

Multidisciplinary Training for Teaching: Design, Practices And Extent Of A Postgraduate Program

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Abstract

Teacher training is still an unresolved issue in Mexico. Middle and high school education, in particular, faces a major challenge due to its lack of a robust institutional structure for the further training of teachers, who hold a professional disciplinary degree, but generally lack pedagogical preparation. To address this situation, a master's degree was approved in 2003 with the intention of providing comprehensive training with a multidisciplinary approach, which was implemented through various mechanisms such as a curriculum based on three axes: the discipline of teaching, the socio-ethical, educational and psycho-pedagogical areas, in correspondence with a scheme of tutorial committees composed of academics from different disciplines. The purpose of this article is to describe the institutional design, analyze some practices and assess the scope of this program in terms of its multidisciplinary approach. This study is both descriptive and analytical. One of the main achievements is to point out that it is necessary to move towards interdisciplinary teacher training and to incorporate contents that address old and new demands such as technologies, environmental care and inclusion.

Keywords: multidisciplinary training; teaching; high school; postgraduate studies.

1. Introduction

The teaching profession is multidisciplinary in origin, where knowledge of the discipline being taught, pedagogical, psychological, sociological and ethical knowledge converge. Today, teachers are faced with demands for the management of technology, care for the environment and inclusion. All this aimed at improving educational processes to train the citizens of our time. Teacher training, ideally, should respond to these needs; however, in Mexico, as in much of the world, the majority of teachers hardly cover the “minimum necessary qualifications,” understood as pedagogical competencies for transformation that include skills to use favor of learning communication and information technologies; knowledge to foster both social-emotional learning and inclusive education; as for citizenship education and sustainable development, of course based on the exercise of reflective practice ([UNESCO, 2022c, p.21](#)).

In Mexico, initial teacher training for preschool (taken from 3 to 6 years of age), primary (from 6 to 12 years of age) and, to a certain extent, secondary (12 to 15 years of age) is guaranteed. by the Normal schools, that is, educational centers specifically dedicated to training teachers, but for upper secondary education (which ranges from 115 to 18 years), there is no robust system specifically dedicated to preparing its teachers. In recent years, courses, workshops and seminars have been offered with different themes promoted by different entities linked to government policy, but in general they are disjointed and do not have a long-term projection (National Commission for the Continuous Improvement of Education , [2022a](#); [2022b](#)). In reality, there are few specialized programs that

serve this sector, so that the profile of teachers who have a tertiary education degree in some discipline, but lack pedagogical, ethical, psychological and sociological preparation, that is, prevails. multidisciplinary, to face the challenges of teaching at an educational level that serves young people who are about to come of age and enter higher education or the world of work.

In this scenario, and with a view to addressing this need, in 2003 the Master's Degree in Teaching for Higher Secondary Education (MADEMS) was created at the National Autonomous University of Mexico (UNAM), whose purpose - in accordance with its study plan - is to train teachers at this level in a comprehensive and multidisciplinary way. It should be said that, in principle, this postgraduate course was intended as a mechanism to train high school teachers at the University itself ¹, but with the passage of time it has expanded its scope and currently serves teachers in fourteen disciplines such as: biology, social sciences, Spanish, philosophy, physics, geography, history, mathematics, psychology and chemistry, all subjects that are part of the secondary education curriculum in different public and private institutions. Schools, faculties, institutes and research centers related to these disciplines participate as venues in the program and there is a staff of tutors who belong to different areas of knowledge. The latest official data provided by the coordination of this postgraduate program indicate that in 2023 there will be a total enrollment of 238 students and a teaching staff made up of 288 academics.

Twenty years after its creation and implementation, it is worth asking if this multidisciplinary approach proposed in the curriculum is effectively permeating the training of the student body, and if the institutional mechanisms that were

established operate to achieve the synergy of the disciplines for improvement. teaching and, ultimately, the improvement of practice in high school classrooms in accordance with current educational demands.

In this sense, what is presented below is a review exercise of a particular postgraduate program to analyze its educational proposal in terms of the

commitment to multidisciplinary in order to demonstrate what favors this encounter between disciplines, as well as contribute elements for improvement.

The document is divided into five sections, the first briefly explains some of the theoretical aspects and the methodological route; In the second, the curricular structure is presented to glimpse the components of the program that were designed to promote multidisciplinary training; In the third, some practices are analyzed to show how the different disciplines come into play in school processes; In the fourth, some opinions of the graduates about the training received are presented, in the fifth, and finally, an assessment of the scope of this master's degree is made with a view to a possible revision of the study plan.

2. Theoretical methodological notes

This article arises from the experience and participation in three research projects related to the Master's Degree in Teaching for Higher Secondary Education at UNAM. The first was carried out with the objective of analyzing the incorporation, mentoring and graduation processes. In this, information was recovered and systematized through a documentary search and an incursion into the field in three ways: systematization of information on training processes in the classroom; obtaining admission data and the student's career through the admission

committee; participation and review of discussions in the academic committee, which is a body that contributes to decision-making in conjunction with general coordination (Mireles, 2021). The second was a study of graduates, in which the documentary information was updated and strengthened, in addition to applying a questionnaire to 39 people who were trained in the program in order to know their characteristics and opinions about the training received (Santos , 2023). The third investigation is underway, it is a collective project, in which training practices and processes are analyzed from a qualitative perspective through interviews and questionnaires with different actors in this postgraduate program. ²

The above has allowed us to recover, organize and systematize documentary and empirical information of different kinds that serves as background for the analysis presented here. In addition to this, the following methodological route was designed:

- a) Search and analysis of literature on multi, inter and transdisciplinary. It was a conceptual review and at the same time establishing a link with education and in particular knowing what has been written regarding teacher training. The question that guided this stage was how to understand multidisciplinary in the field of education, specifically in the field of teacher training?
- b) Review of the institutional documentation of the original study plan approved in 2003 and the update in 2013, as well as the regulations and operating standards of the MADEMS, in order to find the structural elements that allow the multidisciplinary training stated in the general objective of this program. The questions that guided the exploration were: what elements of the curriculum make

multidisciplinary training possible? how are they articulated?

c) Description of some academic practices oriented to multidisciplinary. Some spaces of confluence between academics and students are reviewed regarding the work to obtain the degree, tutoring, the subjects they take, the participation of academic entities and teaching practice. The question was formulated as follows: how are the mechanisms intended to promote multidisciplinary implemented in practice?

d) General assessment of the scope and limits of what is achieved through institutional mechanisms regarding multidisciplinary training. The central question was: to what extent is multidisciplinary training possible and how can its potential be maximized?

Derived from the processes described in the first section, it was found that the discussions on multidisciplinary, also called pluridiscipline, are linked to inter- and transdisciplinary, these focus mainly on the production of knowledge and the study of complexity, which It is understandable because that is where its origin lies. It is agreed that they involve dialogue, intersection, combination, interaction, cooperation, encounter, between different types of knowledge, methods, theories, coming from different disciplines that are linked around a problem, which is to say that they are articulated in the search of complex answers. In a simple way, it can be said that what varies between these three modalities is the degree of “depth” of “imbrication”, which is established between the areas of disciplinary specialization. So, in summary, multidisciplinary refers to juxtaposition (biology, ethics), interdisciplinary to conjunction (biology and ethics) and transdisciplinary

to integration (bioethics), the latter being considered a maximum and ideal degree for research and creation of knowledge in contemporary society ([Paoli, 2019](#)).

It is regularly proposed that this logic - multi, inter and trans - arises in the face of the excessive fragmentation of knowledge even when it is recognized that the world, nature, society and human beings are too complex to be understood in parts or in sections as is the case. with disciplinary specialization. ³ The discussion in this regard is old and occurs in different areas: epistemological, theoretical and practical, from the natural sciences or the social sciences, in such a way that there is great accumulated capital. For [Follari \(2005\)](#) this proposal became visible in the

seventies of the last century and then faded in the eighties, later in the nineties it regained visibility and relevance, according to this author it has been in a coming and going which has generated different approaches and traditions (hybridization, openness). In this timeline we find that, for half a century, some reflections on interdisciplinarity in relation to teaching and research in universities were developed; the text by Apostel et al. is well known about this . [\(1975\)](#). Decades later, another milestone appeared in the debate with the proposal of Nicolescu (1996) who, from quantum physics, focused on developing transdisciplinarity in conjunction with the idea of levels of reality.

With ups and downs, the theoretical debates in this regard remain on the scene with a greater or lesser degree of depth. Here we only want to point out that in the educational field not only were discussions brewed, being a field of action the idea transcended in such a way that throughout Over time, university models and study plans for vocational training have been designed and implemented, the central axis

of which is multi, trans or interdisciplinary. For example, in Mexico the Metropolitan Autonomous University (UAM) was founded in the seventies of the 20th century with a multi and interdisciplinary curricular model ([Hernández-Vázquez, et al, 2020](#) ; [Follari, 2013](#)). Subsequently, other curricular proposals have been reported in different professional fields, for example, in the field of health ([Barrientos-Cabezas et al., 2020](#)), in engineering ([Henao et al., 2017](#)) and social work ([Cárdenas et al. , 2017 al., 2015](#)), all in different latitudes of Ibero-America.

Particularly in terms of professional teacher training, contrary to what one might think, there is little production in the region. Some reports dated in the nineties of experiences or proposals were found where the aspiration to incorporate a multi

and interdisciplinary perspective in the curriculum is explicitly expressed ([Saltamacchia et al., 1992](#)). Years later, multidisciplinary has been associated with the development of teaching competencies ([Rasilla et al., 2018](#)).

The above allows us to reflect in two directions: first, the list of production and theoretical-epistemological debates on the topic is extensive; with respect to the definitions of multi, inter and transdisciplinary, encounters and disagreements are observed. As can be expected, there is no single definition for these concepts; there are nuances that can sometimes cause confusion for non-experts, and even more so can cause obstacles when it comes to putting them into practical terms. Second, in the field of teacher training, in addition to concepts, the epistemological stance of complex thinking and problem solving is useful to discard unidisciplinary or merely technical models, with the understanding that teachers are potential agents

of transformation, who By exercising their practice from broader perspectives, they can encourage students to modify learning structures. Therefore, it is assumed that the teacher training process is a practice that involves the sum of efforts and collaboration between disciplines.

The above is not a simple task, it would be naive to think that a shift in this direction will be achieved by decree, paraphrasing Hernández-Vázquez et al. (2020) , certain conditions need to be forged and met, given that if we aspire to form multidisciplinary and interdisciplinary curricular designs, this implies collegiate work and the creation of flexible academic and administrative conditions, as well as the participation of a convinced teaching staff. of the benefits inherent to the articulation between disciplines. In this scenario, it is advisable to look closely at the academic projects that have been launched to learn from the experience and at the same time work on improvement.

Based on the above, this article reviews multidisciplinary training, understood as the encounter, interaction, intentional and systematic of two or more disciplinary fields, which is promoted during the career of students in a postgraduate program (MADEMS) during the training process (four semesters), in order to provide the students (teachers in practice or in initial training) with different disciplinary knowledge (pedagogical, psychological, ethical, sociological) that is mobilized together for the improvement of teaching practice in upper secondary education.

For what has been said, what follows is the review of the study plan, to identify the elements that guide and guide multidisciplinary.

3. The multidisciplinary curricular model

One of the components of the curriculum is the curricular design, ⁴ in which proposals for theoretical-methodological models are generated that allow, through different phases, the development of study plans and programs. It is in these where the prospective vision of a professional is reflected, what students are expected to achieve at the end of the training process, as well as the subjects, contents, strategies and activities that will be developed to meet a general objective. These documents also define the specific mechanisms to make possible the articulation between the different disciplines.

According to the Coordination of Educational Development and Curricular Innovation (CODEIC, 2017), a disciplinary proposal is characterized by having a study plan with content from a single field of knowledge that may include subjects or modules from related disciplines; Only one academic entity participates in these. On the other hand, there are multidisciplinary proposals, such as the one that will be seen later, which consist of the integration of different disciplines, subjects, modules or school activities to address content, develop a project or seek solutions to a problem (Vélez and Terán ,2010).

Multidisciplinarity can then be understood as a model in which two or more subjects from different fields of knowledge are taught, and the relationship between content is encouraged through various strategies, so its implementation is unique in each institution. That is, in this model the fields or disciplines remain separate, but connections between them are deliberately made. According to the Methodological Guide of the Universidad Veracruzana (2005), multidisciplinarity is the juxtaposition of some disciplines that find points of articulation that allow

them to analyze the same object or problem.

Therefore, multidiscipline in curricular design refers to the different relationships, articulations or interactions that are established between the disciplines, without there being a deep integration between them, but which together allow for a holistic or comprehensive understanding of different problems.

Based on the above, in the MADEMS curriculum (2013) some elements regarding multidisciplinary clearly stand out:

The first of them is the general objective, which literally states: “To solidly and rigorously train, with an innovative, multidisciplinary and flexible character, education professionals at the Master's level, for the teaching practice appropriate to the needs of Education. Upper Middle” (p. 50).

The second, the structure of the curriculum contemplates three lines of training: 1) socio-ethical-educational, 2) psycho-pedagogical and 3) disciplinary (p. 55). The first two make up a common curricular area called “General Teaching”; also the area of “Disciplinary Teaching” that specializes in the line of each field of

knowledge; and a third area, “Integration of teaching” that combines the three lines of training.

The third refers to the participation of fifteen academic entities to make the study plan possible. It is necessary to mention that this group includes schools, faculties and research centers. Thus, for example, the Faculty of Sciences, the National School of Higher Studies of Morelia, the Research Institute on University and Education, the Faculty of Philosophy and Letters, among others, all UNAM agencies that collaborate with infrastructure participate. , services, human, material

and financial resources that they make available to the program.

The fourth points out that in this master's degree teachers are trained in fourteen fields of knowledge: biology, social sciences, health sciences, Spanish, philosophy, physics, French, geography, history, English, classical literature, mathematics, psychology, chemistry . Thus, in the seminars and school activities of the common curricular area, teachers from various disciplines coincide, which facilitates a multidisciplinary dialogue around a shared axis that is teaching.

The fifth is the tutorial committees, these are made up of three academics who, according to the operating rules, must belong to at least two of the three lines of training (disciplinary, socio-ethical-educational or psycho-pedagogical). Additionally, the committee must be made up of academics from more than one participating entity. The functions of this committee focus mainly on advising for degree work. Each semester, at least one evaluation meeting is held where the three members of the committee assess the student's progress and express their opinion from their different specialties.

The sixth, teaching practice. From the second semester to the fourth, students take this subject that involves teaching in front of the group. Its objective is “the

integration of the theoretical and methodological knowledge acquired in the academic activities of the three lines of training of the Master's Degree (the socio-ethical-educational, the psycho-pedagogical and the disciplinary) and its application in the corresponding teaching scenarios. particularly in high school educational centers to promote in an organized and gradual manner the establishment, development and consolidation of teaching skills consistent with the

graduation profile of the Curriculum Plan” (MADEMS, 2013b, p. 55).

The seventh is the graduation work, which in its different modalities (thesis, professional experience report, teaching practice report, published article), is a final product that is considered an integrative strategy of the contents developed throughout the program. which, in addition to addressing a problematic situation identified in the context of upper secondary education, serves as evidence of the way in which teachers make use of the incorporated knowledge to analyze, argue, propose, design, implement and evaluate a contextualized proposal.

As can be seen, in the curricular structure the seven elements are articulated to ensure that students can access comprehensive and multidisciplinary training, which not only refers to the implementation of proven teaching techniques, which are accumulated with the knowledge of the teaching discipline, or the technical learning of didactic planning, but rather the integration of theoretical background from three lines of training.

Now, it is time to describe how what has been said is materialized in the practices and processes of the graduate program.

4. Multidisciplinary-oriented practices

Based on the curricular structure, the practices are developed in different ways and with particular adjustments in each of the fourteen fields of knowledge and in each participating entity. This is because, as is known, the actors are the ones who implement and operationalize the curriculum and this can generate heterogeneous practices. It is not the intention here to establish detailed differentiations, but rather to offer a panoramic view of how academic processes occur, trying to show how

multidisciplinary is possible in teacher training and what makes it difficult.

Tutor assignment. During the first semester of the master's degree, each student is assigned a tutor to begin their work toward obtaining the degree. The academics who belong to the program's roster are classified into three types of profiles: those with a disciplinary title (physicist, chemist, biologist, historian, etc.); those who have training in the psychopedagogical or socio-ethical educational area (pedagogue, educational psychologist, educational sciences, educational sociologist); and those who combine the discipline with teaching preparation and experience (philosopher who has training and experience in teaching). The tutor serves as an important figure because he is the one who guides the development of a graduation project, in addition to monitoring the student's school career. Ideally, it is a close accompaniment in which the tutor, in addition to providing information about the specific area, enters or updates the discussions towards the field of teaching. It must be recognized that this first step is more fruitful - if we speak from a multidisciplinary perspective - when the tutor has a dual profile in which the knowledge of the discipline is combined with systematic training in the pedagogical or social area, because in dialogue Constantly among the actors, the link between the disciplines is built. However, despite the benefits that the tutor-tutee bond represents, this training commitment is not always met, which means that the foundations of multidisciplinary work are not completely laid. Furthermore, it should be noted that when the tutor is a specialist in the

discipline, and has few elements to work on educational topics and problems, the unidisciplinary vision naturally predominates in the tutoring process, so for

example the mathematical tutor speaks from his/her framework. discipline with the student who is also a mathematician on problems or topics in his field, teaching in those cases seems to be a secondary exercise.

Subjects from three disciplinary areas. From the first semester, subjects are taken that, in addition to delving into the advances and contemporary problems of the discipline being taught, place the student in the analysis of education and its complexity, for example, the history of upper secondary education is reviewed. , national educational policy, international educational trends, advances in general didactics and specific didactics, work is done on the psychological development of adolescents, professional ethics, among others. Ideally, teachers should direct their efforts to integrate the contents of their subject with those taken by the students in the same semester (vertical coherence), however, in practice the goal is rarely achieved, and regularly for the student they appear as subjects. unrelated, which obviously does not favor the establishment of a multidisciplinary bond. This can be observed in the academic events organized by the program where students necessarily participate to present their progress on their degree work, and in the exhibitions the articulated work of the different subjects they have studied is not observed.

Formation of the tutorial committee. During the second semester, a tutorial committee is assigned to each student. Based on the regulations, this is made up of the main tutor, plus two academics. Preferably, a tutor of the discipline should participate in this committee, plus someone who belongs to the psychopedagogical or socio-ethical educational line. It is also important that the tutors belong to

different academic entities. This standard is fully complied with as it is regulated, ensuring that the student has the opportunity to listen and work based on different and enriching points of view. However, sometimes the disciplinary vision predominates when two teachers of the teaching discipline are appointed, leaving very little room for action to the tutor of the educational area. Furthermore, sometimes the level of participation shown by each tutor to follow each student varies, which undermines multidisciplinary conditions. This is explained, mainly, because the entire staff of tutors still needs to work from the multidisciplinary assumptions of the study plan, the operational rules that govern the formation of the committee are met, but this does not ensure that the tutors work on the same basis.

Teaching practice. Starting in the second semester, a specific subject dedicated to teaching practice is carried out. In it, the student must plan, execute, analyze and report their work in the classroom, which is supervised by both the subject teacher and the head teacher of the group that provides the facilities for the practice to be carried out. This subject can be considered core to the curriculum, as it is the axis in which knowledge from different disciplines can be integrated as part of the teaching action. In many cases, the teaching practice that takes place in the second, third and fourth semester of the study plan is the basis for preparing the degree work, which enhances its meaning and usefulness. To date, some works have been published in which it can be observed how historical, social, pedagogical and didactic knowledge is linked in teaching practice, in innovative intervention proposals that offer good results (Mireles, 2021). However, teaching practice is not always carried out as required by the program, and what should be a theoretical-

practical exercise remains an abstract analysis of the teacher and teaching without a direct impact on the classrooms. This has to do once again with the commitment and knowledge of the academic who is assigned this subject.

Work to obtain the degree. There is evidence that a large part of the graduation projects are theses in which a problem with respect to teaching is posed, to which a response is given based on some theory from the educational field and a discussion in terms of the discipline. of teaching (this is supported by the records of the academic committee since it passes the approval of the thesis titles that include a summary). It is observed that the requirement is that students merge the knowledge acquired in different disciplines into rigorous, solid and articulated work to offer a viable and innovative solution to teaching problems in high school classrooms. To reach this point, the academic committee - in charge of academic-administrative processes - has had a constant exercise of thorough review so that this trend is consolidated.

Participation of different academic entities . In this area, multidisciplinary stands out as a link of mutual and cumulative cooperation between the different participating entities, which takes shape in the use of facilities and material resources, as well as the number of tutors who come from various locations. It is worth mentioning that given the long distances between the camps, it is difficult for students to take advantage of what other entities offer, focusing their activity almost exclusively on the faculty or school in which they are enrolled, which has limited the possibilities of exchanges for favor multidisciplinary. However, this has recently changed given that after the period of isolation due to the covid-19

pandemic and the implementation of emergency remote education, the available digital resources have begun to be used more frequently to facilitate these meetings. , which is a positive sequel that the health crisis left in this school space.

With what has been said so far, it can be seen that even when institutional conditions and study plans are designed to strengthen multidisciplinary training in academic practices and processes, it is not completely achieved. According to Choi and Park (2006), working in multidisciplinary teams does not always work, nor does it always fulfill what it promises to deliver, despite the benefits it can have, such as creating networks, solving problems and improving the performance of institutions. The underlying question is what factors may be associated. From what has been said so far there are two central questions: the first has to do with the curriculum itself, which, although it raises the objective of multidisciplinary work and certain mechanisms for its achievement, It does not explicitly develop the bases for what is understood by multidisciplinary or its importance for the work in teacher training. Second, as long as this absence remains, it is very difficult for tutors and teachers to achieve clarity and, therefore, conviction about the forms of multidisciplinary work that the program offers for the improvement of teaching; consequently, there will still be several potholes that hinder the achievement of the proposed curricular objective.

5. Perceptions of the group of graduates regarding the knowledge acquired

One more issue that is relevant to highlight is the point of view of the graduates regarding the multidisciplinary training received at MADEMS. Here we briefly present some general assessments and perceptions that were obtained in a broader

study that are useful to show how educational actors value, from a distance, what the program provided them during their school career (Santos, 2023) . .

Firstly, there is a positive opinion regarding the program as long as it meets the objective of training for teaching. A majority group of graduates indicate that, in effect, the program provides the necessary tools in the psychopedagogical field to

carry out teaching work. They affirm that, although they mastered disciplinary knowledge, they lacked training to professionalize their teaching practice. They mention that MADEMS allowed them to delve deeper into the disciplinary aspects, to learn about the pedagogical-didactic topics (design of strategies for a better understanding of the topics) and in the historical, political, social evaluation to be able to design different teaching intervention proposals (social area). . In the testimonies, they pointed out that the university degree does not include training for teaching, that is, in the study plans there is an absence of subjects that provide specific knowledge about didactics and psychopedagogy, to be able to work as teachers. In these contributions, the importance of acquiring specific training for the upper secondary level and multidisciplinary or interdisciplinary training is highlighted, since this level has specific problems and requires preparation that allows them to be addressed in a comprehensive manner, considering not only the contents. , but also the context, the purposes of the different high schools, the characteristics of the student body and the objectives that are to be achieved. In the words of the graduates:

It was a very enriching stay due to the exchange of ideas with colleagues in the seminars and colloquiums. As well as the political, pedagogical and psychological

perspective of the postgraduate course (Graduate_01).

The training acquired in the Master's Degree allows you to understand educational processes from a global perspective, it implies the understanding of educational policies, as well as the teaching-learning process (Graduate_04).

This data is confirmed when 70.60% indicated they completely agreed that the program developed the ability to “teach with an inter and multidisciplinary perspective with a comprehensive vision of knowledge” which is indicated in the study plan. 23.5% indicated they agreed and only 5.90% chose the indifferent opinion.

Secondly, some reflections and recommendations are highlighted on the importance of incorporating new disciplinary approaches or contents to the program and promoting the development of others that the proposal already has. For graduates, it is essential that the program offers more consistent training in Information and Communication Technology (ICT), Learning and Knowledge Technologies (TAC) and Technologies for Empowerment and Participation (TEP).) since one of the activities that is carried out most during their work as high school teachers is the development of learning material. In this aspect, today it acquires greater relevance after the covid-19 pandemic in which educational institutions had to adapt to work mediated by technology at all educational levels and types, which revealed certain shortcomings in training. of the teachers.

In addition to the above, the graduates mention that it is imperative to incorporate a line of training to develop teaching strategies for the most vulnerable groups or those with disabilities and to raise awareness about the right to education. They

also emphasize that it would be ideal to pay for related topics. with school management at different hierarchical levels that allow the professional and professional growth of teachers. It is observed, then, that according to the point of view of the group of alumni, the multidisciplinary proposal of MADEMS fulfills the function of training teachers for upper secondary education, with solid knowledge in its three lines of training, which allow them to develop and professionalize their teaching practice in high school, coupled with addressing problems in a comprehensive, contextualized way and from different perspectives. At the same time, there is a need to incorporate elements from other

disciplines such as management or inclusive education that contribute to multidisciplinary approaches to the educational complexity that always imposes new challenges.

6. Final considerations: scope and limits regarding the change of study plan

Currently, the demands of international organizations such as UNESCO, states and society predominate to achieve quality education throughout life with equity and inclusion. To achieve the goal, the focus is on the role that the teacher plays in the learning processes. Thus, teacher training occupies and will occupy in the years to come a relevant place in any educational system, type and level. This makes pertinent the presence of studies that put policies, study plans, practices and processes of initial and continuing teacher training at the center. The analysis of specific cases, such as the one presented here, is useful for local knowledge, but also serves as a reference point to look at ways to face the challenges that arise in a global scenario. There are no general formulas, there are no ideal solutions, but

observing how they do it in other territories contributes to the discussion and decision-making.

An interesting angle is to look at this scenario from multidisciplinary, given that originally the professionalization of teaching practice requires the convergence of knowledge that comes from diverse disciplines. However, the generation of knowledge on the subject in Ibero-America is still scarce. It is necessary to transcend the idea that the compilation of works by authors with different disciplines is a multi- or interdisciplinary exercise, since adding different perspectives without a dialogue between them does not contribute to understanding the complexity. More documented studies are needed that allow us to know how

multidisciplinary, and in the best of cases interdisciplinary, is made possible in the teacher training that today's world demands.

Curriculum proposals are also required to train teachers, of all types and educational levels, that integrate different fields of knowledge to address the plural composition of the 21st century and the problems that arise, with the understanding that teachers specifically trained in This model is intended for new generations to be able to look, build knowledge and innovate from multiple angles and approaches. The global survey on the future of higher education that is envisioned towards 2050 emphasizes “the need for the curriculum to adapt to local and global needs, without forgetting the interactions between different disciplines and the need to promote human-centered critical thinking.” (UNESCO: 2021, p.33).

At this point it is convenient to remember that the proposal of the reflective teacher is an interesting paradigm that invites teachers to make use of their theoretical and

practical knowledge, in an interdisciplinary effort to work on their own knowledge and experiences, the goal is reflection in the action and about it. In this regard, Perrenoud (2011) points out:

Based on interdisciplinary mixes and specific theoretical work, the reflective paradigm will avoid falling into clichés and being confused with some devices always threatened by usury or confinement in a tradition (p. 208).

Therefore, the case of MADEMS, which is identified as a clearly multidisciplinary curricular proposal, is relevant for the region. In this regard, it should be noted that it is desirable that in future revisions of the study plan those structures that have contributed to multidiscipline be preserved, such as the participation of different academic entities, the integration of tutorial committees with academics from more than two areas of study. knowledge, and that we continue to insist on the need for

degree options to represent the opportunity to consider knowledge from different disciplines to build solutions to teaching problems in secondary education. However, given that the curriculum lived or the practices are not always multidisciplinary, sometimes the tutors coming from a specific teaching discipline do not provide sufficient openness to incorporate social, contextual elements, and the pedagogical, psychological, didactics and ethics that should be incorporated, so work must be done on this point.

Furthermore, it is time to think about ways to move towards interdisciplinary, as it is one of the current proposals for the renewal of education with a view to the future for all educational levels and teachers must be trained in this approach to ensure that, In turn, high school students prepare from this perspective that breaks

with the fragmentation of knowledge in search of solutions to problems: “Facing 2050, we have to go beyond the traditional vision of study plans as a simple school subject table and, instead, reimagine them through interdisciplinary and intercultural perspectives that enable students to learn from and contribute to the commons of humanity” (UNESCO, 2022b, p.153) .

From this perspective, it is also necessary to consider in the curriculum some areas that have been in the educational scenario for at least a decade and that have not been addressed, such as the use of information and communication technologies, linked not only to consumption. but also to the creation of content; the culture of peace, human rights, as well as care for the environment, among others that need to be incorporated from interdisciplinarity.

Added to the above are new topics, a product of the most current demands such as gender studies, the inclusion of diversity, socio-emotional care, global citizenship and sustainable development. In this sense, ensuring that today's teachers acquire theoretical-methodological elements to work with students, promoting cooperation and solidarity, as indicated in the proposal of the new social contract (UNESCO, 2022b) will require ethical foundations, sociological knowledge to work in context and specific teaching strategies to modify life in the classrooms and outside of them. All of this, without a doubt, will enrich the curriculum of the teacher-in-training and broaden her perspective regarding the task of educating the youth of the changing generations.

To conclude, it is necessary to consider that as Lenoir (2013, p.52) points out , “Good intentions are not enough, nor is the simple recognition of the need to face

social realities or the vindication of the paradigm of complexity that promotes the use of a transdisciplinary perspective... In education, training to, by and for interdisciplinarity is imposed and must be carried out in a concomitant and complementary manner.”

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