Electronic Didactic Sequences as Teaching Assistance in the Process of Teaching and Learning in Higher Education in Brazil and Portugal

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ABSTRACT

Searching for an active form of student learning using electronic didactic sequences with metacognitive tools can help them become increasingly self-regulating and facilitate the occurrence of meaningful learning. In this context, this article presents the results of our thesis research that aimed to investigate the possible contributions of electronic didactic sequences with metacognitive tools, using Digital Technologies in the academic performance and meaningful learning of students of Higher Education in Brazil and Portugal. The type of research was case study, involving situations of study of multiple cases. A total of 156 students from two universities, a private Brazilian university and a Portuguese public university participated in the study. The students participated in the research in different ways, according to their presence in the classes and participation in the activities. The data collected for analysis were: class mapping questionnaires, previous knowledge assessment, students' participation in activities, evidence notes, conceptual maps and questionnaires of reflexive activity. The data analysis of the questionnaires was based on descriptive statistics, the evaluation of the academic performance was based on the notes, and the conceptual maps were categorized. We observed that these sequences increase the students' study time, since they do not have the habit of studying many hours during the week. The results suggest an improvement in the academic performance, since the students who passed through the activities had a good income in the evaluations.

Keywords: Digital technologies. Higher education. Meaningful Learning. Following teaching.

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Sequências Didáticas Eletrônicas para Auxiliar no Processo do Ensino e Aprendizagem no Ensino Superior do Brasil e Portugal

RESUMO

Buscar uma forma ativa de aprendizado por parte dos estudantes, utilizando sequências didáticas eletrônicas com ferramentas metacognitivas pode auxiliá-los a se tornarem cada vez mais autorreguladores e facilitar a ocorrência da aprendizagem significativa. Neste contexto, este artigo traz um recorte de uma tese que teve como objetivo investigar as possíveis contribuições de sequências didáticas eletrônicas com ferramentas metacognitivas, utilizando as Tecnologias Digitais no desempenho acadêmico e na aprendizagem significativa de alunos do Ensino Superior do Brasil e Portugal. O tipo de pesquisa foi o estudo de caso, envolvendo situações de estudo de múltiplos casos. Participaram da pesquisa 156 estudantes de duas universidades, uma universidade privada brasileira e uma universidade pública portuguesa. Os alunos participaram da pesquisa de formas distintas, conforme suas presenças nas aulas e participações nas atividades. Os dados coletados para análise foram: questionários de mapeamento das turmas, avaliação prévia de conhecimentos, participação dos alunos nas atividades, notas das provas, mapas conceituais e questionários da atividade reflexiva. A análise dos dados dos questionários foi baseada na estatística descritiva, a avaliação do desempenho acadêmico foi baseada nas notas, e os mapas conceituais foram categorizados. Percebemos que essas sequências aumentam o tempo de estudo dos alunos, uma vez que estes não têm o hábito de estudar muitas horas durante a semana. Os resultados sugerem uma melhora no desempenho acadêmico, uma vez que os alunos que passaram integralmente pelas atividades tiveram um bom rendimento nas avaliações.

Palavras-chave: Tecnologias digitais. Ensino Superior. Aprendizagem Significativa. Sequência Didática.

INTRODUCTION

Digital Technologies are tools that can meet the needs of flexibility and adequacy of the teaching and learning process, being versatile and powerful, and providing for a wide range of purposes (Silva, 2010; Cordenonzi et al., 2013).

In a knowledge-building configuration, technologies become tools that help students access, exchange, and share information (Warren, Dondlinger & Barab, 2008). Thus, the use of Digital Technologies can improve traditional forms of teaching and expose students to new and different forms of learning (Strachan & Aljabali, 2015).

Higher education institutions are trying to harness the potential of Digital Technologies to improve and transform education (Battro & Fisher, 2012). There are many examples that indicate how universities can incorporate technologies into their educational offer, aiming at learning (Al-Zahrani, 2015; Costa, Almeida, & Lopes 2016; Han & Shin, 2016).

Thus, this article brings the results of a doctoral thesis that sought to answer the following research problem: how the use of electronic didactic sequences with metacognitive tools based on Digital Technologies can contribute to improve the academic performance and meaningful learning of students of the Higher Education of Brazil and Portugal? To help answer the research problem, the general objective was to investigate

the possible contributions of electronic didactic sequences with metacognitive tools, using Digital Technologies in the academic performance and significant learning of Higher Education students in Brazil and Portugal.

Faber, Luyten and Visscher (2017) comment that it is important to study how digital learning tools contribute to the improvement of the teaching and learning process, since the use of these tools is growing rapidly in education.

THEORETICAL REFERENCE

Today's universities are increasingly occupied by Generation Y students, who have different learning styles that can only be involved in the classroom through modern teaching strategies and learning spaces (Stenberg, 2012). Given these data, higher education institutions are being challenged to adopt innovative educational practices that will increase students' learning and success, particularly in the areas of science and mathematics (Spellings, 2006).

Thus, with the use of technology, it is observed that the role of the teacher gains a new meaning: precisely to create conditions for students to engage in learning activities (Costa & Lopes, 2016). From this, Jacondino, Silveira, Martins and Coimbra (2015) point out that the proposals of the new educational model for undergraduate courses intend to overcome the previous model, focused on the transmission of information and on the verticality of the teacher-student relationship, and seek to transcend the traditional and technical knowledge through the use of active learning methodologies.

In active methodologies, the student also acts in the teaching and learning process, which is based on the principle of autonomy (Miter et al., 2008). Lévy (2009) emphasizes the importance of providing pedagogical solutions that aim to increase the efforts of teachers using resources based on Digital Technologies such as audiovisual and multimedia.

The conceptions of public policies in Brazil in relation to Higher Education respect Law No. 9.394 / 96, Directives and Bases of Education (LDB), which provided greater flexibility in the educational system, expanding and legislating Higher Education in the country. Thus, Higher Education aims to encourage the work of research and scientific research, aiming at the development of science and technology; and stimulate cultural creation and development of the scientific spirit and reflective thinking (Brazil, 1996).

In Higher Education in Portugal, the orientation discourse for the quality of education and its reforms developed mainly from the institutionalization of the Bologna Declaration (Leite & Ramos, 2014), which took place on June 19, 1999.

In their studies, Leite and Ramos (2012) explain that, in relation to the pedagogical-didactic factor, the discourse of the Bologna Declaration is marked by the paradigm that conceives the student as an active subject of the teaching and learning process, which presents new requirements pedagogical work of teachers. Thus, teachers began to cope

with the tension between the search for a teaching exercise in which the student is the subject of the teaching, learning and evaluation process (Leite & Ramos, 2014), and Higher Education has lived with the challenge of (Leite & Magalhães, 2009), after the access expansion phase, to invest in quality and quality assurance systems.

In this perspective, the use of Digital Technologies is indispensable as a resource to provide more dynamic and interactive classes in Higher Education. An example of this type of proposal is the work of Cogo, Silveira, Pedro, Tanaka and Catalan (2010), which associates to the context of Higher Education active methodologies based on Digital Technologies to develop students' autonomy.

Mendes (2015) comments that teachers need to seek methods that promote a less fragmented and more meaningful understanding of scientific knowledge, and emphasizes that didactic sequences can be important elements for this integration.

Zabala (1998) conceptualizes didactic sequence as a set of ordered, structured and articulated activities with the objective of optimizing the teaching and learning process for the student, and involves learning and evaluation activities.

According to Méheut and Psillos (2004), to create a didactic sequence one must take into account both the knowledge to be taught and the initial conceptions of the learner. Thus, a didactic sequence is a group of activities designed and organized by a teacher that aims to achieve a learning objective, in which the particular order of these activities and the rhythm in which they are presented are crucial to the learning process, since the final result does not depend on the content of each task, but on how they are all organized within the didactic sequence (Dolz & Schneuwly, 2004). The didactic sequences are considered good teaching practices and as learning resources.

According to Gonzaga, Mascarenhas and Pinheiro (2009), good teaching practices use active learning techniques, the current challenge being to reflect on one's own learning, to talk about the contents learned or to learn, to relate them to their past experiences or to transfer them into day-to-day situations by taking on the role of lead actor. Thus, the authors explain that the widespread introduction of e-tutoring platforms stimulates in students their direct implication in the learning process itself and in the production of knowledge.

In this sense, Tarouco, Santos, Ávila, Grando and Abreu (2009) argue that the use of interactivity is a strategy to help meaningful learning, involving the student in an active process of study of educational material.

According to Almeida, Costa and Lopes (2016), the use of electronic didactic sequences based on Digital Technologies, which are tools of the interest of the students of this new generation, which is a digital native, can help teachers to facilitate meaningful learning once which use potentially significant materials.

In his study, Ausubel (1963) explains that meaningful learning is the quintessential human mechanism for acquiring and storing a vast amount of ideas and information represented in any field of knowledge, and it is in the course of meaningful learning

that the logical meaning of learning materials are being transformed into psychological meaning for the learner.

In order to verify the occurrence of meaningful learning, the learner must be presented with a sequentially dependent learning task, which can not be performed without a genuine understanding of the previous one, since, strictly speaking, what is being evaluated is meaningful learning of the previous task (Ausubel, 2000). Thus, the evaluation of meaningful learning must be done in terms of seeking evidence, since meaningful learning is progressive (Moreira, 2011).

The close relationship between conceptual maps and meaningful learning comes from the fact that this strategy revealed a high potential to facilitate the construction and acquisition of meanings (Moreira, 2010).

For Novak and Cañas (2008), while concept maps can help in the process of knowledge acquisition, students also need to be taught about brain mechanisms of knowledge organization (metacognition and knowledge regulation), and this instruction can be effected through the use of conceptual maps.

Metacognition is a complex concept that refers to the "knowledge about knowledge" that students can develop during the process of acquiring new information (White & Fredericksen, 2005).

Kipnins and Hofstein (2008) comment that the development of metacognitive competences is a desired result in scientific education because it promotes meaningful learning, autonomy and self-regulation. Self-regulation refers to an active and constructive process in which students set goals, monitor and evaluate their cognition, affection, and behavior (Pintrich, 2000). For Vrugt and Oort (2008), self-regulation is an important aspect of student learning and academic performance.

Amem and Nunes (2006) explain that today's society needs students who are capable of seeking and building their knowledge, who are creative and willing to learn, research and know.

METHODOLOGY

Research Characterization

The methodological approach used was the case study, according to Yin (2013) the use of the case study method may involve both single case study situations and multiple case study situations. This work involved a study of multiple cases, by researching students from two universities.

Stake (2001) calls a type of embedded case study, which is characterized by involving more than one unit or object of analysis, and in which the multiplicity of evidence is partially investigated in subunits whose focus is on the different protrusions

of the case. According to the author, for this type of case, different methods of analysis can be used, being able to speak in sample and to apply statistical analyzes.

Yin (2013) considers that the adoption of the case study method is appropriate when "how" and "why" research questions are proposed and under which the researcher has low control of a situation. In the case study, there is no control of the variables, which if one deliberately wants to study the phenomenon in its unitary character within its context, and the investigation is based on several sources of evidence present in that context.

Data Collection Places

In Brazil, the data were collected at the Universidade Luterana do Brasil, a private university in the metropolitan region of Porto Alegre, Rio Grande do Sul. In Portugal, data were collected at the University of Porto, a public university located in the city of Porto.

Research Subjects

The research target audience consisted of 28 students who were enrolled in the Human Pathology course of the Physical Education course of the Lutheran University of Brazil and 128 students who studied the discipline of Vertebrate Biology of the Biology course of the Faculty of Sciences of the University of Port.

In total, we had a sample of 156 university students, who participated in the research in different ways, according to their presence and participation in the activities. As data collection took place throughout the semester, both in Brazil and Portugal, in some activities, students missed classes, arrived late or did not deliver; therefore, the number of students in the class is different from the number of students who answered the questionnaires and performed the activities.

The sample, both in Brazil and Portugal, was determined by convenience, classes of the counselor and co-counselor (without previous contact with the groups).

Research Stages

The elaboration of the research instruments involved the following steps: a) bibliographic research on the subjects studied in the disciplines of Human Pathology and Vertebrate Biology; b) preparation of study materials; c) elaboration of the class mapping questionnaires; d) elaboration of previous evaluations; e) elaboration of the reflexive evaluation questionnaires of the activities; f) preparation of lesson plans; g) elaboration of the consent term; h) choice of technological tools to be used in electronic didactic sequences.

The bibliographic research on the themes was carried out in books and scientific articles and served as theoretical support for the creation of all study materials. The study materials with the themes for the electronic didactic sequences contained texts in topics with subject matter summary, games and evaluative activity: conceptual maps and questionnaires on the themes.

The class mapping questionnaire involved questions about the student profile, technological profile and study profile.

The previous evaluations contained questions related to the studied content of each subject and were aimed at verifying students' prior knowledge. Identifying students' prior knowledge may be relevant to content learning, where new knowledge can act as a subsumption for meaningful learning (Ausubel, 2000).

The questionnaire of the reflexive evaluation of the activities contained questions about the students' perceptions regarding electronic didactic sequences and the tools used.

The lesson scripts contained the step-by-step of how to do the electronic didactic sequences, providing the electronic address, the description of the order to carry out the activities and the explanation of what are conceptual maps with examples.

The terms of consent contained research data, student identification, and authorization signature.

The research in the Brazilian phase did not pass through the Ethics Committee on Research in Human Beings because the data collection began before Resolution 510/2016 of the National Health Council – CONEP. The research in the Portuguese phase did not go through the Ethics Committee because this procedure is only necessary when working with children and adolescents, in which case it is necessary to ask permission from the Ministry of Education in the first place, and then go through the project in the Ethics Committee. In our case, the survey was voluntarily answered by adults and anonymously, exempting us from passing through such commission.

Electronic didactic sequences were created to support the studies, so students could study the contents of the subjects in a differentiated way through online learning, since they had already studied these contents during the traditional dialogues of Human Pathology and Biology of Vertebrates.

The research was divided into two phases: one in Brazil and the other in Portugal.

In Brazil, data collection took place throughout the first semester of 2016 and consisted in developing and applying two electronic didactic sequences (G1 and G2) with all the contents of the Human Pathology discipline, analyzing students' profiles, comparing academic performance and analyze the students' opinions regarding the activities carried out.

In Portugal, the study took place during the period from April to July 2017 and consisted of developing and applying an electronic didactic sequence in two parts (P1 and P2) with all the contents of the discipline of Vertebrate Biology, analyzing the profile of the students, compare the academic performance and analyze the students' opinions regarding the activities carried out. This phase of the research was carried out through a sandwich-doctorate scholarship granted by the Brazilian Government, through the Coordination of Improvement of Higher Education Personnel – Ministry of Education (CAPES – MEC), aimed at increasing technical-scientific exchange and internationalization of Brazilian researchers.

The content themes of the electronic didactic sequences were composed of a study material with texts, figures that illustrate the texts, didactic activities of the type quiz, of the type "enigma" or of the "true or false" type, questionnaires and the creation of a conceptual map on one of the themes studied.

The data analysis, obtained from the class mapping questionnaires, previous evaluations and reflective activities, were treated using "percentage" proposition measures.

In order to evaluate the conceptual maps produced by students, we developed four classes, based on the specifications developed by Novak and Gowin (1984), Novak (2002), Peña (2005), Ruiz-Moreno, Sonzogno, Batista and Batista Costa and Lopes (2016), and Marques and Pelta (2017). The analyzed classes were: A – type (if the map is one – dimensional or two – dimensional); B – structure (if the map is structured with the connectors); C – hierarchy (form of concept layout demonstrates hierarchy); D – concepts (presence of relevant concepts about content).

In order to analyze the performance during the activities of the electronic didactic sequences, the students were divided into three groups: those that passed through digital activities (did all the activities that were available in the electronic didactic sequence), those that went through digital activities (did some of the activities that were available in the electronic didactic sequence), and those students who did not go through the digital activities (did not perform any of the activities that were available in the electronic didactic sequence). These groups were organized spontaneously according to the level of participation in the activities. According to Camilleri and Camilleri (2016) the empirical findings reveal that there may be several motivations for or against digital learning among different demographics, such as gender, age, and social stratum that may affect their willingness to use Digital Technologies to learn.

For the analysis of the academic performance, we use as basis the grades of the students through the descriptive statistical analysis of the grades of the groups.

The data of the research carried out in Brazil and Portugal were described and related by means of tables, in order to provide an overview of the results obtained.

RESULTS AND DISCUSSION

We started by analyzing the personal, technological and study profiles of Brazilian students with that of Portuguese students (Table 1).

Table 1
Summary of personal, technological and study profiles of Brazilian students and Portuguese students.

Variables	Brazil	Portugal
Age range	Average 27.4 years	Average 19 years
Biological Gender	Female 32% Male 68%	Female 54% Male 46%
Undergraduate	Physical Education	Biology
Semester	Varied	96% no second semester
Works	96% yes	94% no
Already participated in a proposal involving Digital Technologies	56% yes	40% yes
Time remaining connected	48% spend the day conncted	42% spend the day conncted
Computer literacy	60% intermediate	78% intermediate
Time per week spent on studies	76% less than 1h 24% 2h	32% less than 1h 62% 2h 6% no time
Uses some digital technology to study	96% yes	100% yes
What are conceptual maps	8% way of organizing knowledge	80% way of organizing knowledge
Already used conceptual maps in some discipline	4% yes	26% yes

Source: Adapted from Almeida (2018).

From the data, with respect to the profile of the student, we found that Brazilians are older students (27.4 years), with male predominance (68%), who work (96%), and are attending several semesters. We observed that a part of the Brazilian students are digital immigrants (Prensky 2001), were born and spent most of their childhood and adolescence in an analogue world and were presented late to Digital Technologies and somehow were forced to live with them (Pauletti & Ramos , 2017).

The Portuguese are younger students (19 years old), with a slight female predominance (54%), do not work (94%), and are attending the second semester. Portuguese students are considered to be digital natives (Prensky 2001), who according to Pauletti and Ramos (2017) are students who have always been connected to most of their lives, who think and process information differently from previous generations and are no longer for which the educational system was created.

Regarding the technological profile, a little more than half (56%) of Brazilian students "have already participated in proposals involving technologies", "spend the

day connected" (48%), most (60%) "considers their computer skills intermediaries "and 96%" use digital technologies to study ".

In relation to Portuguese students, this data is similar, since 40% of Portuguese students "have already participated in proposals that involve technologies", "spend the day connected" (42%), and more than Brazilian students (78%) "consider their intermediate computer literacy "and 100% reported that" they use digital technologies to study ". Today there is a strong tendency to use Digital Technologies as a subsidy in the teaching and learning process, since its insertion and popularization in our daily life (Lopes & Lopes, 2017).

Regarding the study profile, Brazilian students dedicate few hours per week, 76% reported studying "less than one hour per week", 8% only of students "knew the concept maps tool" and only 4% had already "used the conceptual maps in class. " Portuguese students dedicate more hours per week of study, since 62% reported studying "two hours per week", and unlike Brazilians, 80% of students "knew the concept maps tool" and 26% had already "used maps conceptual in class".

Analyzing the previous knowledge of the Brazilian and Portuguese students regarding the answers of the pretests considered good, the results can be visualized in Table 2.

Table 2
Summary of previous knowledge analyzed in previous evaluations considered good.

Variable	Brazil n= 10	Portugal n=10
Pretest	G1 – 4 questions G2 – 2 questions	2 questions

Source: Adapted from Almeida (2018).

We verified that the students' previous knowledge regarding the contents of the subjects were low both in Brazil and in Portugal, in relation to the time of study, the Brazilian students dedicate in average less of an hour of studies per week and the Portuguese in average two hours for week.

Analyzing the participation and performance of Brazilian and Portuguese students in relation to electronic didactic sequences, the results can be seen in Table 3.

Table 3
Results of participation and performance of students from Brazil and Portugal in relation to electronic didactic sequences.

Variables	Brazil	Weight (10)	Portugal (n = 128)	Weight (5,5)
	Participants (n=28)	Average	Participants (n=128)	Average
Students who have passed through digital activities	G1= 9 (32.1%) G2= 18 (69.2%)	G1 = 7.6 (76%) G2 = 7.5 (75%)	20 (15.6%) (83.6%)	4.6
Students who have partially passed through digital activities	G1 = 8 (28.6%) G2 = 8 (30.8%)	G1 = 5.1 (51%) G2 = 5.0 (50%)	29 (22.6%) (72.7%)	4.0
Students who did not go through digital activities	G1 = 11 (39.3%) G2= 0	G1 = 2.5 (25%) G2 = -	79 (61.7%) (76.4%)	4.2

Source: Adapted from Almeida (2018).

Regarding the students' participation in the activities (electronic didactic sequences), we can see that adherence was much more significant in Brazil, because in G2 activity all students participated in the activities in a total or partial way, while in Portugal, only 49 (38.3%) participated in the activities in whole or in part.

Regarding the averages, we also observed that in Brazil, those who participated in total or partial activities had higher averages than students who did not participate in the activities. These results were not so significant in Portugal, since there was a small difference between the means of the grades among the students who participated in the activities in total or partial form of those who did not participate. Warren, Dondlinger and Barab (2008) comment that in a configuration of knowledge construction, technologies become a tool that helps students access information, communicate and collaborate with colleagues.

Iqbal and Bhatti (2017) report that students with self-management skills demonstrated better results in an online learning setting. In online activities at a distance, the student chooses the place and the time to study, this makes it necessary to organize their time, which promotes strategies of self-regulation of learning. For Boekaerts, Pintrich and Zeidner (2000), self-regulation skills are fundamental for students to guide their own progression in the educational scale, to ensure the continuity of their education and to learn effectively to learn.

We analyze the conceptual maps of Brazilian students and Portuguese students, according to the four pre-established classes. For maps, maps with appropriate structures for the class were considered (Table 4).

Table 4
Summary of the analysis of the conceptual maps of the four classes with adequate structures in Brazil and Portugal.

Váriables	Brazil	Portugal
A- Type	G1 = 33.1% G2 = 77.7%	P1 = 33.3% P2 = 42.8%
B- Structure	G1 = 88.9% G2 = 88.9%	P1 = 87.9% P2 = 80.9%
C- Hierarchy	G1 = 66.6% G2 = 77.7%	P1 = 33.1% P2 = 47.6%
D- Concepts	G1 = 66.6% G2= 72.2%	P1 = 45.5% P2 = 52.4%

Source: Adapted from Almeida (2018).

Regarding the type of map, we verified that the Brazilian students had a better comprehension of the concepts, because in G1 33,1% and in G2 77,7% created two-dimensional maps. The Portuguese students had more one-dimensional maps, because in P1 33.3% and in P2 42.8% created two-dimensional maps.

In the structure class, both the Brazilian and the Portuguese students organized the maps well, predominating the maps with connectors between the concepts. According to Ferrão and Manrique (2014 p.210) "the choice of good words of connection presupposes the understanding of the relationship between the concepts or the meanings of the concepts".

Regarding hierarchization, we found that Brazilian students better organized concepts, because in G1 66.6% and in G2 77.7% made maps with a hierarchy of concepts. The Portuguese students made less hierarchical maps, because in P1 33,1% and in P2 47,6% they created maps with a hierarchy between the concepts.

Regarding the concepts, we found that Brazilian students created maps with more relevant content concepts, since in G1 66.6% and in G2 72.2% contained the most important concepts. The Portuguese students made maps with this class less relevant, because only 45.5% in P1 and 52.4% in P2 contained the most important concepts of the contents.

In their study, Novak (2002) reports that even when using learning experiences that involve activities that illustrate concepts and principles, many students fail to learn. Pendley, Novak and Bretz (1994), a study of Chemistry university students, after a detailed activity over the content described students conceptual errors showed the same activity as before. For Novak (2002), the challenge is how to help students build and rebuild their conceptual frameworks that will help them increase their cognitive competence.

Of course, meaningful learning concepts depends not only on the conceptual maps, which it is believed is that the learning of concepts is essential for cognitive development of the student and that the conceptual maps can greatly aid this process (Moreira, 2010).

Pink, Darroz and Rosa (2013) state that the use of metacognitive strategies has been touted as a learning enhancer for causing challenges and opportunities, in which the student is taken to construct and reconstruct their own knowledge. So, as a cognitive strategy of organization of knowledge, concept maps enable numerous metacognitive nature of gains since mobilize cognitive structures of students as monitoring and regulation of thought itself and of its own shares (Boruchovitch, 1999).

We analyze the opinions of Brazilian students and the opinions of Portuguese students regarding electronic didactic sequences, as we can see in Table 5.

Table 5
Views of students from Brazil and Portugal regarding electronic didactic sequences.

Variables	Brazil	Portugal
Quality of (texts / organization) of didactic sequences	36% good 28% very good 36% excellent	71,4% good 28.6% very good
Content of study material	100% adequate	97.9% adequate
Conceptual mapping contributed to learning	72% yes	71.4% yes
Difficulty in drawing up concept maps	68% no	61.2% no
You liked to use Digital Technologies	92% yes	83.6% yes
You would use the concept maps to study in other disciplines	72% yes	61.2% yes
How content is presented on Wiki helps to learn the story	94% yes	93.8% yes

Source: Adapted from Almeida (2018).

Regarding the opinions of the Brazilian students, we observed that they had a good evaluation of the activities, since 36% classified as "excellent the quality of electronic didactic sequences", 100% classified the study material as "adequate", most of the students (72 %) considered that "conceptual mapping contributed to learning," 68% reported "having no difficulty in developing conceptual maps" and 72% "would use conceptual maps to study for other subjects." Brazilian students demonstrated a very high acceptance of Digital Technologies, since 92% "liked using them in class" and 94% "evaluated how positive the content is made available on the wiki to learn".

In relation to the Portuguese students, we observed that they also had a good evaluation of the activities, since 71.4% classified as "good the quality of electronic didactic sequences", 97.9% classified the study material as "adequate" and, as the majority of the students (71.4%) considered that "conceptual mapping contributed to learning", 61.2% said they "had no difficulties in developing the conceptual maps" and 61.2% "would use conceptual maps to study in other disciplines ". The Portuguese students showed a good acceptance of Digital Technologies, since 83.6% "liked to use them in class" and 93.8% "evaluated how positive the content is made available on the wiki to learn".

Thus, we observe that e-learning plays an important role in introducing a change in the teaching and learning process of Higher Education. For Burlamaque and Barth (2015) teachers need to be aware that technologies can be an ally in the teaching and learning process. In this context, Cignachi and Duarte (2015) comment that allowing a reflection on the methodologies used in the academic context means thinking in a decision making aimed at improving teaching practice, teaching and, consequently, learning of the learning subjects.

FINAL CONSIDERATIONS

This work had as main objective to investigate the possible contributions of electronic didactic sequences with metacognitive tools, using Digital Technologies in the academic performance and significant learning of students of Higher Education in Brazil and Portugal.

Regarding the research question – How can the use of electronic didactic sequences with metacognitive tools based on Digital Technologies contribute to the academic performance and meaningful learning of Higher Education students in Brazil and Portugal? – We noticed that these sequences increase the students' study time, since they do not have the habit of studying many hours during the week. Thus, the results suggest an improvement in their academic performance, since the students who passed through the activities performed better in the tests.

The metacognitive tool concept maps helped in the metacognitive process of learning to learn, enabling students to organize their knowledge, contributing to meaningful learning. For this reason, we consider its use in the teaching and learning process important, since conceptual maps allow a representation of the relations between concepts, helping the student in the conceptual hierarchical perception, revealing which are more important and which are secondary.

The use of the Digital Technologies are presented as tools that help to enhance teaching and learning actions, since they are modern, dynamic and the daily use of the majority of students. Thus, activities based on these technologies in which the student studies some of the content at home have the potential to help students become increasingly self-regulating. Using electronic didactic sequences on the wiki site helps students to study, as it organizes the content into topics, facilitating the apprehension of the themes.

The most limiting step was to implement electronic didactic sequences at a distance, since in the beginning few students accessed the material, mainly in Portugal, leading us to apply also the electronic didactic sequence in person. We realize that, even though students are integrated with Digital Technologies in their daily lives, they still have difficulty in integrating them into their everyday studies.

We perceive the importance of exploring different ways of enhancing the teaching and learning process in Higher Education, in which the teacher can take advantage of the digital media skills and mobilize several skills crucial to students' scientific education.

However, it is worth exploring the learning mechanism to develop different applications of Digital Technologies and metacognitive tools in Higher Education classes.

The study reported here shows how Digital Technologies can be used to support students in the teaching and learning process in disciplines with very large classes and with very extensive content. Thus, it seems to us very important to change the students' attitude in the learning process, creating situations that make them more active in the process and more self-regulating.

Our approach to electronic didactic sequences and the use of the metacognitive map conceptual tool proved to be feasible and could be implemented to aid in the teaching and learning process.

We noticed the need for future adjustments of the methodology and electronic didactic sequences, to increase the acceptance of technologies, especially in Biology classes in Higher Education in Portugal. We intend to better explore strategies to support and stimulate metacognition and self-regulated learning for students.

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