MORIN, 2000. p .40). And complements.

In fact, hyperspecialization precludes seeing the global (which it fragments into portions) as well as the essential (which it dilutes). Now the essential problems are never breakable, and the global problems are increasingly essential. Moreover, all particular problems can only be correctly posed and thought out in their contexts; and the very context of these problems must be increasingly positioned in the planetary context. (2003. p.13).

The new education methodologies must make the connection between what is learned and what is experienced in daily life, in addition to overcoming prejudice for the new that arises. The methodological obstacle This seems to be the most important, since the elaboration and adoption of an interdisciplinary work methodology implies the previous overcoming of the institutional, epistemological, psychosociological, cultural obstacles, of qualified personnel formation and also the overcoming of the material obstacles (FAZENDA, 2011, p. 92) So rethinking this formation in an interdisciplinary perspective invites us to confront different knowledge to enable change regarding other areas of scientific knowledge. Thus **??**orin (2003. p. 13) emphasizes the need for a reform of thought, as "there is an ever widening, profound and grave inadequacy between separate, fragmented, compartmentalized knowledge between disciplines" and that all fragmented knowledge leads us to hyperspecialization. Although specialization cannot characterize a problem in itself, as we agree with Ramos (2016) when he tells us that "specialization surpasses mythology by trying to cope with hitherto unexplained phenomena" (p. 29), according to the same author. "specialization becomes insufficient, because its relation to life is remarkably instrumental and the mechanistic principle puts the usefulness of the useless among its walls; the art of science; the man of nature" (2016 p. 29) also" hyperspecialization prevents the perception of both the global [...] and the essential. (MORIN, 2000 p. 41).

Although the hyperspecialized teacher trainers may hold the knowledge for themselves, the knowledge may not reach the teacher still in formation. Thus the process of teacher training requires discussions about the challenges related to the teaching genesis that must be not only theoretical but also epistemological and methodological, which is the relationship between the disciplines, where each one must respect the limit of the other and yet there is a consonance between them so that constitution of learning is not fragmented and compartmentalized. Morin (2003) brings us some "Challenges", which must be overcome and shows the inadequacy between knowledge that is separated into disciplines and so there is a fragmentation of knowledge that can create problems for humanity, and these challenges are complex, multidisciplinary, global, planetary.

Specialization is a problem when the specialists close in on themselves, avoiding working with people from areas other than their own, but when they opens themselves to dialogue, specialization can guarantee a more integrated teaching leaving a legacy for the teacher in training.

It is considerable to understand that the obstacles described and categorized here become interrelated as material obstacles usually result from inadequate planning that disregards economic and financial aspects and even of space and time, which are a priority in motivating project participants. It is possible to highlight, in this same way, that the obstacles related to vocational training are the source of the previous ones, since in the initial and continuing education programs, habits and routines are taking shape and establishing themselves as unquestionable principles.

Thus, the discussion of obstacles is as important as the discussion of the possibilities of interdisciplinarity. We believe, agreeing with Augusto & Caldeira (2007) that these obstacles are overcome by collective effort and relevant dialogue.

Given what is posed to us, would it be controversial to state that it is indispensable to establish a critical awareness of the value and meaning of interdisciplinary work? To then assume a stance that indicates the paths that help in their understanding and applicability? And in the face of all these obstacles, is it possible to practice interdisciplinary teaching? What are they? III.

7 Methodology

The research analyzed the perceptions of 15 professors of an Education Bachelor degree from a public university divided into three areas of knowledge, namely: Biological Sciences (03), Biodiversity (04) and Education (08). This sample population corresponded to 57.6% of the total teachers that make up the teaching staff of this course.

Data collection was based on the application of a questionnaire on Google forms (2018, 2019) that ensured security and better organization of the data since the answers were automatically sent to a spreadsheet as the questionnaire was answered. The categories of obstacles announced by Fazenda (2011) were considered in his

most relevant studies on the topic, namely: (1) epistemological and instructional; (2) psychosociological and cultural; (3) methodological and (4) training related. At the time, we asked teachers to choose how much impact these obstacles have on an interdisciplinary practice.

Initially, the data was organized by the Google form program. Closed questions were automatically organized into charts and tables (GOOGLE 2018, 2019) which eliminated the process of entering answers if the questionnaires were answered manually. For the analysis, we used the procedures: Likert scale and discourse analysis (based on content analysis).

8 Source: Prepared by the authors (2019)

The Likert scale is a type of psychometric response scale and has been employed in opinion polls. According to Silva Junior; Costa (2014) "Likert's verification scale consists of taking a construct and developing a set of statements related to its definition, to which respondents will give their degree of agreement" (SILVA JUNIOR; COSTA 2014, p. 4). The principle of this scale is to categorize the responses and also to introduce them ranging from "strongly approve" to "strongly disapprove". Likert (1932) is a neutral point in the "undecided" center.

IV.

9 Results and Discussions

We used the categories of obstacles announced by Fazenda (2011) in her most relevant studies, namely: (1) epistemological and instructional;

(2) psychosociological and cultural; (3) methodological and (4) training related. At the time, we asked teachers to choose how much impact these obstacles have on an interdisciplinary practice. The options were: totally agree, partially agree and indifferent.

We can highlight that the epistemological and instructional obstacles and the psychosociological and cultural obstacles gain more relevance in the understanding of the researched subjects, 66.7% and 60% respectively, followed by Training with 40% and Methodological 33.3%. This primarily means evidence in the installed culture of the challenge of breaking down barriers between disciplines and classifying knowledge according to a hierarchy that we still perceive today in university curricula.

When the passage from knowledge to action occurs a set of social and natural phenomena usually rooted in the teaching practice prevents overcoming this obstacle as an example, we have the accommodation and defense of the value of their discipline (FAZENDA, 2011). It seems to us that the act of developing their classes just considering their subject is not only a condition of curriculum completion, but also a necessity for practical exercise in higher education. Regarding the prerequisites, Japiassu asserts: It is not a question of denying certain "recurrences" in scientific disciplines, but of showing that it is no longer possible to conceive science as a monument that would be built stage by stage, cumulatively and continuously, on fundamental, solid and guaranteed foundations. (1976, p. 63).

For Gusdorf (apud Fazenda, 2011), the elimination of disciplinary barriers runs into laziness since it is more easier to develop lessons in a fragmented way than to discuss ideas and share one's own. These habits, for the author, result in rigid institutional structures:

Each new discipline puts itself in an attitude of consecrating itself before others to secure its place, cutting off communication with the rest of the mental space. This attitude is almost always reinforced by the institution, which encourages the "theorization and maintenance of an epistemological capitalism" (GUSDORF, apud FAZENDA, 2011, p. 90).

Preserving disciplinary status to some extent promotes the isolation of disciplines and lack of communication.

As a result of this first and greatest obstacle, we show that such difficulty is based on the change in mentality of the people who refer to the categories placed on the psychosociological and cultural obstacles that also assume great relevance in this research. One of the causes announced by Fazenda (2011) for this situation is the "ignorance of the real meaning of the interdisciplinary project", which evidences in significant part in the answers of the questioned teachers the focus on the conceptual perspective of interdisciplinarity or the distanced answers of the epistemological debate.

Referring also to the obstacles that interfere with the full exercise of interdisciplinarity in higher education, we ask: In addition to these related obstacles, which one (s) would you mention in view of facing your pedagogical practice in higher education? The following

10 Obstacles

Totally agree Agree partially Indifferent Partially agree Totally disagree Epistemological and instructional 66,7% 33,3% ———— We highlight that from the 15 participants, 13 (86.6%) answered, and 5 (38.4%) do not fit in the obstacles described. We present 6 (46.2%) categorized obstacles according to the teacher's view.

11 Psychosociological and cultural

60% 40% —- —- —- Methodological 33,3% 66,7% —- —- —- Training related 40% 53,3%**6**

In this context, the obstacles cited by P02, P09 and P12 were classified in the category of training related obstacle, as they refer to the weakness of the teachers' preparation and their formation. The other obstacles

presented (P04, P10 and P11) are epistemological and instructional, because in order to be overcome they demand the elimination of disciplinary barriers. Still, we could see a psychosociological obstacle (P11) that is revealed when the expressions of vanity and hyperspecialization of agents hinder interdisciplinarity (MORIN 2000, FARM 2011) as we see.

In this evidence, we corroborate the idea that there are many challenges to be overcome in order to enable interdisciplinary practices. However, the formation of an interdisciplinary team requires the personal and collective confrontation of these obstacles, that is, it requires, first of all, people who have the disposition to overcome themselves, with an intentionally prepared planning based on a curriculum thinking in a perspective in which dialogue and the connection are present as a continuum.

12 a) The possibilities

And while the challenges are many, they must be tackled, as the advantages of interdisciplinarity in school, with emphasis on more meaningful teaching, are numerous. To analyze the possibilities of the interdisciplinary movement from the teacher's perspective we used a vast literature highlighting the indications of Fazenda (2011) and Santomé (1998), which tells us that there are possibilities of integrating interdisciplinarity in teaching, such choice was made because we had greater contact with this literature and it was somewhat more didactic in its proposition.

We do not intend to exhaust the list of possibilities of interdisciplinary practices within the list below and on the other hand this is not the central object of this monograph. We even understand that this point deserves an exclusive dedication of studies and possibilities in view of the variety and versatility of experiences present in thesis records, dissertations and published scientific articles.

However, in summary, we can conclude that from the literature we could access, we highlight: (1) Modification of curriculum structure, (2) Elimination of barriers between subjects, (3) Elimination of barriers between people (4) Elaboration of Interdisciplinary Project, among other possibilities described by teachers in the construction of an interdisciplinary work are also pointed by some scholars on the subject (JAPIASSU, 1976; FAZENDA, 2011; SANTOMÉ, 1998;) i.e. debates in the institution to evaluate, reflect and implement innovations and interdisciplinary practice; teacher training on the subject; curriculum organization.

To the teachers of this research, we presented these four possibilities and ask them to check on a scale of 1 to 5.

The degree of viability they represent in an interdisciplinary practice in higher education. For data analysis, we leaned on the Likert method and

13 Professor

Obstacles Category According to **??**azenda (1999, p. 16) it is necessary to abdicate the insecurity that hinders interdisciplinary teaching. According to the author, this insecurity of interdisciplinary practice can only be overcome from the desire and attitude towards knowledge for an interdisciplinary practice. The effectiveness of interdisciplinarity with its obstacles and possibilities is necessary as a theoretical reflection on interdisciplinarity could not fail to address the aspects related to obstacles and possibilities of its implementation. (FARM 2011, p 47).

Therefore, it is essential that educational institutions require and encourage adherence to interdisciplinary practice, because this proposal when practiced can improve teaching and learning avoiding the fragmentation and compartmentalization of science. Regarding collective projects, Fazenda (2011) gives more emphasizes to the elaboration process, while teachers highlight the experience of their development. Thinking interdisciplinary practices regarding teachers' analysis, we evaluate that it is focused on interpersonal aspects, emphasizing the integration between people through pedagogical relations.

Still on this topic of possibilities, we ask that, in an open question, teachers report others in order to develop their pedagogical practice in higher education. From the 15 participants, 9 (60%) answered. We present the data on Table 02. Teachers (P15) (P03) (P05) indicated that teacher education would be a possibility for interdisciplinary realization, while P02 and P13 indicated that the elaboration of Interdisciplinary Projects would be a possibility for interdisciplinary practice.

14 Teacher

Possibilities Category P02 Support from the teaching center and PROGRAD for the promotion of actions aimed at understanding interdisciplinary practices, making them more accessible to teachers who wish to integrate themselves with this way of thinking and acting in the context of the classroom.

15 Elaboration of Interdisciplinary Projects

16 P13

I believe that, immediately, a simple practice of interaction between teachers, with proposals for common activities across disciplines, would be an efficient tool for breaking the compartmentalized division of the approaches addressed.

17 Elaboration of Interdisciplinary Projects

18 P06

Define specific time for this exercise (including planning and execution steps).

19 Elaboration of Interdisciplinary Projects

20 P03

None, but I believe that the barrier between people is not only related to ego or interpersonal conflicts, but to one's formation and convenience. Formation P15 None, but I believe that the barrier between people is not only related to ego or interpersonal conflicts, but to one's formation and convenience. According to Fazenda (2011) thinking of teacher education in an interdisciplinary way goes beyond sustaining various subjects; it sooner calls for a change of attitude towards the knowledge area.

The interdisciplinary teachers, in the author's view (1994, p.31), are beings who seek to research, and are committed their peers. They identify themselves as dissatisfied with what they do, "in this understanding, interdisciplinarity can occur through numerous possibilities of theoretical and methodological practices (RAMOS, 2016. P. 94). Therefore, the formation must enable other perceptions about knowledge, facing this "globalized world" (SANTOMÉ 1998) that is in constant transformations.

V.

21 Abreviated Considerations

To recognize the obstacles and possibilities of the interdisciplinary movement from the teacher's perspective we employ the categories of obstacles announced by Fazenda (2011) and Japiassu (1976) in their most relevant studies on the topic, namely: (1) epistemological and instructional; (2) psychosociological and cultural; (3) methodological and (**??**) training related in the analysis. We can highlight that the epistemological and instructional obstacles and the psychosociological and cultural ones gain more relevance in the understanding of the research subjects, 66.7% and 60% respectively. Regarding the possibilities, 15 (100%) subjects answered 66.7% totally agree that the elaboration of teachers' interdisciplinary projects would be a possibility for the realization of interdisciplinarity. So the constitution of a team that intends to act from an interdisciplinary perspective would be relevant. Thus, these data reveal the importance of a team of teachers committed to the formation of future teachers and therefore must meet the new demands of a "globalized world" (SANTOMÉ, 1998) to act pedagogically with a more interdisciplinary spectrum, despite the obstacles. Thus interdisciplinarity is not just a single knowledge; it is a broad movement of interaction and integration between different possibilities offered by the sciences in which the disciplines are able to unfold when the barriers between them are overcome. Assuming interdisciplinary assumptions requires changes in teaching practices, since we are talking about teacher trainers. And for interdisciplinary practice it is necessary to go a long way to enable teaching and research **??**FRIGOTTO 2008;FAZENDA 2011 **??**AZENDA , 2014)) as well as its extension since it starts from a change of teachers' attitude their willingness to further this theme. [1] [2]

1

[Note: Source: Elaborated by the author, 2018]

Figure 1: Table 1 :

1

Figure 2: Table 1 :

1

[Note: Source: Elaborated by the authors(2019)]

Figure 3: Table 1 :

2

P02	Teacher's lack of knowledge on planning interdisciplinary activities.	Training related
P09	Difficulties in deepening the epistemological debate on a broad perspective.	Training related
P12	Not having adequate formation or seeing debates on the matter at UFRB.	Training related
P04	The fragmentation of curricular components is cultural. Our education models are fragmented and under this perspective we are unconsciously induced to think our components separately ...]	Epistemological and instructional
P10	Obstacles related to institutional policies.	Epistemological and instructional
P11	Conception incompatibility of the subjects that operate the curriculum aiming at forming future professionals, with the formative proposal recommended in the PPC of the course of any and all formative modality (undergraduate, bachelor and technologist). After all, when this perspective occurs, the conceptions in dispute and, eventually, the expressions of vanity and hyperspecialization of agents make it difficult to align the proposals (of the subjects and the PPC) with the profile of the egress.	Epistemological and instructional / Psychosociological and cultural

Figure 4: Table 2 :

2

[Note: Source: Elaborated by the authors, 2019]

Figure 5: Table 2 :

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