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Connections between the Pedagogical Project of an Undergraduate Course in Mathematics and the Content Technological and Pedagogical Knowledge[1]

Karla Jocelya Nonato[a,b]
Nielce Meneguelo Lobo da Costa[c,d]

[a] Universidade Anhanguera de São Paulo – UNIAN, Programa de Pós-Graduação em Educação Matemática: Formação de Professores, Currículo e História, São Paulo, SP, Brasil
[b] Universidade Federal de Mato Grosso do Sul, Campus do Pantanal, Corumbá, MS, Brasil.
[c] Universidade Anhanguera de São Paulo – UNIAN, Programa de Pós-Graduação em Educação Matemática, São Paulo, SP, Brasil
[d] Universidade Anhanguera de São Paulo – UNIAN, Programa de Pós-Graduação em Ensino de Ciências: Formação de Professores, Currículo e História, São Paulo, SP, Brasil

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ABSTRACT

Context: As Digital Information and Communication Technologies (DICT) evolve, they enable to implement innovations that reflect on social life, including school and its curricula, requiring various teachers' knowledge to act in the new educational scenarios. **Objective:** To identify the presence of DICT in the curriculum and the possibilities of integration in the future pedagogical practice of Undergraduate course students in Mathematics. **Design:** In order to answer the question of how the Course Pedagogical Project of the Course (PPC) is organized, in the face of current technological advances, a documental analysis, of an interpretative nature, was developed at the PPC of the Undergraduate Course in Mathematics of Federal University of Grande Dourados (UFGD), located in Dourados, Mato Grosso do Sul (MS), Brazil, deployed in 2017. **Data collection:** Syllabuses and bibliographies presented in PPC were analysed. **Results:** Choosing as categories those established in the project itself and interpreted in the light of the theoretical framework constituted by the TPACK (Technological Pedagogical Content Knowledge), Web curriculum and Mathematical Enculturation. The following were considered: the social context, the technologies integration into the curriculum and the new knowledge construction by

[1] This text was based on publication referring to the 2nd Stricto Sensu Kroton Research and Post-Graduate Seminar, 2020, and expansion of the Article “Graduate students in Mathematics at Federal University of Grande Dourados: Links between the Pedagogic Project and the Content Technological and Pedagogical Knowledge ”, with addition of data and discussions.

Corresponding author: Karla Jocelya Nonato. Email: karlanonato@yahoo.com.br

the graduation students. **Conclusions:** PPC prescribes a curriculum that, by being transformed into practiced curriculum, it can integrate the DICT and promote the construction of technological and pedagogical knowledge of the graduation students' content and the Web curriculum construction is seen in this process.
Key words: Curriculum; DICT; TPACK; Web curriculum; Mathematical Enculturation.

RESUMO

Contexto: à medida que as Tecnologias Digitais de Informação e Comunicação (TDIC) evoluem, essas possibilitam implementar inovações, que refletem na vida social, incluindo a escola e seus currículos, exigindo diversos conhecimentos dos professores para atuarem nos novos cenários educacionais. **Objetivo:** identificar a presença das TDIC no currículo e as possibilidades de integração, na futura prática pedagógica, de estudantes do Curso de Graduação em Matemática. **Design:** para responder à questão sobre como se organiza o Projeto Pedagógico do Curso (PPC), diante dos avanços tecnológicos atuais, foi desenvolvida uma análise documental, de cunho interpretativo, no PPC do Curso de Licenciatura em Matemática da Universidade Federal da Grande Dourados (UFGD), localizada em Dourados, Mato Grosso do Sul (MS), implantado em 2017. **Coleta de dados:** foram analisadas ementas e bibliografias apresentadas no PPC. **Resultados:** foram eleitas como categorias as estabelecidas no próprio projeto e interpretadas, sob a luz do referencial teórico, constituído pelo TPACK (Technological Pedagogical Content Knowledge – Conhecimento Tecnológico e Pedagógico do Conteúdo), Web Currículo e Enculturação Matemática. Foram considerados: o contexto social, a integração das tecnologias ao currículo e a construção de novos conhecimentos, por parte dos licenciandos. **Conclusões:** o PPC prescreve um currículo que, ao ser transformado em currículo praticado, pode integrar as TDIC e promover a construção de conhecimento tecnológico e pedagógico do conteúdo dos licenciandos e, neste processo, vislumbra-se a construção do Web Currículo.
Palavras-chave: Currículo; TDIC; TPACK; Web currículo; Enculturação Matemática.

INTRODUCTION

We live in the digital culture age, in which digital technologies, with their constant innovations, interfere in the ways of individuals to learn and represent their thinking, especially when we consider the possibilities made possible by mobile devices with access to the Internet and *the web 2*.0, which allow the development of innovative procedures, both individual and collective, for teaching and learning that lead to new forms of knowledge production (Nonato & Lobo da Costa, 2020).

Contemporary society has been rapidly adapting to the evolution of digital information and communication technologies (DICT), making them part of everyday life in the performance of different activities, as pointed out by Homa and Groenwald (2016). By focusing on educational activities, specifically in mathematical Education, these authors highlight the need to adapt to this society, seeking a new look regarding teaching and learning, because the DICT can assist the teacher in his or her work and bring about significant changes in Education.

As well as society, the DICT are constantly evolving, acting as destabilizing elements of people's behaviours and being able to promote “social and cultural transformations,” as pointed out by Almeida (2014, p. 20). These transformations are reflected in the ways of thinking and being in contemporary society, making new goals also established in the economic and educational field, affecting schools, students and teachers.

In schools, the DICT must help achieve these new educational goals and this implies the need for changes in various aspects, including the curricula. The curriculum is influenced in many ways, as is the teacher practice, who can extend the curriculum outside the spaces and times demarcated by the classroom, providing the integration of formal (technical) knowledge with the informal (daily) knowledge of the digital world. The transitions in the curricula, integrating technological resources, show “the emergence of web curricula” (Almeida, 2014, p. 22).

The current students of Basic Education are, in general, those born after 1995, called “digital natives,” integrating the English “generation Z”, “zap,” meaning “energy,” originating from “to zap,” that is, do something very fast. This generation is characterized by spontaneous connectivity with the virtual world (Prensky, 2010). Therefore, it is assumed that the DICT inspire them and are easily integrated into their daily lives. Prensky (2010) believes that, as they are born in a society characterized by the presence of digital technologies, our students have an altered learning profile in relation to previous generations, with different, faster brain structures, capable of carrying out more tasks at the same time than those performed by students of previous centuries.

However, the ease of dealing with the DICT, attribute of these students who use them intuitively, due to the “generational gap”, does not always correspond to the way in which most teachers perceive and use digital technologies, and in contrast, in the effect they cause in their brains (Prensky, 2010).

Here then comes a dilemma, which is to integrate the DICT into the teaching and learning processes of “Generation Z” students, the teachers need to develop knowledge, skills, attitudes, values and emotions to teach in an educational context that is new to them but familiar to their students. It has to do with It is C.H.A.V.E., a new group of competencies that helps, teachers and professionals in general, this era "to broaden understanding, awareness, application, and improvement of social and economic reality with a socio-critical vision 'through' and 'of' Technologies" (Schneider & Schneider, 2020, p. 55).

For the individual to build digital skills knowledge must be in "constant evolution and transformation" (Schneider & Schneider, 2020, p. 56), and must be able to learn throughout their lives. Of the teacher, technological knowledge is required at this moment, among other knowledge, and that they are able to link it to pedagogical knowledge and to the content knowledge (Mishra & Koehler, 2006).

This task, of building knowledge for teaching in the presence of technology, must be started in the teacher initial formation, that is, in the undergraduate degree, and a theoretical reference that has been shown to be expressive to define the wealth of such knowledge is the TPACK (Technological Pedagogical Content Knowledge), developed by Mishra and Koehler (2006).

As the graduation students experience technology integration experiences in their initial Education, they are expected to be able to develop similar actions in their professional practice after graduated. We understand that the Pedagogical Course Project (PPC) is part of the prescribed curriculum and in the course experience it becomes the curriculum practiced (Sacristán, 2000). Thus, we assume that one of the ways of establishing whether future teachers are experiencing the use of the DICT in the curriculum practiced is to investigate what the possibilities are of building knowledge (technological, pedagogical and content) made possible in the PPC of the Graduation in Mathematics and, also, the possibilities for the teacher trainers to integrate the DICT into the subjects by transforming the prescribed curriculum into practiced curriculum.

In this sense, we present in this Article partial results of a doctoral research, in which we analysed the PPC of the Graduation in Mathematics course of Federal University of Grande Dourados (UFGD), located in the city of Dourados, Mato Grosso do Sul (MS), in order to achieve the following objective: to identify the presence of the DICT in the curriculum and the possibilities for pedagogical practice in the course, that is, to provide indications for the actions of the teachers trainers.

Our inquiry is how does UFGD organize its Pedagogic Course Project before the technological advances? Thus, we seek to identify how the Undergraduate Degree in Mathematics integrates the DICT into the curriculum, before the digital culture and in order to build a web curriculum.

It is worth pointing out that, although UFGD is a new university in the state of Mato Grosso do Sul, the Graduation course in Mathematics is not, however it was restructured in 2017.

We will describe below the scenario in which UFGD is inserted and the context of the Undergraduate Degree course in Mathematics offered by UFGD.

DOURADOS, UFGD AND THE GRADUATION IN MATHEMATICS

Dourados was Agricultural Colony of Ponta Porã until 1923 and is now the second largest city in the State of Mato Grosso do Sul, being behind only the State capital, Campo Grande. Dourados is a city with unique characteristics in the State of Mato Grosso do Sul. It has a population of approximately 225,495[2] inhabitants, of which more than 17.000 are indigenous, being the largest indigenous reserve in the state. It is the main urban centre in the interior of the State of Mato Grosso do Sul. Located in the Central-South region of the State, the city is close to the border with Paraguay (121km) and the capital of the State, Campo Grande (220km), which gives it a privileged geographical position.

Dourados presents some unique economic characteristics for the State of Mato Grosso do Sul, such as the growth of the industry, however, just as in the other cities of the State, its economy is predominantly directed toward Agriculture & Livestock The municipality produces several grains, being the largest producer of maize[3] and there is also diversity in animal production, including even silkworm rearing. Even with the plurality of agriculture and Livestock, the food industry and the slaughterhouses have been emerging as a viable economic alternative in the municipality.

[2] https://cidades.ibge.gov.br/brasil/ms/dourados/panorama

[3] http://www.dourados.ms.gov.br/index.php/cidade-de-dourados/

Figure 1.

Image of the Map of Mato Grosso do Sul. Adapted from http://www.viagemdeferias.com/mapa/mato-grosso-do-sul/

Despite the force of the field, Dourados consolidated itself as “University City” in the South of the State, serving twelve (12) municipalities (Caarapó, Deodápolis, Douradina, Dourados, Fátima do Sul, Glória de Dourados, Itaporã, Jateí, Juti, Nova Alvorada do Sul, Rio Brilhante and Vicentina), which make up Grande Dourados (UFGD, 2017), five (05) of them (Caarapó, Douradina, Dourados, Itaporã and Juti) with indigenous villages, since Mato Grosso do Sul has one of the largest indigenous populations in

Brazil, with approximately 80,459[4] indigenous people, with villages also located in Dourados and Itaporã (neighbouring town at 17 km), of which approximately 25,000 are in the five (05) municipalities cited.

The main ethnic groups that form the indigenous population of MS are Guarani and Kaiowá, distributed in eighteen (18) municipalities: Amambai, Antônio João, Aral Moreira, Bela Vista, Caarapó, Coronel Sapucaia, Douradina, Dourados, Eldorado, Itaporã, Japorã, Juti, Lagura Caarapã, Maracaju, Paranhos, Ponta Porã, Sete Quedas and Tacuru (UFGD, 2012, p. 07). Of this population, 72% of the people are at school age and, according to the INEP/MEC School Census, there are approximately 486 indigenous teachers (UFGD, 2012), that is, approximately 1 indigenous teacher for every 120 students and many of them, have education in Pedagogy, with few being qualified at higher level in other degrees, to meet specific areas of knowledge.

Dourados was consolidated as "University City" for attending the twelve (12) municipalities that form Grande Dourados, already mentioned, and others from the States of MS and the country, reaching a contingent of approximately 25,000 students, distributed in 184[5] undergraduate courses. In addition to the students of the 51 Lato and Stricto Sensu post-graduate courses) in the face-to-face modality[6].

To meet the demand, Dourados has two private institutions of in-person higher education and three public institutions, namely: University Centre of Grande Dourados (UNIGRAN), Anhanguera College of Dourados, Federal Institute of Mato Grosso do Sul (IFMS), State University of Mato Grosso do Sul (UEMS) and Federal University of Grande Dourados (UFGD). UFGD offers undergraduate degree in Mathematics and the Intercultural Indigenous degree – Teko Arandu, with qualification in mathematics and other qualifications, in an attempt to meet the demand of the indigenous needs of the state. In addition, UEMS also offers Undergraduate Degree in Mathematics at Dourados University Unit, both in a face-to-face manner, one of the private

[4] https://www.secid.ms.gov.br/comunidades-indigenas-2/#:~:text=Em%20Mato%20Grosso%20do%20Sul,%2C%20Atikun%2C%20Ofai%C3%A9%20e%20Guat%C3%B3

[5] Site information https://www.douradosagora.com.br/noticias/cidades/dourados-tem-mais-de-25-mil-universitarios-mais-que-habitantes-de-59-municipios, de 2018. Access on 01/20/2021.

[6] According to information from the institutional sites, there are 38 courses at UFGD (with the internships), 11 at UMS and 02 of specialization at IFMS.

institutions, UNIGRAN, offers Undergraduate Degree in Mathematics in distance learning modality.

The Federal University of Mato Grosso do Sul (UFMS), which gave rise to UFGD, was established in Dourados in the decade of 1970, with the purpose of mainly meeting the demand of the rural population of the region. The State Law No. 2.972 of 1970 determined, among other things, “the creation of pedagogical Centres in the cities of Corumbá, Três Lagoas and Dourados; and the creation, in Dourados, of Agronomy course.” (UFGD, 2017, p. 3), at that time, the first to be deployed in the State in 1978.

In 2005, after student demonstrations and population support, UFGD was taken from UFMS, being constituted by Dourados Campus and the Experimental Nucleus of Agrarian Sciences. UFGD was created on July 29th, 2005, through Law No. 11.153, maintaining the courses already offered and, in 2006, began its expansion process, creating the courses of Chemistry, Food Engineering, Production Engineering, Zootechny, Social Sciences, Indigenous Graduation and Environmental Management degree. In 2009, more courses were created: Psychology, Nutrition, Economics, Physical Education, Performing Arts, Energy Engineering, Agricultural Engineering and International Relations. And in 2014, the courses of Civil Engineering, Mechanical Engineering, Architecture Engineering, Computer Engineering and Physics Graduation degree.

The undergraduate degree in mathematics was one of the UFGD courses from UFMS, and was started in 1984, in the morning period, when there was the “implementation of the Qualification in Mathematics, coming from the Short Graduation Course in Science” (UFGD, 2017, p. 7). In 1987, the course was offered in the Full Graduation modality and, after the creation of UFGD, it worked in two periods: morning and night.

As UFGD, the institution was restructured, extinguished the departments and created the colleges, printing a strong pace of expansion of the undergraduate courses. The Mathematics Graduation became part of the College of Exact Sciences and Technology (FACET). FACET began by offering the undergraduate degrees in Mathematics and Information Systems and then other courses, such as Chemistry, Physics and Engineering (Computer Engineering, Food Engineering, Production Engineering and Energy Engineering). In 2010, FACET was divided, with engineering courses giving rise to the Engineering College (FAEN).

Today, FACET is formed by undergraduate courses in: Mathematics, Chemistry, Physics, Information Systems and Computer Engineering. UFGD has also expanded the offer of courses at Post-Graduate level; FACET offers a master's degree in Environmental Science and Technology, Chemistry, Professional Mathematics Master (PROFMAT) and Professional National Masters in Physics Education, as well as a PhD in Environmental Science and Technology. The expansion of UFGD strengthened the title of "University City" to Dourados, which today attracts students not only from Grande Dourados region, but from all over Brazil.

From the context presented, we consider social and cultural diversity as one of the characteristics of UFGD students. In the case of Undergraduate Degree in Mathematics, the focus of this Article, the course is offered in different shifts, morning and night, which in itself attracts a distinct public. Thus, we assume that the course PPC should be thought to meet 1) social and cultural multiplicity, 2) current legislation and 3) the students' daily life, including the emergence of digital technologies.

CURRICULUM, WEB CURRICULUM, AND MATHEMATICAL ENCULTURATION

Nowadays we live the digital culture age and the DICT are used as a form of expression, as a language and not only as a tool. They are "structuring the ways of expressing the thought and curriculum that develops mediatized by them." (Almeida, 2014, p. 25).

The curriculum only acquires educational form and meaning from the moment it passes through transformations in practical activities (Sacristán, 2000). The process of curriculum development, according to Sacristán (2000, p. 105), it goes through six phases (prescribed curriculum, curriculum presented to the teachers, curriculum modelled by the teachers, curriculum in action, curriculum performed, and curriculum evaluated), of which we discussed two: the prescribed curriculum and the curriculum practiced.

Every education system has a prescribed curriculum, which is the "consequence of the inexorable regulations to which it is submitted," it guides "what its content must be, especially in relation to compulsory schooling." (Sacristán, 2000, p. 104). We understand that PPC is our prescribed curriculum, as it guides professors with the content in relation to each school period of the course.

The curriculum practiced or "curriculum in action" consists of the real practice of the classroom and "is realized in the academic tasks" (SACRISTÁN 2000, p. 105) which will meet the needs of the graduation students as citizens of the digital age.

Practicing a curriculum integrating the DICT, which they have mastered, results in the construction of new cognitive skills, which are different from those mobilized in the resolution of a simple addition, requires teachers and students to master the technological resources to employ them in the teaching and learning processes, and thus, this contributes to the process. Whereas this curriculum is built, we see a web curriculum (Almeida, 2014, p. 27).

The web curriculum is a curriculum transformed with the integration of DICT and our understanding of what comes to be curriculum goes beyond the simple political selection of convenient content, of behaviour which is essential - from rules indicated in official documents - and which are drawn up at a certain historical moment. We consider that the curriculum exceeds what is pre-determined for each course, since when it becomes a curriculum practiced or accomplished, fulfilled in the school environment, it must be in incessant construction/reconstruction, undergoing transformation, to meet the demands of the students and the school community.

The transformation required by the web curriculum integrates the DICT into teaching and learning processes requiring the teachers to possess, among others, technological knowledge (TK) and be skilled in linking it to the pedagogical knowledge of content (PCK) (Mishra & Koehler, 2006). It is possible and necessary that the knowledge for teaching, in the presence of digital technologies, be built in the undergraduate degree. To discuss the knowledge mobilized by the teachers during the integration of digital technologies into their classes, we will use the theoretical framework TPACK (Technological Pedagogical Content Knowledge), elaborated by Mishra and Koehler (2006), as it has been shown relevant to establish this essential framework for the teacher (Nonato & Lobo da Costa, 2020a).

It remains for the teacher to appropriate knowledge that goes beyond the specific contents that he or she teaches, in the case of mathematics, and to develop new knowledge to deal with the challenges presented to exercise the pedagogical practice with the DICT, faced with a generation familiar with digital technologies and without too many difficulties in learning how to deal with the news they present daily.

Mathematics, as well as any other subjects, has its specificities, a structure of its own organization, a way of recognizing proofs and evidences, the teacher, in addition to the content, needs to know the appropriate pedagogical strategies for teaching and the resources available for the approach of different themes, among them the DICT. Thus, the knowledge that the teachers possess influences what and how they plan, decide and do in the classroom, reflecting what the students learn (Nonato & Lobo da Costa, 2020a).

These dimensions are influenced by the contextual realities (cultural, for example) that are in constant transformation (for example, DICT) and should be articulated to the teaching and learning processes. Everyday life is full of cultural knowledge, which must be reorganized in the learning process.

In short, the "generation Z" is impregnated by the culture of technology (Passero; Engster, & Dazzi, 2016) and when the teacher uses the daily practices of these students in their classes, it reveals the importance of adding cultural values to the mathematical knowledge (formal). Still in the learning process, the student must recognize the cultural values of mathematics, also thinking of identified social groups, and for this it is necessary to present to them sources of other cultures, material and sufficient means to investigate (Bishop, 1988). Considering the technological innovations present in our daily life, at the disposal of society bringing information constantly, we assume that the programmatic contents of the initial Education courses of mathematics teachers should allow the students to build knowledge and experience experiences integrating technologies in the context of the teaching and learning processes of mathematics, based on the informal knowledge presented by them.

In the next section, we present the research trajectory.

RESEARCH TRAJECTORY

The methodological approach of a research is not a choice of the researcher, but a decision thought out and taken from the questions and objectives, which define the trajectory. In this sense, this research was designed in the qualitative approach, with the interest in the process of the graduation students' formation in mathematics. The data collected were in the form of words, expressed in the official documents of the Graduation course, which, according to Bogdan and Biklen (1997), are some of the characteristics of qualitative research. We used the documental analysis of an interpretative nature in the data.

We are based in Bogdan and Biklen (1997), for which qualitative research allows the researcher to take new paths, without giving up rigor and consistency. Therefore, we elaborate the procedures and analysis strategies, within the range of interlinked interpretative practices, to enable the PPC to be understood in its own context.

To answer the question, we analysed the documents that are publicly available on the institution's website, because we regard them as a genuine source of data, as Cellard explains (2008) and interpreted them according to Severino's guidelines (2007), that is, by reading between the lines, as if we established a dialog with the authors of the PPC.

The data were collected from public documents made available on the UFGD website, on the page for the Graduation Degree Graduate Course in Mathematics (https://portal.ufgd.edu.br/cursos/matematica/index). The documents gathered were Resolution UFGD number 35/2017, which approves the Pedagogical Project of the Graduation course in Mathematics and Resolution UFGD number 53/2010, which presents the General Rules of the Undergraduate Courses of UFGD.

PPC is considered by the researchers and by the institution itself as a document of the course, which, according to Cellard (2008), inserts the research into the documentary analysis. We emphasize that we also consider PPC as a curricular document, considering its characteristics syllabus, bibliography, methodology, evaluation, etc.

The written document is an inexhaustible source of data that has not received treatment yet, so we chose to perform the interpretative analysis of the documentary data, adopting a position of respect for the ideas presented, overcoming the message of the document as if we were talking with the teachers trainers, authors of the PPC (Severino, 2007).

The structure of the analysis was as follows: We started with the textual part of the PPC, where the following items are included: Initial Considerations; Introduction, with the history of UFGD, UFMS, Dourados Campus at UFMS, the creation of UFGD, the Mathematics Course at UFMS and UFGD; course identification; course design; evolution of the PPC; Summary of the methodologies used in the curricular structure construction and Legal Basis. It continues with the abstract on the Academic Administration (course coordination, the coordinator activities and formation, Permanent Committee of Support for Coordination and Structuring Teacher Nucleus), Objectives and the desired Profile of the Entrant student.

Following, in the sequence of PCC, are described: the Core of components common to the University; Core of components common to the Formation Area; Core of specific components of the Formation Area and Specific Academic Activities; followed by the curricular matrix.

In the analysis of the curricular matrix, considering the objective and the question of research, for data organization, we used the categories established in the Pedagogical Project itself of the course, namely Core of components common to the University; Core of components common to the Formation Area; Core of specific components of the Formation Area and Specific Academic Activities. Such categories were interpreted in the light of the theoretical framework of TPACK, Web Curriculum and Mathematical Enculturation.

Following the order placed in PPC, we finalized the analysis explaining on the "Learning Evaluation", the teaching staff, the technical-administrative and physical facilities such as library and laboratories. Exposed the research trajectory, in the next section we explored in details the PPC of the Graduation in Mathematics of the Federal University of Grande Dourados.

PEDAGOGICAL PROJECT OF THE GRADUATION COURSE IN MATHEMATICS

The PPC of Graduation in Mathematics, analysed here, was implanted in 2017 through Resolution UFGD number 35/2017. In addition to the general norms, it is in accordance with Article 24 of the General Regulations of the Undergraduate Degree Courses of UFGD (Resolution UFGD number 53/2010), which defines the curricular structure of the courses and divides them into: "core of components common to the University; core of components Common to the Formation Area; Core of specific components of the Formation Area and specific academic activities. (UFGD, 2017, p. 16).

PPC presents a brief history on the creation of UFGD, emphasizing that it was dismembered in 2005 by UFMS and including the history of this University. Then it justifies the need to offer the Undergraduate Degree in Mathematics in Grande Dourados region, which is lacking in Mathematics teachers, motivating the offer in two periods (morning and night) and that the labour market requires a professional which dominates the mathematical contents, learn to employ teaching methodologies properly and "must master these new technologies and employ them in classroom education to promote integrated education in our society." (UFGD, 2017, p. 6), in addition to being able to keep up-to-date, be creative, competent and critical.

The sub-item Social need of the course is the only passage in which the document addresses the regional context, indicating in a brief way the existence of the indigenous population in the region, which validates the insertion of the subject "Interculturality and Ethnic-racial Relations" attending the Resolution CNE/CP number 02/2015, recognizing and valuing ethnic-racial diversity[7] (Brazil, 2015).

PPC presents the objective of the course as to train teachers to serve the labour market, who dominate the mathematical contents, acting in a "competent way in the didactic action" by making use of teaching methodologies appropriate to the "sociocultural environments" and the "new technologies, in order to promote integrative education." (UFGD, 2017, p. 14).

Based on the establishment of this objective, in the profile section of the entrant student, the document highlights that it must be an "agent of social transformation," able to "use teaching and learning of mathematics as an instrument of social integration, inserting the citizen into an increasingly complex and computerized society." (UFGD, 2017, p. 14), being able to "analyse, judge and elaborate teaching materials adapted to the varied educational contexts and teaching conditions including the use of new technologies." (UFGD, 2017, p. 15).

After the textual part of PPC, composed by fourteen (14) pages, the course curricular matrix is presented, divided into component nuclei. Namely: Core of components common to the University; Core of components common to the Formation Area; Core of specific components of the Formation Area and Specific Academic Activities.

The first is the "Core of components common to the University", composed of fifteen (15) subjects, all with 72 hours of workload, namely: Healthy eating; Artistic appreciation in Contemporary; Science and Everyday life; Knowledge and Technologies; Body, Health and Sexuality; Human Rights, Citizenship and Diversity; Regional economies, Arrangements, Products and Markets; Education, Society and Citizenship; Territory and Borders; Ethics and

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[7] Article 5 To assure the common national base and to provide the entrant student (...): VIII - the consolidation of inclusive education through respect for differences, recognizing and valuing ethnic-racial, gender, sexual, religious, generational diversity, among others.

Knowledge paradigms; Interculturality and ethnic-racial Relations; Languages, Logic and Discourse; Society, Environment and Sustainability; Sustainability in Food and Energy Production; and Information and Communication Technologies. Of these, each college offers two to four subjects, as an optional subject, the graduation student must choose two (02) to attend.

The fifteen (15) subjects present basic and complementary bibliography to be defined by the teachers lecturing the same. In this list, we identify that the subjects "Knowledge and Technology" and "Information and Communication Technologies" address the DICT. The subjects of the "Core of components common to the University" are focused especially on promoting interdisciplinarity in the curriculum and can be addressed by any student at UFGD. In case the graduation student chooses to address them, he or she will have the possibility to build part of the technological knowledge.

It is worth noting that the subject "Interculturality and Ethnic-racial Relations", which is an integral part of this nucleus, proposes discussions on racial issues, both "Afro-Brazilian" and Indigenous issues in the context of Mato Grosso do Sul. If the graduation student chooses to take part in it, he or she will have the possibility of knowing a little of the indigenous culture, so close to it, and if he or she encounters an indigenous student in non-indigenous or indigenous schools he or she will have the possibility of being a teacher with the bias of the mathematical enculturation

The next one described in PPP is the "nucleus of components common to the formation area ", also with offer from FACET, covering four (04) subjects of 72 hours each, related to teacher Education in the area of exact Sciences, namely: Linear Algebra and Analytical Geometry; Introduction to Calculation; Differential and integral Calculation I and Probability and Statistics. The four subjects are mandatory to the graduation student in Mathematics. None of the subjects of this common core of PPC makes mention in their syllabuses or bibliographies of the use of DICT, are focused on the content knowledge.

In PPC, the "core of specific components of the Education area" is divided into two groups: Basic Education subjects and teaching Education subjects. The basic Education subjects cover the various fields of mathematics; they provide the basis for the graduation degree to build the content knowledge, together with the core subjects of components common to the formation area. The subjects of "pedagogical formation provide the future teacher with skills to work in teaching mathematics" (UFGD, 2017, p. 16) in Basic Education, in addition to the already traditional subjects of pedagogical character, such as Psychology of Development and Learning, Didactic, Teaching Structure, Brazilian Sign Language, Special Education and Practices as a Curriculum component. In this Core, the pedagogical knowledge, pedagogical content, the content technological and perhaps the TPACK can be built.

Most of the course subjects make up this core, due to the range of possibilities of methodologies, if the technologies are used in an integrated way, that is, they are used in a way articulated to the curriculum and daily life of the classroom (Patriarca, Lobo da Costa, & Kfouri da Silva, 2019), there is the possibility of building the web curriculum, when it provides the construction of new cognitive skills different from those mobilized, without the use of the DICT. The subjects that form this core were organized in Table 1:

Table 1.

Subjects of the Core of specific components of the formation area (Nonato & Lobo da Costa, 2020, p. 5-6)

Dimension	Subject	Workload in PCCC	Workload
Pedagogical	Science and Culture in Mathematics Education	-	72
	Special Education	-	72
	Human Rights Education	-	72
	Didactic Fundamentals	-	72
	Mathematics History for the Mathematics Teaching	36	72
	Informatics for Mathematical Education	36	72
	Brazilian Sign Language	18	72
	Politics and Educational Management	-	72
	Development and Learning Psychology	-	72
	Teaching Practice I, II, III, IV and V	72	72
	Projects and Research in Teaching and Education	36	72
Basics	Linear Algebra	-	72

Elementary Algebra	-	72
Mathematical Analysis I and II	-	72
Arithmetic	-	72
Calculus II	-	72
Calculation of Various Variables	-	72
Vector Calculus and Differential Equations	-	72
Geometrical Constructions	-	72
Algebraic Structures	-	72
Physics I	-	72
Mathematics Foundations I, II and III	-	72
Plane Geometry and Spatial Geometry	-	72
Discrete Mathematics	-	72

In the syllabuses of the subjects of the “Core of specific components of the formation area”, we identify the explicit indication that teachers should “use computational resources” in the following subjects: Geometric Constructions, Flat Geometry and Spatial Geometry. However, in their bibliographies there are no sources indicating how the resources will be used. We emphasize that the pieces of equipment, access to the Internet or the presence in PPC do not guarantee the insertion of the DICT and its integration into the curriculum, as indicated by research results by Almeida and Assis (2011), by Bittar (2010), among others. However, the infrastructure supporting the use of DICT in education, as well as the indication of this use in PPC are essential to enable both the insertion and integration of DICT into the educational process.

As for the formation group in the pedagogical dimension, we observed that the teaching practice subjects I, II, III, IV and V have similar syllabuses and bibliographies, but for distinct mathematical contents. This leads us to infer that they seek to develop autonomy in the graduation student so that, as a teacher, they define the most appropriate methodologies for teaching each content and class, including the definition of which technological resources should be used. The DICT are included in both the syllabuses and in the bibliographies of the five (05) Teaching Practices of the course. According to the syllabuses, we see the possibility for the graduation student to build the TPACK, since there is clearly concern about the pedagogical, content and technological knowledge.

PPC includes “Specific Academic Activities” composed of the subjects: Complementary activities, Supervised Internships of Teaching and Final Paper, which were disregarded in this analysis because they do not present syllabuses and/or bibliographies, which, in our view, makes it impossible to identify the characteristics under research.

After the curricular matrix, PPC presents the “Learning evaluation system”, where it transcribes the chapter II, from Article 142 to Article 150, of UFGD Resolution number 53/2010. We highlight the articles 146 and 147, which explain the type of evaluation instrument used by the teacher. According to the PCC established, the instruments should “consider the objectives proposed in the education plan” (article 146), in addition, “the evaluations should cover the competencies, skills and content developed” (article 147). The matrix analysis indicates the preservation of the teacher's autonomy regarding the choice of evaluation instruments and the establishment of criteria, provided they are included in the education plan and are disclosed to the students.

Finally, PPC presents the faculty, the technical-administrative and describes the physical facilities, such as library and laboratories. The course has twenty (20) teachers, of which two (02) have major in Physics and the others in Mathematics. The table with information about the teachers is incomplete, in view of what was presented; we observed that 50% of the teachers are doctors, which can be considered a low number. Of the teachers with PhD, 60% are in mathematics, 30% in related areas and 10% in education (teacher with major in Physics). Regarding Mathematical Education, the course has only one (01) teacher, and his or her major is master’s degree. Because it is a Graduation degree, and considering the timetable foreseen for practice as a Curricular Component and Supervised Internships, we understand that the teaching staff needs teachers with Education in the Education and/or Mathematics Education area.

In relation to the technical-administrative staff, the PPC states “the course has two technicians in Informatics” (UFGD, 2017, p. 61), what leads us to question: are they also responsible for the administrative part of the course?

The Central Library of UFGD serves its students and students from the State University of Mato Grosso do Sul (UEMS) for loans and is open to the community in general for consultation. It is computerized, offers books, journals and space for individual and collective studies. It has a room with twenty computers with access to the Capes Portal and the library loan system. There is no information on the bibliographic collection for undergraduate degree in mathematics, making it impossible a further analysis.

The Mathematics Undergraduate Support Infrastructure consists of Mathematics Course Projection Room, Mathematics Teaching Laboratory I (LEM I), Mathematics Teaching Laboratory II (LEM II) and Mathematics Computing Laboratory (LIM). Located at FACET, each room has distinct objectives and pieces of equipment.

The Mathematics Course Projection Room is equipped with a TV, DVD and home theatre. LEM I has a digital recorder and a portable video camera, its objective is to "provide a favourable environment for activities aimed at the educational practices necessary for the formation of a mathematics teacher", LEM II does not have any materials yet and is designed to work as "a workshop for building educational materials". LIM is equipped with 30 computers, networked and with internet; its objective is to "provide students with the Mathematics course knowledge on the use of computers and software intended for the use of mathematics teachers in Elementary and High School Education." (UFGD, 2017, pp. 63-64).

Each of these rooms, intended for support infrastructure, is $36m^2$. This space holds approximately 30 students. Considering the average number of students in mathematics courses, we believe that the institution offers sufficient physical accommodation for its students. The document analysis indicates that LIM is equipped to provide the integration of DICT as requested by the teachers' trainers.

From the analyses we present the final considerations.

FINAL CONSIDERATIONS

The labour market requires new cognitive skills from the teacher, given the characteristics presented by "Generation Z" students. The teacher needs to be able to form himself or herself in action, exploring the DICT in his or her own learning (Almeida, 2014) and in the teaching processes of mathematics he or she undertakes. It is essential for the teacher to construct, still in the undergraduate degree, technological knowledge, pedagogical knowledge and content knowledge (mathematical), in addition, he or he must be able to make the connections between them, considering also the contexts in which the educational process occurs, until reaching the TPACK.

Considering the issue of the educational context, we have found that UDGD has a specific asset, which is its characteristic of diversity by the attention of the cultural groups that surround Grande Dourados, particularly that of the indigenous people. The Indians, as well as all cultural groups, develop intrinsic forms of languages, beliefs and ideas, thus we can agree that they also develop their own mathematics (Bishop, 1988), implying the need for curricular proposals that recognize the school and non-school mathematical knowledge.

PPC mentions the concern to address the "diverse socio-cultural environments" in its objectives, but the only subject that deals with the theme is in the list of optional subjects. Before presenting the syllabus, the PPC mentions that "Education of ethnic-racial relations and Afro-Brazilian and indigenous history and culture" will be contemplated at the Supervised Curricular Internship, which is a subject of mandatory nature. The proposal is to develop teaching-oriented activities; however, there are no indications on the promotion of articulation between theory and practice, in order to support the development of practice.

We consider that, despite the latent need of the region to train mathematical enculturating teachers, who value the culture of indigenous ethnic groups, integrating the DICT into the Mathematics curriculum, we have not found in the PPC of Graduation in mathematics indications that this occurs in fact. In the analysis, we started from the assumption that the absence of discussion of the indigenous context in the course under analysis was performed by UFGD to offer a course of Intercultural Indian Graduation degree – *Teko Arandu*, with qualification in mathematics, among others. Since the PPC establishes that the graduation student can study optional subjects in other courses of the institution, the Intercultural Graduation could be an option, but when we analyse the pedagogical Project, we observe that the public is specific and composed of teachers who work in indigenous schools, with a model of alternation, and there is no possibility of accepting Graduation Degree Graduates in Mathematics to course optional subjects.

The PPC analysed show, from the first pages, the concern to train the teacher for the labour market and for the use of the DICT, however in the prescribed curriculum, the basic and complementary syllabuses and bibliographies do not reflect the importance of preparing a teacher who dominates the new technologies, for we see that its use is explained in a few of them, in the case of subjects of the pedagogical dimension and those related to Geometries.

The curriculum holds the stigma of improving Education, because the quality of teaching is related to content and forms, and, sceptical about the prospect of profound changes in educational systems “we have discovered the importance of more subtle action mechanisms that shape practice.” (Sacristán, 2000, p. 9), present in some subjects of the course.

The subject of Informatics in Mathematical Education aims to discuss the “use and analysis of software for teaching mathematics” and the “principal actions of the teacher for promoting the students’ mathematical learning through the use of technologies”, but, when analysing the PPC, we could see that the course discusses the integration of the DICT into the teaching of mathematics, but it does not do so in the subjects of mathematical knowledge, except for Geometries.

PPC establishes that the course is prepared for the insertion of digital technologies in its curriculum, since there are laboratories equipped with computers and internet access available only for the mathematics course, as well as technicians for eventual unforeseen events. The insertion or integration of digital technologies into the curriculum does not depend only on the availability of resources or prescription in the curriculum, but on their effective use in teaching and learning processes.

Upon making use of the DTICs in the teaching and learning processes, transforming the curriculum and providing experience of integrating the DTICs during the course of the education of the graduation student, the greater are the chances for the graduation student to build the pedagogical, content and technological knowledge, consequently, they will be able to build the pedagogical content knowledge, the technological content and the Technological Pedagogical Content Knowledge (TPACK).

We have concluded PPC prescribes a curriculum that, by being transformed into practiced curriculum, it can integrate the DICT and promote the construction of technological and pedagogical knowledge of the graduation students’ content and, in this process, the Web curriculum construction is seen. The possibilities are more evident in teaching subjects and Geometries.

STATEMENT OF THE AUTHORS' CONTRIBUTION

The two authors participated actively in the writing and discussion of the results, as well as reviewing and approving the final text version.

STATEMENT OF DATA AVAILABILITY

Data sharing is not applicable to this Article, because the data are public and have been accessed when creating the corpus of data in this study.

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