CURRICULUM AND TECHNOLOGY: SYSTEMATIC LITERATURE REVIEW WITHIN THE DOMAIN OF THE E-CURRICULUM JOURNAL[1]

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ABSTRACT

A Systematic Literature Review was carried out to characterize the scientific output provided by the *e-Curriculum Journal*, resulting from academic research on the Curriculum and technology, which was based on the technique of content analysis. In accordance with the guidelines of the Study Protocol, the SLR included the following: planning and formalization; a bibliographical survey; a meta-analysis of the initial results; a summary of the meta-analysis; and finally a critical analysis of the results. 141 articles were selected from 571 published during the 15-year history of the e-Curriculum. Four analytical categories were identified by the meta-analysis: teacher training and practice with projects; technology and the Curriculum in the school setting; courses, activities and resources; learning and knowledge construction. The main finding was that there is a convergence between teacher training and practice and projects involving technology and the Curriculum in the school setting, which showed the potential value of digital technologies for teacher training. With regard to courses, activities and resources, references to distance learning and hybrid courses are predominant. Learning and knowledge construction by the teacher and students are combined, as the ¨learning¨ teacher creates situations that are suited to the students involved in knowledge construction. It can be concluded that e-Curriculum publications fulfill their social and scientific purpose by encouraging the academic world to be engaged in the creation and democratization of knowledge.

KEYWORDS: Scientific publications; Teacher training and practice; Digital technologies; the Curriculum; Knowledge building.

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CURRÍCULO E TECNOLOGIA:
REVISÃO SISTEMÁTICA DE LITERATURA NO ÂMBITO DA REVISTA CIENTÍFICA E-CURRICULUM

RESUMO

Com o objetivo de caracterizar a produção científica disponibilizada pela Revista Científica e-Curriculum, resultante de pesquisas acadêmicas sobre as temáticas que versam sobre currículo e tecnologia, foi realizada uma Revisão Sistemática de Literatura (RSL) com o uso da técnica de análise de conteúdo. De acordo com o Protocolo de Estudo, a RSL contemplou as etapas: planejamento e formalização; levantamento bibliográfico; metanálise dos resultados iniciais; sumarização da metanálise; finalizando com análise crítica dos resultados. Foram selecionados 141 artigos, dentre os 571 publicados nos 15 anos de existência da Revista. Com a metanálise foram identificadas quatro categorias de análise: formação e prática docente com projeto; tecnologia e currículo no contexto escolar; cursos, atividades e recursos; aprendizagem e construção do conhecimento. Como principal resultado destaca-se a convergência entre as temáticas formação e prática docente com projetos e tecnologia e currículo no contexto escolar, evidenciando o potencial das tecnologias digitais para a formação de professores. Na abordagem dada aos cursos, atividades e recursos, predominam cursos a distância e híbridos. Aprendizagem e construção do conhecimento pelo professor e pelos alunos são abordadas concomitantemente, pois um professor aprendente cria contextos favoráveis à construção de conhecimento pelos alunos. Conclui-se que as publicações analisadas revelam o desempenho da função social e científica da e-Curriculum ao promover a democratização do saber construído pela academia.

PALAVRAS-CHAVE: Publicações científicas; Formação e prática docente; Tecnologias digitais; Currículo; Construção de conhecimento.

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REVISIÓN SISTEMÁTICA DE LITERATURA EN EL ÁMBITO DE LA REVISTA CIENTÍFICA E-CURRICULUM

RESUMEN

Con el objetivo de caracterizar la producción científica puesta a disposición por la Revista Científica e-Curriculum, resultante de investigaciones académicas sobre los temas que tratan de currículo y tecnología, se llevó a cabo una Revisión Sistemática de Literatura (RSL) con el uso de la técnica de análisis de contenido. Según el Protocolo de Estudio, la RSL contempló las etapas: planificación y formalización; recopilación bibliográfica; metaanálisis de los resultados iniciales; sumarización de metaanálisis; finalizando con un análisis crítico de los resultados. Se seleccionaron 141 artículos, entre los 571 publicados en los 15 años de existencia de la Revista. Con el metaanálisis se identificaron cuatro categorías de análisis: formación y práctica docente con proyecto; tecnología y currículo en el contexto escolar; cursos, actividades y recursos; aprendizaje y construcción del conocimiento. Como principal resultado se destaca la convergencia entre los temas de formación y práctica docente con proyectos, tecnología y currículo en el contexto escolar, poniendo en relieve el potencial de las tecnologías digitales para la formación de los profesores. En el enfoque de los cursos, actividades y recursos, predominan los cursos a distancia e híbridos. El aprendizaje y la construcción del conocimiento por parte del profesor y de los alumnos son tratados concomitantemente, ya que un profesor que aprende crea contextos favorables a la construcción de conocimiento de los alumnos. Se concluye que las publicaciones analizadas revelan el desempeño de la función social y científica del e-Curriculum al promover la democratización del saber construido por la academia.

PALABRAS CLAVE: Publicaciones científicas; Formación y práctica docente; Tecnologías digitales; Currículo; Construcción de conocimiento.

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1 INTRODUCTION

Integrating the Curriculum with Information and Communication Technology (ICT) has been one of the key lines of research undertaken by researchers linked to the Post-graduate Program in Education: Curriculum (*Programa de Pós-Graduação em Educação: Currículo, PPGE*) of the Pontifical Catholic University, Sao Paulo (*Pontifícia Universidade Católica de São Paulo, PUC-SP*).

As a result of these research endeavors, the online *e-Curriculum Journal (Revista Científica e-Curriculum)[2]* was launched, and this has been published by the PPGE/PUC-SP since 2005. Its focus is on publishing research and scientific-academic articles in the wider field of Humanities, mainly education, particularly in the subfield of curricula specifically designed for multiple educational modalities.

Throughout its existence, the Journal has drawn attention to current trends with regard to design the curriculum in a globalized world, chiefly in the area of technology and, hence, sought to improve the quality of its scientific output, both locally and internationally. During its 15 years of activity, it has published 43 volumes, which comprise 346 articles for ongoing demand, 220 articles on thematic dossiers and five academic narrative reports.

A Systematic Literature Review (SLR) was carried out with the aim of characterizing the scientific output resulting from academic research on technological subjects that were published by the *e-Curriculum Journal* (Perrier, 2019; Gonçalves, 2015; Ramos, A., Faria, P. M., & Faria, A., 2014; Munzlinger, Narcizo, & Queiroz, 2012; Khan, Kunz, Kleijnen & Antes, 2003). The SLR derived from the creation of an objective bibliographical survey-based protocol, that was compiled for searches on the e-Curriculum database and its criteria enabled us to find the articles on the subject under investigation.

Hence, by strictly following clearly-defined procedures, it is possible to understand the nature of the articles published in the *e-Curriculum Journal* that are about technology and obtain scientifically valid results. To achieve this goal, this article is divided into three parts: the first involves forming the basis of bibliographical references by means of SLR-established principles and protocols. The second concerns the handling and summarizing of the initial results, through a meta-analysis carried out with the aid of computer-assisted qualitative data analysis software NVivo 12[3], as a means of understanding the similarities that allow the

analytical categories to be determined. Finally, in the third section, there is a critical analysis and discussion of the meanings attributed to the emerging categories, together with some final remarks.

2 METHODOLOGY: ESTABLISHING THE FRAMEWORK FOR THE BIBLIOGRAPHICAL REFERENCES

Bearing in mind that there is a wide set of articles published in the *e-Curriculum Journal* on technology, education and the curriculum, both in thematic dossiers and the ongoing demand for articles and academic narrative reports, there was a need to study the conceptual design for this area within this authorized publishing medium for scientific output. From its inception, the Journal has centered on the question of the curriculum and acted as a medium for spreading scientific knowledge on related themes.

The SLR methodology was employed to help understand technological trends by revealing the procedures used to locate, systematize and analyze the articles in clearly defined stages, so as to minimize the risk of bias that might result from the personal views of the authors of this study.

The purpose of establishing a procedural protocol when planning a research project is to ensure it has sufficient objectivity to allow any researcher to replicate the study (Gouch, Thomas, & Oliver, 2012). For this reason, the study protocol model devised by Ramos, A. et al (2014) was adopted, which included the following guidelines: aims; a research domain supported by arguments; inclusion and exclusion criteria; methodological criteria for assessing validity; results; data filtering and handling.

The framework for the bibliographical references was established through SLR procedures within the scope of the *e-Curriculum* collection resources. The boundaries of the survey were fixed to cover the period of the Journal's existence, and comprised all of its editions published between 2005 and 2019, with the aim of determining the works that would match the "technology" descriptor. An analysis of abstracts and keywords was conducted to check which of these articles corresponded to the subject-areas of Technology, Education and the Curriculum.

The E-Curriculum Journal has an internal search engine that allows publications to be found that are related to a specific topic; however, this kind of tool was unsuitable for this

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study as it had a few limitations that restricted the results. Thus it was decided just to skim – read (Bardin, 1977) all the published abstracts and academic narrative reports and then select those that had technology-related themes.

Content analysis proved to be the most suitable procedure for critically understanding the meaning of communications and data processing, when based on the work of Chizzotti (2006). Thus, it was decided to adopt the content analysis as a qualitative data analysis technique described in stages (Bardin, 1977).

As for the SLR, five basic stages were followed in accordance with the Study Protocol (as shown in Figure 1).

Figure 1 – Stages of the Systematic Literature Review
Source: Adapted from Munzlinger et al (2012, p. 52).

Munzlinger et al (2012) summarize the SLR procedure in three stages (as shown in Figure 1): Planning and preparation of the study protocol, implementation of the protocol, summary of results. However, for the purposes of this study and to provide a more detailed description of the process, a meta-analysis was included as it is essential to understand the summarized results in Stage 4, which conform to the recommendations of Ramos, A. et al (2014). Finally, the study was supplemented with a critical analysis, so that reflection could be given to more meaningful interpretations.

The SLR sought to locate manuscripts published in the *e-Curriculum Journal* that dealt with technology in the context of the curriculum and education. Hence, within the well-defined objectives and scope of the research, a line of reasoning was established about how the search engine should be used, together with the criteria for inclusion and exclusion and methodological validity, which led to the results (required for the publications). These results underwent a qualitative analysis with the aid of NVivo 12 software, which offered a snapshot of how the *e-Curriculum Journal* has been used as a mechanism of knowledge diffusion for academic research carried out in the field of technology, education and curriculum, and assisted in determining the meanings attributed to this theme by their authors.

The purpose of Stage 1 was to define the procedures for the selection of articles and academic narrative reports that were required for the research so as to allow a critical analysis of the results and thus categorize the prevailing issues in the scientific communications of the *e-Curriculum Journal*, including spontaneous, on-demand publications, thematic dossiers and academic narrative reports.

The basic line of research centered on the word "Technology", since the research domain already covered the area of education and the curriculum as these constitute the main objects of concern of the Journal. At the outset, all the publications that returned positive results in their titles, key words and abstracts were included in the research-based argument.

The exclusion criteria removed interviews, reports, debates, essays, forewords, reviews or abstracts published in other sources, as they were not relevant. Following this, all the articles and academic narrative reports were examined that met the requirements of the research-based argument and were included by the internal search engine criteria - and not eliminated by the exclusion criteria. The articles were compiled and catalogued on the basis of their content and focal point and after that, a skim reading (Bardin, 1977) was carried out.

The data filtering and handling was done by the research authors in accordance with their views and interpretative skills, and this allowed the concepts of the framings to be determined and a decision made about whether the study would have technology, education or curriculum as its focus. This process resulted in adjustments being made to the previous classification which was drawn up when the results were first obtained.

Table 1 summarizes the activities involved in the research planning and formalization represented in the Study Protocol on the subject of technology within the *e-Curriculum Journal*.

Table 1 - Study Protocol

Purpose	Research on the production of articles related to the theme of technology in the context of education and curriculum.
Scope of the Research	*E-Curriculum Journal (Revista Científica e-Curriculum)*
Research Argument	Articles and academic narrative reports that somehow dealt with technology
Inclusion Criteria	Articles and academic narrative reports that make clear references to technology
Exclusion Criteria	Interviews, reports, debates, essays, forewords, reviews or abstracts of published works.

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Methodological criteria for validity	Analysis of all the abstracts in the publications that met the requirements of the research argument and were not interviews, reports, debates, essays, forewords, reviews or abstracts, to ensure they were suited to the goals of the survey.
Results	All the articles that met the requirements of the research argument and the inclusion criteria, and were not affected by the exclusion criteria, were compiled and catalogued in accordance with their content and focal point.
Data filtering and handling	After reading through and analyzing the abstracts, it was decided whether the focus should be on technology within the context of education and curriculum.

Source: The authors.

As is clear from the way the Study Protocol was planned, the aim of searching the publications was to discover what has been produced about technology within the scope of the *e-Curriculum Journal*.

Since it was decided not to use the search tool of the Journal itself for the survey as a part of the methodology, Stage 2 entailed conducting a survey of the published articles that were suited to the adopted research argument: the inclusion of data referring to the publication year; edition and volume number; title; author(s); key-words; abstract; URL; and publication type.

The resulting data were used to compile a database in which all the publications were entered, regardless of how far they converged with the study goals, and thus remained available for future analyses.

Once the database was created, filters were added for weighing the inclusion and exclusion criteria that were applied to the titles, key-words and abstracts. The term *Curriculum* was added to the inclusion criteria, as it is implicit in the Journal's policies and all the publications address issues related to it.

Abstracts from articles and academic narrative reports that met the requirements of the research argument were analyzed to confirm if their publication was suited to the goals of the survey. Hence, 139 articles and 2 academic narrative reports were obtained from a total of 566 articles, together with 5 academic narrative reports in the Journal's 43 editions in the last 15 years.

The selected 139 articles and 2 academic narrative reports were then submitted to a meta-analysis so that their interrelationships could be interpreted.

3 RESULTS AND SUMMARY OF THE META-ANALYSIS

Since there was a large amount of surveyed data derived from the selected articles and academic narrative reports that, until then, had not shown any clear signs of being correlated, we relied on a computer program to arrange them in a more dynamic form, and reveal similarities that had not been apparent in the skim reading. This helped to utilize the time devoted to the analysis of the results more effectively.

There are countless computer applications designed for qualitative and quantitative data handling, each with easy-to-use features, limitations and characteristics that make their resources more suitable for each type of study. In this research, the decision to work with NVivo 12 software was based on the fact that it has already been used in previous research projects conducted by the authors and offers appropriate resources to undertake the required work.

NVivo 12 helps researchers collate and analyze unstructured information, and assists in the identification of categories, similarities and other features that are hard to detect as they become obscured within a large volume of data. It also allows for different kinds of data consulting and representation, and can thus assist researchers in conducting analyses and reaching conclusions.

With the aim of integrating the content of the 139 articles and 2 academic narrative reports selected for the subject-areas of technology, education and curriculum, a statistical analysis was conducted that was based on the most frequently recurring significant words. This process of analysis, which represents the meta-analysis, made it possible to combine the publications by grouping their patterns of similarity in a dendogram, by using the 30 most frequent words; this served as a means of determining the analytical categories.
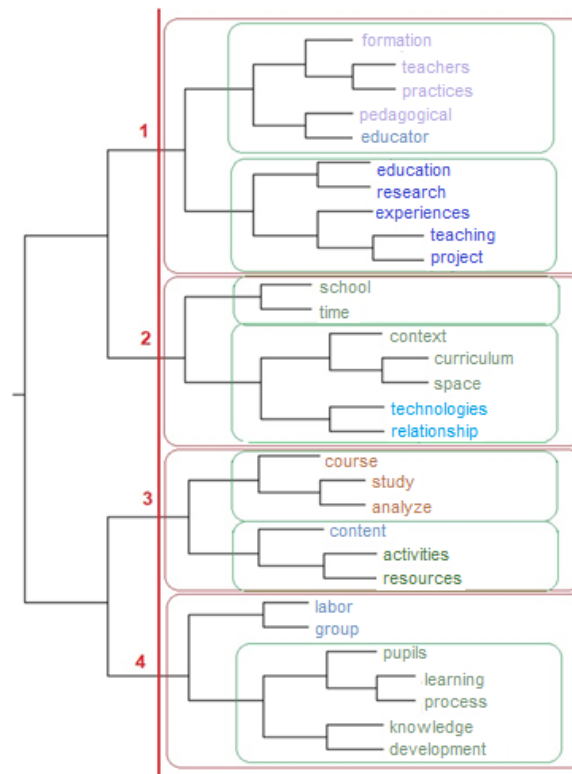
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Figure 2 - Analysis of representative clusters of the 139 articles and 2 academic narrative reports selected in accordance with the research protocol[4]
Source: NVivo 12, 2020; edited by the authors.

The cluster analysis (Figure 2), made it possible to illustrate four well-defined groups on the line-segmentation in red, (as shown in the diagram). The reading of the clusters allowed the following categories to be defined: (1) Teacher training and practice with a project; (2) Technology and the Curriculum within the school; (3) Courses, activities and resources; and (4) Learning and knowledge building. The red frames mark the boundaries of these categories and also the corresponding sub-categories that are formed of the clusters of recurring words detected by the software and shown inside the green frame.

It should be stressed that before generating the word frequency, all the texts were examined after the bibliographical references, headings and footnotes that were included to comply with the publishing requirements of the Journal had been removed, as they had repetitions of words that would distort the results in the word frequency. Words which had no bearing on understanding the context, such as prepositions and conjunctions, or were of no significance for the immediate goal, were also excluded.

Since the objective of this study was to characterize the scientific output in the *e-Curriculum Journal* on issues related to the curriculum and technology, it was decided to

analyze Categories 1, 2 and 4 as Category 3, although they were linked to the subject, with regard to articles that were not about specialist courses (some having been conducted by distance learning, which will be the object of a future study).

Hence, the meta-analysis provides a comprehensive view of how the most frequently recurring words might be clustered. This is a means of disclosing converging or similar ideas on account of their similarity or proximity, and the ¨meanings¨ that are inherent in this study, as well as determining the three analytical categories[5] and sub-categories discussed in the next section.

4 CRITICAL ANALYSIS AND DISCUSSION OF THE RESULTS

This analysis sets out by responding to the challenge posed by Camas (2010, p.31) in the academic narrative report entitled "*E-Curriculum Journal*: Origin and Evolution of a Journal in the Field of Education and Curriculum Built with Pedagogical Collaboration", published on the 35th anniversary of the Post-graduate Diploma Program in Education: Curriculum. After describing the origins of the Journal, the above-mentioned author asks: "What is the Meaning of a Journal?" This was answered on the basis of the analytical categories defined with the aid of NVivo 12, and their ¨back-and-forth¨ movement in the publications in which they originated. It also included a dialog with the various authors of the selected texts and a shared understanding of the meanings that these researchers attributed to the three most frequent categories generated by NVivo 12.

4.1 Teacher training and practice with projects

The training of teachers and researchers, especially with regard to the aid of ICTs and how to use them, is a recurrent theme in the *e-Curriculum* publications. Among other researchers in the field, Almeida, M. E. B. (2005, 2016, 2019), Prado and Valente (2002), Kenski (2003, 2005), Zuin and Pesce (2010), Almeida, M. E. B. and Valente (2012a, 2014), Padilha and Zabalza (2016) have published and been cited in articles published throughout the history of the Journal. One of the emerging themes is the spreading of ICT in society and the re-definition of the concepts of time and geographical space, with the consequent establishment of conditions for teacher training.

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Santos and Abranches (2016, p.9 21) underscore the "growing presence of Graduate and Undergraduate courses, that are run at a distance or in a hybrid format […] as a potential modality for Continuous Teacher Education." However, discussions about teacher training are not confined to the modality and potentialities of distance learning, and should be followed by reflections on the challenges of improving the quality of education.

Kenski (2003, p. 21) argues that teachers "circulate culturally mediated by technology that is contemporaneous to them. The latter transforms the way they think, feel and act." In other words, they must adapt to a new ¨communicational¨ reality, and their training cannot take place in isolation, outside this context. Hence, the search for training models that significantly improve pedagogical practice, cannot ignore the possible benefits brought about by the dissemination of digital technology in society.

Viol and Miskulin (2014) lay stress on the issue of teaching practices and their inter-relationship with ICT. In the view of the authors, when teachers use ICT in their teaching practice, they are on their way to forming a web design curriculum (Almeida, M. E. B. & Silva, M. G. M., 2016). They cite Almeida, M. E. B. and Valente (2012b, p. 59), for whom designing a web curriculum is a process of interconnecting ICT "with curriculum development in pedagogical activities in which teachers and students are responsible for this technology and use it to learn, as if it were invisible."

Cerny, Almeida, J. N., and Ramos, E. (2014) argue that the effective training of teachers, as well as other professionals, should foster "more autonomous learning attitudes." They cite Ramos, E. M. F. and Fagundes (1997) and reiterate that, unless people are allowed to learn and to learn cooperatively how to incorporate ICT s, rather than make innovations in education, the current problems will only get worse.

Hence, teaching practice is not separate from teacher training. When Almeida, M. E. B. (2016), writes on the academic narrative report that portrays the times when she lived in the academic world and at school, she underlines the importance of knowledge building in her professional career as a teacher and as a researcher and how it can be obtained through research and practice. Thus, teacher training must be guided by the principles of "knowledge *for* practice", "knowledge *of* practice" and "knowledge *in* practice" (Cochran-Smith & Lytle, 1999).

Teachers are also active subjects in this creative process, as researchers or even faculty members, who both contribute to research studies about their teaching practice and are

guided by it (Viol & Miskulin, 2014). According to Almeida, M. E. B. (2016), "they are intertwined: practices, reflections about practice and theories that lead to a better understanding of practices and assist their investigation." When teachers, or future teachers doing a teacher-training course take part in research projects that benefit from educational experiences mediated by ICT, they gradually take control of technology in a critical and reflective way.

Hence, it is worth reiterating that the research studies that appear in the *e-Curriculum Journal* attach significant importance to teachers acting as researchers of their own practice and able to teach through research. In addition, the articles stress the importance of peer collaboration, as well as learning that effectively integrates professional practice with the theories and principles that underpin it throughout their training (Prado, 2009; Cruz, Nascimento, & Viana 2019; Rosa & Fagundes, 2014), and key factors that should be a part of the training curriculum.

The results obtained were corroborated by publications appearing in different media outlets, from both these and other authors devoted to investigating teacher training. This kind of training should be understood as a preparatory reflection, in which the Curriculum is able to integrate professional development and practice. This perspective on training is supported by, among others, Tardif (2000, 2012), Pimenta (1999) and Freire (1996). Nóvoa (2017) believes that teacher training should take place in the "frontier zone", made viable in the teacher training mediated by ICT, when a form of ¨cross-breeding¨ can be observed between training and the work spaces of the participant teachers. This entails valuing the "professional continuum" between teaching at different educational levels, as well as in on-site and online contexts (Rodrigues, Almeida, M. E. B. & Valente, 2017). These and other current studies substantiate the ICT capacity for teacher training that is supported by a) a critical-reflective, constructive and contextualized conception, b) integrating digital technology, curriculum and training and c) pedagogical practice (Almeida, M. E. B., 2019).

4.2 Technology and the Curriculum in a school setting

It should be pointed out that digital information and communication technology is mainly a language and a cultural tool as it structures thinking, knowledge and the curriculum. This view is supported by Almeida, M. E. B. (2016), who emphasizes the need for a critical

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appropriation of technology by defining it as an intentional activity inherent in cultural relations.

This means that ICT structures pedagogical activities and, thus, should be incorporated in schools as a goal in itself. Perhaps owing to a lack of clarity about this assumption, one bibliographical survey on the curriculum and ICT carried out by Evangelista and Sales (2016, p.1123) found there was a "mismatch between the curriculum and digital technology […]", and also pointed out that this mismatch exists in the discussion on the space-time issue. The authors remind us that "when thinking about the relation between the curriculum and digital technology, the space-time issue should be taken into account, since digital technology and the Internet contribute to its re-signification." (Evangelista & Sales, 2016, p.1123). In light of this, they recommend a less instrumental and more critical use of ICT in education and use (Amante 2011, p. 239) to support the idea that ICT "is not the cause of the changes needed for the revival of learning." (Evangelista, Sales, 2016, p. 1124).

The analysis of the articles listed in this category found there was a considerable growth in studies concerned with investigating the links between technology, education and the curriculum in concrete contexts of pedagogical practice. These studies reveal signs that the mismatch pointed out by Evangelista and Sales (2016) can be related to the features of the analyzed contexts or that this kind of mismatch has been declining. This latter view is supported by the reports and analysis of the pedagogical use of technological artifacts found in schools, while it also shows the difficulties of effectively integrating ICT with the school curriculum.

In view of this, studies on the use of different technological artifacts in education are discussed, by, among others, the following authors Santos and Abranches (2016), Almeida, M. E. B. and Valente (2014), Malaggi, Silva, J. T., and Teixeira, A. C. (2012), Basso (2009) and Marinho (2006). Their studies reflect on the educational uses and role of ICT in the curriculum.

The texts produced by Marinho (2006), Basso (2009), as well as the state-of-the-art in research carried out by Vosgerau and Milani (2014), suggest that there is an expansion of ICT combined with the need for new pedagogical practices for its integration in the Curriculum.

In the academic narrative report entitled "*E-Curriculum Journal*: Origins and Evolution of an Electronic Scientific Journal in the Field of Education and Curriculum Built with Pedagogical Collaboration", Camas (2010, p.14) describes the use of ICT for research

purposes. He also describes how the *e-Curriculum Journal* was created and points out the opportunities provided by virtual meetings, recordings and resumption of planning, in short, of the collaborative work mediated by ICT. This is an indication that the e-Curriculum provides a space for supplementary training for the Post-graduate Program in Education: Curriculum students, who mainly carry out their activities through ICT mediation.

The analysis of the articles listed in this category is corroborated by publications in other sources that reveal the authors' concern with the conscientious use of ICT by teachers, who should play the role of mediators, or, in Valente's words (2005), agents of learning. It can be confirmed that ICT is present in a considerable part of the educational world in Brazil, as shown by the results in the ICT in Education Research 2018 (Cetic.br, 2019). However, it is still necessary to move towards the construction of web curricula as described by Almeida, M. E. B. and Valente (2012b, p. 59): "a process of ICT interconnection in forming a curriculum for pedagogical activities in which teachers and students take control of this technology and use it to learn, as if it were invisible."

4.3 Knowledge learning and construction

The question of knowledge construction mediated by ICT is addressed in articles of the *e-Curriculum Journal* with an emphasis on the professional knowledge of students or teachers.

Viol and Miskulin (2014) cite Fiorentini (2009) in their analysis of professional knowledge construction by teachers. They underline the importance of study groups and the setting up of communities of practice for the acquisition of teaching autonomy and, by extension, of curricular innovations originating from school practices.

 Professional knowledge construction and research by teachers affect the way they teach and, hence, the students' learning processes. Rosa and Fagundes (2014) state that the scientific initiation projects supervised by teachers and the use of ICT, are interconnected in the students' learning process and foster knowledge construction.

Viol and Miskulin (2014, p.1313) add that "ICT presupposes new ways to generate and master knowledge." They change the ways of knowing and representing ideas and "[when] integrated with the teaching-learning process, they can encourage interaction and

collaboration between peers and lead to knowledge construction." (Viol & Miskulin, 2014, p. 1316).

"The process of knowledge production is permanent and dynamic, playing a fundamental role side-by-side with processes of organization and distribution of information." (Cruz et al, 2019, p. 1857). Like teachers, "students must be able, as subjects, to work collaboratively, solve problems, overcome difficulties, establish changes in their social environment, and these capabilities must be developed throughout their academic life." (Cruz et al, 2019, p. 1858).

For their part, Malaggi et al. (2012) refer to the concern over the appropriation of technological resources for carrying out teaching practices based on projects with the students' active participation. The same methodological strategy is adopted by Trein and Schlemmer (2009).

Guimarães (2012), as cited in Cruz et al. (2019, p. 1867), corroborates this idea when he defines the main feature of learning "in times of digital convergence", as a "chiefly collaborative process, in which social networks are featured around common interests, facilitating and guiding knowledge construction." He also draws attention to the current need for the learner to be someone who "plays a central role in the learning process and cannot be regarded as a passive receptor of information, since he must necessarily be included as author, co-creator, evaluator and critical commentator." (Guimarães, 2012, as cited in Cruz et al, 2019, p. 1867).

Studies published in other sources corroborate this analysis. Hence, the characteristics of today's learner converge towards the concept of active learning, as outlined by Dewey. The essence of this learning entails advocating a practical education, based on learning through experience, which allows the learner to actively build and rebuild knowledge from logical and concrete elements (Teixeira, A. S., 1977; Dewey, 1973).

Rodrigues et al (2017) argue that the creation of digital learning narratives boosts knowledge construction in learning contexts where students record, share and analyze experiences that inter-relate formal and non-formal educational contexts. These require an active attitude on the part of the learner, particularly when narratives are produced and shared in virtual networks.

The network's main function is to assist in establishing communicational and collaborative relationships between the participants (Teixeira, A. S., 1977). In this way,

throughout its 15-year history, the publications of *e-Curriculum Journal* have played a key n role in the socialization of knowledge constructed by teachers and researchers who are devoted to studies on education and the curriculum especially, in the area of the Curriculum and technology.

5 FINAL REMARKS

This article has sought to characterize the scientific output made available by the *e-Curriculum Journal*, and resulting from academic research on issues related to technology, education and the Curriculum.

When analyzing the meanings attributed by the authors of published articles in the *e-Curriculum Journal* throughout the 15 years of its history, it was possible to grasp what was meant by an "electronic scientific journal that goes beyond its limits, beyond publishing guidelines for any researcher - regardless of their field of knowledge - and beyond the location of a graduate program" (Camas, 2010, p. 30).

The planned inclusion of technology and its interfaces with education and the Curriculum is present in 141 of a total of 571 publications, which shows its significance.

The category "teacher training and practice with projects" has a close relationship with the recurring issues (sub-categories) in the publications, followed by "technology and curriculum in the school setting"; both proved to be interrelated, and illustrate the change in the way education is being carried out, with an emphasis on the creation of environments that are conducive to active learning and to research, and the same approach is required in teacher training. In addition, they highlight the ICT capacity for teacher training underpinned by a critical-reflective, and constructive concept that is contextualized through its integration with teacher training and pedagogical practices, viewed from a hybrid perspective.

With regard to learning and knowledge construction, the analysis reveals the extensive theorizing of professional knowledge construction undertaken by teachers. It is defined as a composite, temporal and plural concept that encompasses curriculum knowledge and students' knowledge; this includes both scientific and didactic/pedagogical knowledge of content and the ability to convert the former into the latter. However, it is mainly designed for understanding the pedagogical activities of ¨learning¨ teachers, who seek to enlarge their

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knowledge when it is geared to teaching and learning and creating suitable situations for students who wish to be involved in knowledge construction.

The set of publications that was analyzed also enables us to understand the role of *e-Curriculum Journal* in the academic milieu and of teachers in their daily practice. Thus, it can be stated that the main purpose of a scientific publication, (that is, the act of carrying out research and publishing its results), is to ensure the ¨democratization¨ of the knowledge acquired by the academic world, so that it can be made accessible for discussion in society. In light of this, it can be claimed that, the *e-Curriculum Journal* has been performing its social role, since its free-access publications discuss key issues, as described in this article. At the same time, it complies with the prevailing principles and standards of a respected scientific journal, which ensures the quality of the published works, as well as their significance and topicality.

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NOTES

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[2] Henceforth the name e-Curriculum is adopted to designate the *Revista Científica e-Curriculum.*

[3] The NVivo12 is a software developed by QSR International to aid the investigation of qualitative and mixed methods. By using this software, it is possible to incorporate, collate and analyze data from text, audio, and video files, emails, images, calculus worksheets, online questionnaires, information on websites and social networks among many other sources. To learn more, go to: https://www.software-shop.com/producto/nvivo_portugueshttps://www.software-shop.com/producto/nvivo_portugues.

[4] The translated word "formation" corresponds to "*formação*" which in Portuguese means teacher training.

[5] The NVivo software program works with the concept of nodes and sub-nodes The software carries out the labelling of nodes to designate the convergence points between the main concepts discussed in different articles and, in this study, the terms "nodes and sub-nodes" will be synonymous with the categories and subcategories adopted for analysis.

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