DIGITAL TECHNOLOGY AND INTERDISCIPLINARY TEACHING PRACTICES: THE DEVELOPMENT OF DIGITAL AUTHORIAL EDUCATIONAL MATERIALS IN THE UNDERSTANDING OF TEACHING PRACTICES

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Abstract

The purpose of the research is to analyze how undergraduates at Universidade Federal do Ceará (UFC) [Federal University of Ceará] transform their understanding about teaching practices from the development of Materiais Autorais Digitais Educacionais (MADES) [Digital Authorial Educational Materials] in interdisciplinary context. Considering the fragmentation of knowledge and the underutilization of Tecnologias Digitais da Informação e Comunicação (TDICs) [Digital Technologies of Information and Communication] as central problems in teacher training, this qualitative research, characterized as a Case Study, presents as unit of analysis five interdisciplinary groups of undergraduate students who were participants in the Technoteaching discipline offered by UFC in 2015. The research is subdivided in three stages: planning, data collection and analysis. The first stage involves the preparation of the instruments and equipments for the data collection and analysis, and the elaboration of the data collection protocols. In stage two, the data is collected for the verification of undergraduates’ previous knowledge, investigation of the development of MADEs, and for the verification of posteriori knowledge of the undergraduates. In the stage three, the data analysis is performed by interpreting findings using methodological triangulation of the collected data. Conceptual transformations were detected in the definition of the concept of Technoteaching by the students, evidencing elements of interdisciplinarity, as per the use of TDICs based on the transmission of content and the construction of knowledge with the student. Although students still perceived teaching practices as being centralized in the teachers, they have visualized the possibility of teachers becoming apprentices in the development process of MADEs. The results will be presented to the “Grupo de Trabalho das Licenciaturas” [Bachelor's Degree Working Group] at UFC to assist in the modification process of the Political Pedagogical Projects of the current undergraduate courses. This research is ongoing, and it is intended to be continued in 2017 per the execution of projects linked to Grupo de Pesquisa Tecnodocência (GPT) [Technoteaching Research Group].

Keywords: Digital Technology, Teacher Training, Interdisciplinarity, Educational Material.

1 INTRODUCTION

Currently, basic and higher education teachers have difficulty in developing an interdisciplinary work with the use of the Digital Technologies of Information and Communication (TDICs). According to Tardif (2002), this is a consequence of the inefficient training that is still based on an applicationist proposal of knowledge. In the case of the undergraduate training, Gatti (2010) highlights the existence of knowledge pulverization, generating a fragile teacher preparation for teaching in Basic Education. The contents are disarticulated, there is an unbalance between theoretical and practical disciplines, and the contents are disconnected of the reflections and from possible integrations with the digital technologies.

The simple incorporation of the knowledge associated to the digital technologies in the teacher training does not in fact guarantee a pedagogical and integrative transformation, only reinforces the current schooling practices (COLL, 2009). Loureiro, Lima and Soares (2014), in a research developed with higher education teachers, have found that there is an interest of teachers to deepen their knowledge about technological innovations. However, they try to apply it in methodologies for teaching practice, usually in an expositive form. The authors suggest that the fragmentation of the knowledge imposed to undergraduates in training can be minimized by the development of an interdisciplinary work that seek the integration between TDIC and teaching practices, called “Technoteaching”. Interdisciplinarity is understood as the integration between different types of knowledge, establishing the necessity of conceptual exchange between specialists by sharing knowledge, reflexions and joint discussions (JAPIASSU, 1976).
Researches in the field reveals that interdisciplinary work used on the TDICs context could help to promote a transformation in teaching practice. Amem and Nunes (2006) agree that the transformation is possible and also brings favorable contributions, since it allows the utilization of non-conventional learning methods, facilitating the information exchange, the interaction of users, and the integration between knowledges. Andalécio (2009) suggests that the changes promoted by TDICs, in the teaching practices with the collaborative constructions of the knowledge by exchanges that involve cultural aspects, are revolutionary.

In this sense, it is understood that the authorial production of learners, whether teachers or students, is fundamental for the appropriation of TDICs in their cognitive processes. Material Autoral Digital Educacional (MADE) [Digital Authorial Educational Materials] is defined as all and any educational material developed for a learner that utilizes a digital equipment connected or not to the internet with creation, planning, execution, reflection and evaluation developed by the learner himself or in groups, as process or product of teaching, learning and evaluation. Thus, the development of MADEs is linked to the utilization of resources available on internet, as well as resources available offline, so that teachers and students can benefit through the construction of new knowledge.

Therefore, the authors ask: How the development of MADEs in the interdisciplinary context influences the understanding of the undergraduates about teaching? Thereby, a methodological strategy focused on teaching, based on Theory of Meaningful Learning and Constructionism for the development of Materiais Autorais Digitais Educacionais (MADEs) [Digital Authorial Educational Materials] in interdisciplinary groups in the training of undergraduate students, proposed in the Technoteaching discipline offered in 2015 by UFC, is used.

The aim of this work is to analyze how the undergraduate students transform their understanding about teaching from the development of Materiais Autorais Digitais Educacionais (MADEs) [Digital Authorial Educational Materials] in the interdisciplinary context. The results of the research from the project IUVI01, registered in the Instituto Universidade Virtual [Virtual University Institute], evaluated and approved by the Research Committee in 2015, are presented, composing one of the works developed by Grupo de Pesquisa Tecnodocência [Technoteaching Research Group] registered in the directory of CNPQ, certified by UFC.

2 THE TDICS IN TEACHER TRAINING

The teacher training proposals that contemplate the integration between TDICs and the educational aspects are presented in diversified ways by research and policies of countries that consider the use of digital technology as a form of global, social and cultural communication. The introduction of the use of TDICs is linked to the professional development, and most of the times are planned as a continued teacher training. However, the TDICs could also be considered in their initial training.

The Unesco proposal (2002) is presented in four stages. Initially, developing the knowledge of teachers about technological aspects is needed. The performance of personal and professional tasks using internet resources and more common software such as text editors, spreadsheets and slides, helps the understanding of the possibilities related to the uses of digital technology. Then, it is necessary that the teacher learns how to apply the TDICs to improve the learning of his students and his own learning. The teacher becomes capable of recognize the technological functionalities, adapting them to the students' preferences by the development of projects and activities based in problem-solving.

The proposal suggests that the teachers should be part of the digital technological development of artefacts, because of their skills and knowledge. This means that the teachers should be included in the conception of the systems and integration of the context where the technological artefact will be applied, as well as in the definition of symbols that will be utilized. The mass application of these educational products does not reflect the conquered advances of pedagogical knowledge; the construction of a social identity is not supported when, in general, these questions are not considered by the digital technology developers. Thus, both students and teachers return to conditions of uncritical consumers of technologies practiced in the mid-twentieth century.

The second proposal suggested by Unesco (2002) consolidates the exclusion of teachers and students, reinforcing the uncritical condition in which utilizes the idea that the teacher is responsible for learn to apply the TDICs in the teaching context. However, this aspect is exemplified by digital technological artefacts characterized as work tools applicable to Education, and not by software developed to include contents. Therefore, the Unesco (2002) proposal does not suggest that the
developers propose contents that allows the construction of student knowledge in partnership with the teacher. Finally, it suggests that–the technological artefacts should be adapted to the students’ preferences, placing them in full and grounded domain of production. This aspect guarantees an authorial production of educational material conditioned by the needs of governability, the curriculums and school decisions, excluding the particular and subjective aspects of each students group and teachers. The example of the mobile phone wide use in the society and its exclusion of the school is really enlightening. In most Brazil schools, although the students and teachers utilize these tools in their everyday life, the use of mobile phones is not allowed to not spoil good progress in school. Situations like that does not support the proposal of the integration between TDICs and teaching, as well as the cultural development for the production of authorial materials closer to the life realities of students and teachers. Only after these two steps the teachers will be able to contemplate the pedagogical transformation. In this moment, teachers should learn to integrate the characteristics of digital technology with the didactic-pedagogical objectives facing a collaborative work based on the construction of knowledge. However, the appropriation of this attitude does not happen immediately. The results found should be shared, discussed, reflected in a collaborative form with their peers, colleagues and specialists, so that the changes are implemented and incorporated into the teaching practice (ALMEIDA; VALENTE, 2011). It is important to highlight that the knowledges from the TDICs should not be isolated, or even, considered special in relation to other knowledges necessaries to teaching. According to Almeida and Valente (2011), the study of the knowledge from the TDICs requires an even greater understanding of the disciplinary, pedagogical contents and the relations established between them. The teacher training is linked to spaces and times that creates conditions for the construction of computational knowledge; understanding of educational aspects related to the software utilized, of the different forms of integration between TDIC and curriculum; and understanding the different ways of achieving this process in teaching practice.

One aspect that is evident in the authors cited above is that the perspective suggested deals with processes of inclusion and use of the TDICs by the teachers, highlighting that these are not mobilized to rethink their practices in learning spaces based on integrations between TDICs and teaching. Therefore, it makes these digital technological artefacts adjusted to the current schooling practices with variations aesthetics, didactic and methodological, not contributing with deeper epistemological changes that involve, for example, the power-knowledge relations between students and teachers. In the dialogue proposed by these authors it is recognized that the direction of the transformation is oriented to the teacher, his own knowledge, and not to the necessary transformations related to the relations between students and teachers. Still, is necessary to reinforce the perspective fundamented by Coll (2009) that this approach based in the superficial transformations of the teachers is not enough to the consolidation of the integration between TDICs and teaching.

Considering that there is a potential recognized by the Intellectuality about the possibilities of integration between TDICs and teaching and, on the other hand, there is a perception that the phenomenon of the use of digital technologies by the teacher in the construction of his lectures is subject to a consolidated practice, it is believed that the changing point is the development of Materiais Autorais Digitais Educacionais (MADEs) [Digital Authorial Educational Materials], because it allows for students and teachers the possibility of applying their reflections and knowledges in the construction of products respecting their previous experiences, their contexts and their experiences. The MADE realized represents the end of a process that involved studies of context, systems, relations between the parts and other subjective aspects that help the formation of cooperatives groups of study and work.

According to Coll (2009), the perspective of the authorial development of artefacts mobilizes the change, what suggests that the non-participation of teachers and students in the conception and application of the artefact tends to do not provide significant changes in the teaching practice. The opposite, as stated above, perpetuates a consolidated practice.

The international vision for the use of TDICs in the teaching training it is not distinct of that sought in the Brazilian proposals. Studies realized in Quebec about the professional competences for the future teachers highlight that the appropriation of the TDICs for the planning, the conduction of classes, and the managing of learning are essential to the teaching practice. The teacher must know how to communicate utilizing the TDICs, as well as plan and teach with it, encouraging his students to use them to learn better. Corroborating with the presented ideas, the teachers should utilize the TDICs as
tools that promote their own learning. However, the studies highlight that the pedagogical integration between TDICs and teaching should happen diagonally (KARSENTI; VILLENEUVE; RABY, 2008).

The authors perceived that the focus implies a potential change in the teaching practices and do not simply incorporate teaching to a consolidated practice. This approach suggests the necessity of other changes in the context of institutions and spaces of teaching, learning and evaluation. However, the changes that become perceptible reach superficial levels and, in this case, are subjected to a kind of “frame” that does not transform into the institutional spaces. Therefore, the teacher achieves more superficial changes without being able to change the big structures that involves education, such as curricular forms and intentions.

When working in the TDICs context, this objective is reached when resources are provided, enabling the exploration, investigation and the discovery. The learning becomes effective through the construction of the knowledge, freedom of action and reflection from the mistakes done in the process. The feedbacks sent by the system in use, considered important to the learning process, are generated as function of choices and actions of the apprentice within the system. The computer should be utilized as a machine to be taught. Starting from their premises, the apprentice must insert his own set of ideas to obtain the answers of his own actions (VALENTE, 2002).

In contemporary times, when the use of machines is deeply linked to the communication, mainly when it is observed the students’ utilization of these digital technological artefacts, it is necessary to explain and evolve the argument of Valente (2002), once that is not necessary to teach the computer to search for any right answer or to perform any action, but to integrate this machine with ways to rescue or collect information. Thus, is necessary, in the human space, to consolidate answers and to raise new questions, among them confronting the own teacher with the information that he publishes in learning spaces.

That perspective significantly changes the relationship between authority and the ownership of the truth to the point that, in the beginning of the phenomena of increased information access in the early 90’s, and to this day, there is a movement of invalidating information as superficial when originated in the internet, suggesting that this information must be confronted with what the professor will use and that is, hypothetically, more profound and true.

Viseu and Ponte (2012), while studying the influence of the TDICs in the development of didactic knowledge of undergraduates in Mathematics and their reflexive capacity in the work experience period, perceive a possibility of development of self-evaluation about the practice and the amplification of knowledge by comparing themselves with their colleagues. Although they only utilized e-mail and forums as digital tools to discuss and exchange experiences, the results were satisfactory. The e-mail helped the subjects of the research to develop their capacity to reflect, allowing them to think before writing, different of what is done in a presentential discussion, and they also can confront their opinions with the opinions of other colleagues. The forum was considered beyond just a place of meeting colleagues and teachers, but mainly as a place to confront ideas, what provided discussions based on readings and focused in the experiences of teaching practice. According to the students, to rethink during the virtual discussions develops the capacity to question ideas.

Lima and Loureiro (2015) suggest that mobile devices can be used to contribute and positively influence the students’ actions in the learning process. Inspired in Papert (2008), they emphasize the importance of teaching and producing bigger and better levels of learning from a minimum level of teaching, fundamental the proposal of having the focus on the context and actions of authorial production. There is a possibility of greater appropriation of the processes and technological artefacts, as well of the transformation of gathered information in knowledge that students and teachers in fact appropriate.

However, the producers of technology for education are focused on valuing the products, such as software, on the artefacts that will be provided for the teachers, rather than the study and development of authorial products that could be integrated into their didactic-methodological actions.

The Banco Internacional de Objetos Educacionais (BIOE, 2016) [International Bank of Educational Objects] currently provides approximately 20.000 digital objects for the teacher to use in different levels, areas and teaching modalities. The teacher web portal (MEC, 2017), despite being an initiative to help the teacher with suggestions of classes, media support, news about education, governmental initiatives, interaction with other teachers and possibilities of continuing training, is still an underutilized resource in undergraduate training at UFC. Product development is not integrated with the context of educational institutions in loco, but these institutions are appendices that could be used or not by the
students of Basic education. The knowledge translated there were not part of its conception, development or application managing, what characterizes a non-authorial action, placing the students and teachers as consumers of these products and not in the condition of producers and authors of new knowledges (LIMA; LOUREIRO, 2017).

3 METHODOLOGY
This qualitative research utilizes as methodology a Case Study. This choice is justified by the fact we investigate a contemporary phenomenon, considering the real context of undergraduate students of the Universidade Federal do Ceará [Federal University of Ceará]; considering the non-requirement of control over behavioral events, valorizing the spontaneous expression of the thinking of investigated subjects; and of utilizing sources of direct evidence in the understanding of the phenomena studied (YIN, 2005).

The results of the research from the project IUVI01, registered in the Instituto Universidade Virtual [Virtual University Institute] evaluated and approved by the Research Committee in 2015, are presented, composing one of the work developed by the Grupo de Pesquisa Tecnodocência [Technoteaching Research Group] registered in the directory of CNPQ, certified by UFC. The unit of analysis is composed by five interdisciplinary groups of undergraduate students formed by a maximum of four participants, from different undergraduate courses of Universidade Federal do Ceará [Federal University of Ceará], who were participants in the Tecnodocência discipline offered with 32 vacancies in 2015, by the Pró-Reitoria de Graduação (ProGrad) [Undergrad Division Dean] with the support of IUVI. The site provided by ProGrad for the realization of the research is the Laboratório Interdisciplinar de Formação de Educadores (LIFE/UFC) [Interdisciplinary Laboratory of Teacher Training] on Fridays from 14h to 18h.

The class has twenty four (24) students, seventeen (17) men and seven (7) women. They are undergraduates of Biological Sciences, Physical Education, Philosophy, Physics, Geography, Letters, Mathematics, Music and Chemistry. The average age of the group is twenty five (25) years. Five (5) participants are in the beginning of the courses, seven (7) are in the middle of the course and twelve (12) are close to finish. All of them make use of computers and internet. Sixteen (16) prefer to use it at home, six (6) prefer to use it at the university and the others use at work. Twenty two (22) make use everyday and the other two (2) use three times a week. They navigate mainly through social media, websites about profession and work, academic works, games and entertainment.

The Technoteaching discipline has the purpose to train students who want to work as teachers facing the utilization of an interdisciplinary methodological proposal integrated to the TDICs, based on the theoretical-practical study of Ausubel’s Theory of Meaningful Learning (AUSUBEL; NOVAK; HANESIAN, 1980), the Flow Theory of Csikszentmihalyi (1990), the Philosophy of Difference focused on Foucault (1979), the interdisciplinary concepts highlighted by Japiassu (1976) and the proposal of utilization of the Digital Technologies in Teaching and Learning processes presented by Papert (2008). The discipline enables the valorization and utilization of the previous knowledges by the participants, the construction of the engagement and meaning of the concept of teaching, and the development of critical-reflexive thinking about teaching practices.

The research is subdivided in three stages: planning, data collection and analysis. The first stage involves the preparation of the strategies, protocols, instruments and the policy of data storage in the data collection, and the strategies, instruments and the ways of data storage in the data analysis. In addition, all the equipment for the development of MADEs are prepared.

In the stage two, the data is collected in three steps: investigation of undergraduates’ previous knowledge about teaching; investigation about how the undergraduates conceive, develop and propose the MADEs; and, investigation of posteriori knowledge presented by the undergraduates about teaching.

In the first step, the students fill an online questionnaire available in a web cloud containing information about the utilization of TDICs in their personal and university context, and their understandings about teaching.

In the second step initiates the discussions and theoretical understanding about the concepts of interdisciplinarity and MADE by seeking information and analysis of teaching practices. The interdisciplinary groups are formed and each one defines his own work theme, the contents involved and the objectives to be accomplished for the development of an interdisciplinary teaching work. The
group elaborates scripts for the development of MADEs, and executes the necessary actions for the implementation facing contents articulation.

In the third step, the previous answered questionnaires are presented to the students for the application of changes to the concepts previously defined about teaching. The instruments of data collection are, therefore, the questionnaire filled by the same student in the two steps of the data collection and the developmental scripts of MADEs.

Three protocols of data collection are utilized, subdivided on: the collection of previous knowledge by questionnaire, monitoring MADEs development, and the redefinition of the concept of teaching by reviewing the questionnaire previously filled. The aspects to be considered in the protocols are: presentation of general objectives of the research project, specific objectives of the collection, the description of the activities developed, the necessary questions to guide the work during the execution of activities, and a guide for the elaboration of the report of the case study.

The data analysis is performed by interpreting the discourses used explicitly by the interdisciplinary groups in the questionnaires and \textit{a posteriori} in comparison to the development script for the elaboration of MADEs. Therefore, a methodological triangulation is utilized, favoring the data comparison of distinct instruments of the research, in order to verify the convergences and divergences of the interpretations in a linear form (STAKE, 2010). The analysis is performed individually by each one of the researchers and, subsequently, the results obtained are discussed in weekly meetings to equalize the information, establishing an internal validation.

The data analysis is subdivided in three focal points: understanding the aspects related to interdisciplinarity; understanding the aspects related to the digital technologies; understanding the aspects related to the center of the teaching action. The first focus analyzes the following elements: how interdisciplinarity is understood and utilized by the groups; which are the difficulties of the groups while working in an interdisciplinary way in the development of MADEs. The second focus analyzes: which are the digital resources chosen by the groups for the development of MADEs and how they think about teaching in this process. The third focus analyzes: how the undergraduates guide the teaching action; how they propose the use of MADEs in teaching.

4 RESULTS AND DISCUSSION

The results are presented from the three (3) stages of the research facing the interpretation of the discourses utilized in the questionnaires and in the MADEs, followed by the interpretation and discussion focused on the theoretical reference used. The interdisciplinary groups studied are titled G1, G2, G3, G4 and G5 to avoid misuse in the language used in the text.

4.1 Previous Knowledge about Teaching

The survey questionnaire has thirty (30) questions. To analyze the concept of teaching two (2) questions are used: “What is teaching?” and “What is technoteaching?”

None of the groups cited the term interdisciplinarity in the definition of the concepts of teaching and technoteaching. The groups did not mention the fact that the teachers work together in teaching practice. The teaching action seems to be unique, specific of one teacher and of his knowledge area.

The necessity of the utilization of digital technologies was not explicit when defining teaching by none of the groups. However, when the groups were defining technoteaching, the digital technologies were present in all the answers. For most of the groups, the digital technologies can be used for the transmission of knowledge: "We can say that would be the use of technology to perform the task of teaching and give classes" (G2); in few situations, they think of the utilization of digital technologies for the construction of knowledge in a partnership with the student: "It is the action of helping the student to construct his knowledge supported by technologies" (G3). The center of the teaching action is linked to the figure of the teacher as owner of the knowledge. In a few situations, the center of the teaching action is linked to the student.

Facing a formative teaching process based on the fragmentation of knowledge and on an applicationist proposal of knowledge as affirmed by Tardif (2002), it is expected that the understanding of teaching by the undergraduates presents in an unilateral form, disconnected from other knowledges. However, the form of utilization of the TDICs in teaching reveals the way undergraduates think about teaching itself. According to Coll (2009), teachers who make use of expository theoretical teaching, will also do so when using TDICs in their teaching practice.
4.2 Development of MADEs and understanding about Teaching

MADEs were developed by the undergraduates, participants of the interdisciplinary groups. In total, five (5) MADEs were developed with particular characteristics to attend the interdisciplinary teaching work, considering each specific area of knowledge of the undergraduates. The G1 developed slide presentations with information about the Islamic culture with comic strips written in french, and explicative gifs about chemical elements of batteries and the energy released by bombs used in terrorist attacks. The G2 developed a presentation in Prezi about elements found in a mobile phone, such as chemical elements of the battery that could cause cancer, how those cancers can invade a human body, the songs that can be played on the device, and the link with literary elements. The G3 developed a slide presentation using parts of the film Matrix to explain the phototropism, the law of gravity and the hero's journey as a narrative. The G4 developed a slide presentation utilizing parts of the movie Ant-Man to explain Rutherford Atomic Theory, the cinema script as a textual genre, and the discussion about social issues presented in the movie. The G5 developed a slide presentation using images about Guernica from Pablo Picasso and war posters of Spanish Civil War to explain about the use of imperative mode in Spanish, as well as digital simulators to explain projectiles launching.

The utilization of a common theme for all groups assisted in the production of materials closer to the interdisciplinary concept. The proposals refer to the central theme and contribute to the exhibition of contextualization in the presentations. However, each slide was presented as a direct relation between the specific content of a certain knowledge area and the theme, and only few relations between different areas. The undergraduates had difficulties expliciting the connection and to develop a slide common to all the knowledge.

According to Japiassu (1976), the interdisciplinarity can be an advantageous propitious way to minimize the impact of knowledge fragmentation. Andalécio (2009) affirms that the insertion of the TDICs in the teaching context supports the process of the construction of collaborative knowledge by cultural exchanges. However, to experience this process in practice requires the engagement of the individuals involved and the work with the subjective power disputes that are immersed in a culture where small fiefdoms of knowledge are safeguarded. Therefore, it is understood by the authors that the time of experience must extrapolate the time proposed by a discipline and should permeate the entire whole formative process of undergraduates.

In all the groups the development of MADEs were based in the development of presentations. Only G2 and G5 utilized different proposals, using Prezi and a simulator, but with the same intention of presenting contents. It is important to highlight that the laboratory provides free access to tablets and internet by the undergraduates. Therefore, they could have chosen the utilization of online resources and mobile applications in the development of MADEs. The concern of the undergraduates was first to find a way to present the content for the students and then after develop other activities.

The center of the teaching action in all the groups is the teacher. The teacher should present the content, manage the information, prepare the class material, and conduct the actions of the student. In none of the MADE, the undergraduates started the process with an activity to be executed by the student, with search and construction of knowledge centered in the student action. Even if they had that intention, the activity was not incorporated into the MADE, as if this material were exclusive to the teacher.

Facing the proposal evidenced by Unesco (2002), the undergraduates are still in the early stages. It is evident that they are familiar with the internet and its possibilities of navigation, but they are still not able to connect digital resources to proposals of more daring educational materials that differ of the proposal of presenting-the content by slides. This aspect seems to be influenced by the methodology utilized in the proposal of teaching practice, corroborating with the reports of Loureiro, Lima and Soares (2014), when they perceived that the interest of teachers in the use of digital technologies, although destituted of methodological innovations.

4.3 Posteriori knowledge about teaching

The questionnaire a posteriori is composed by thirty (30) questions. Two (2) questions are utilized to analyze the concept of teaching: "What is teaching?" and "What is technoteaching?", the same ones utilized before in the survey questionnaire.

Again, none of the groups cited the term interdisciplinarity in the definition of the teaching concepts. However, some groups brought elements of the interdisciplinarity in the definition of the concept of technoteaching : "It is a new form of teacher learning, where the interdisciplinarity is common and
favorable to the integration of digital media" (G2); "tecnoteaching is the union of the technologies into the teaching, not in a mechanical manner, but in a planned manner and constructed collectively" (G5).

The concept of teaching seems to be more difficult to change, rooted since the basic education, than the modification of a new concept like tecnoteaching. According to Ausubel, Novak and Hanesian (1980), anchoring a new concept to one already existent in the cognitive structure of the learner makes the learning meaningful. To connect the undergraduates to new concepts such as technology, the student as the center of the teaching action, and the teacher as a learner, becomes more complex for a concept already structured and anchored to other antagonic precepts. The authors consider more difficult to remove anchors of concepts than create new concepts facing the existing ones.

Exactly as in the survey questionnaire, none of the groups explicit the necessity of the utilization of the digital technologies in the definitions of teaching. However, while defining tecnoteaching, the digital technologies were present in all the answers. For most groups (G1, G3, G4), the digital technologies can be utilized to transmit knowledge: "It is a way of spreading knowledge through technological resources that bring rapid, efficient and innovative benefits" (G1); in a few situations (G2 and G5), they think of their use for the construction of knowledge in partnership with the student: "Tecnoteaching is seeking to transform technologies into important tools in the construction of knowledge of the student, not simplistically, but to make the technology part of this process" (G5). The center of the teaching action is still linked to the figure of the teacher as a knowledge holder. In few situations, the center of action is linked to the figure of the student. However, in the questionnaire a posteriori the possibility of the teacher to become a learner in the tecnoteaching is visualized: "It is a new form of teacher learning, [...] everything is together in the sense of transforming education, making knowledge alive and applicable to the student's daily life" (G2).

Although the perspective of Coll (2009) is confirmed in the way how undergraduate think about the use of the TDICs in the teaching exactly the same of his teaching practice, it is possible to see an evolution of the groups who a differentiated thought about this use, also a differentiation in que quality of how they understand teaching. The organization of the strategies in the elaboration of MADEs and of the discussions about the teaching actions using the TDICs supported the development of the process of collaborative learning as defended by Almeida and Valente (2011), adding to this a differentiated understanding about teaching and the development of a new concept, the Tecnoteaching.

5 CONCLUSIONS

When faced with seeking the analysis of manners in which the UFC undergraduates transform their understanding about teaching from the development of MADEs in an interdisciplinary context in the tecnoteaching discipline offered in 2015, some important transformations were perceived in the relationship established between teaching, interdisciplinarity and TDICs.

Initially, participants presented a unilateral understanding about teaching, individually and exclusively based in the action of the teacher, excluding the digital technologies and the partnerships. In the development of MADEs, they had difficulty in articulating the knowledge of different areas and they focused mainly in the development of slides for presentation of contents centered in the teaching action. However, they revealed conceptual modifications only when dealing with the tecnoteaching concept, incorporating elements of interdisciplinarity, of digital technologies centered in the transmission of contents, but also in the construction of knowledge with the students. Although the center of the teaching action remained in the teacher, they brought the possibility of him becoming an apprentice in this process. Here it is possible to build a perspective that reveals the necessity of the integration of a deeper and horizontal discussion about theoretical models of knowledge construction, different from those being practiced, emphasizing the necessity of interdisciplinary interaction between different individuals, and the establishment of more horizontal cooperation between the actors involved with teaching, learning and evaluation.

Therefrom, the integration between the digital technologies of information and communication and the teaching requires a fundamentation that equalizes the differences between individuals and knowledges, teachers and students, and that consolidate an epistemological basis of interdisciplinary action that seems to fundament the pluralities involved in this process.

According to Lima (2014), the conceptual modifications, especially those already anchored to the cognitive structure of the learner, do not happen when facing new discussions at only one discipline. It is necessary to think and re-signify the formative process of undergraduates by all the individuals.
involved in the initial academic formation. Therefore, the data collected from this work and others raised by the Grupo de Pesquisa Tecnodocência [Technoteaching Research Group] seek to contribute to the provision of theoretical and empirical subsidies for reflections about the curriculum of undergraduate courses, especially in the context of the current discussions about the Bases Nacionais Curriculares (BNCC) [Curriculars National Basis] and the Extensionalization of the Curriculum.

The intention is to continue with the research about the development of MADEs and their influence in the understanding of the concept of teaching for the undergraduates of the UFC, deepening the study about teaching practice and the way that the undergraduates utilize the MADEs developed in contact with students of public school.

REFERENCES


