SYSTEMATIC MAPPING OF SCIENTIFIC LITERATURE ON TECHNICAL AND SUPERIOR COMPUTING COURSES AND EMPLOYABILITY

MAPEAMENTO SISTEMÁTICO DA LITERATURA CIENTÍFICA SOBRE EGRESSOS DE CURSOS TÉCNICOS E SUPERIORES DE INFORMÁTICA E EMPREGABILIDADE

MAPEO SISTEMÁTICO DE LA LITERATURA CIENTÍFICA EN CURSOS TÉCNICOS Y SUPERIORES DE INFORMÁTICA Y EMPLEABILIDAD

Renata Luiza da COSTA[1]

ABSTRACT: This article presents results regarding systematic mapping research. The aim was to obtain knowledge about the relationship between professional qualification and employability potential of computer graduates in the region where the formation is offered. To this end, 11 scientific publications from 2011 to 2018 were selected, whose research field included responses from graduates of technical or higher education courses in Informatics. Data analysis was guided by the Historical-Dialectic Materialist method. The results show that, in a broad sense, the employability of computer professionals is high; graduates from cities with a greater industrial-technological network, almost all, get good jobs in this area, but those from cities in opposite situations, almost in the same proportion, work outside the formation area or are unemployed. Thus, it was possible to see that only technical or higher education does not guarantee employment and development in and in the location where the formation was carried out, as the latter also depends on the existence of companies in the same area and on other social factors.

KEYWORDS: Graduates. Computer courses. Employability.

RESUMO: *Este artigo apresenta resultados de pesquisa do tipo mapeamento sistemático que objetivou apresentar o potencial de empregabilidade de egressos de cursos de informática, em nível técnico e graduação, e sua relação com o desenvolvimento local. Para isso, foram selecionadas 11 publicações científicas de 2011 a 2018 que tiveram como campo de pesquisa respostas de egressos de cursos técnicos ou superiores de Informática. A análise dos dados foi orientada pelo método Materialista Histórico-Dialético. Os resultados mostram que, em sentido lato, a empregabilidade dos profissionais da informática é alta; os egressos de cidades com maior malha industrial-tecnológica, em quase 100%, conseguem bons empregos nessa área, mas, aqueles de cidades em situação oposta, quase na mesma proporção, atuam fora da área de formação ou estão desempregados. Assim, foi possível perceber que somente a formação técnica ou superior não garante emprego e desenvolvimento na e da localidade onde foi efetuada a formação, pois, este último depende, também, da existência de empresas da mesma área e de outros fatores sociais*.

[1] Federal Institute of Education, Science and Technology of Goiás (IFG), Inhumas – GO – Brazil. Titular Professor in the area of Informatics. Doctor in Education (PUC Goiás). ORCID: https://orcid.org/0000-0002-2638-6314. E-mail: renata.costa@ifg.edu.br

PALAVRAS-CHAVE: *Egressos. Cursos de informática. Empregabilidade.*

RESUMEN: *Este artículo presenta resultados de búsqueda del tipo mapeo sistemático. El objetivo fue conocer la relación entre la calificación profesional y el potencial de empleabilidad de los egresados de informática de la región donde ocure la formación. Para esso, se seleccionaron 11 publicaciones científicas de 2011 a 2018, cuyo campo de investigación incluyó respuestas de egresados de cursos de educación técnica o superior en Informática. El análisis de los datos fue guiado por el método materialista histórico-dialéctico. Los resultados muestran que, en un sentido amplio, la empleabilidad de los profesionales de la informática es alta; los egresados de ciudades con mayor entramado industrial-tecnológico, en casi el 100%, consiguen buenos empleos en este ámbito, pero los de ciudades en situaciones opuestas, casi en la misma proporción, trabajan fuera del área de formación o están en paro. Así, se pudo constatar que solo la educación técnica o superior no garantiza el empleo y desarrollo en y del lugar donde se realizó la capacitación, ya que esta última también depende de la existencia de empresas en la misma área y otros factores sociales.*

PALABRAS CLAVE: *Graduados. Cursos de informática. Empleabilidad.*

Introduction

The reality experienced by graduates of a course must be analyzed if there is really a concern to offer training that collaborates with the social transformation of subjects and their society (MACHADO, 2001), because society is what its citizens are.

As for the formation of citizens, higher and technical education institutions play an important role in their professional and general formation, as they deal with the deepening of intellectual development and the teaching of a profession to students in a way that is very close to the possibilities of the world of work, having considering that, for the most part, they deal with individuals who are approaching the end of adolescence or are already adults, as is the case of higher education courses.

Although there are considerable differences between universities and institutions specifically for teaching at a technical level, both need to deal with the relationships that involve the quality of the graduate student, referred to here by alumni, and their employability. These issues are of great relevance both for educational institutions and for society in general. For the first, because its reason for existence is the formation of the individual for society; for society in general because it needs qualified and educated citizens to feed the processes of social, economic and political development, in a broad sense (BRUNO, 2011).

Regarding jobs, specifically in the IT area, at different levels, data from different national and international entities predicted the lack of qualified professionals and some parts of the world already experience this lack of qualified professionals for related vacancies. Information and Communication Technologies (ICT) (SOFTEX, 2012; 2013; 2019).

When we investigate the paths traced by graduates of a course, we can verify if they work and how they work in the world of work, and can also identify characteristics of their personal and particular situation that influence their professional situation. Through professional performance, post-completion of the course, it is also possible to capture the perceptions of the newly graduated professional regarding their difficulties of inclusion in the professional market they are looking for.

Machado (2001, p. 45, our translation) explains that monitoring graduates is "a mechanism that provides a faithful picture of the process of insertion of former students into the world of work", which means that knowing their professional trajectory makes it possible to obtain information about the formation offered and the society in which they live and work, which, in turn, supports better decisions about what institutions need to review in their courses.

Given the above, the research question that guides this scientific article is: How is the employability of graduates of IT courses, at technical and undergraduate levels, from public institutions, in relation to local and regional development? For this, a systematic mapping was carried out on research aimed at graduates of computer courses, at technical and higher levels, published from 2011 to 2018.

Thus, this article aims to present a systematic mapping of the employability potential of graduates of computer science courses, at technical and undergraduate levels, and its relationship with local development.

Relations between education and work: graduates, critical formation and employability

The relations between work, education and development are complex because they involve the formation of people throughout life, social objectives, which include those of an economic and social order, and require investments by society.

Assuming that we live in a capitalist society, often, aspects of economic order are strongly considered in isolation from other social components to make decisions regarding the formation of citizens. However, Brazil is one of the countries that experience the losses of this type of decision, because, since the formative cycles of citizens do not meet neither the

behavioral nor the professional formation of individuals at qualitative levels, the inclusion of these individuals in society, as well as their personal and professional performance, can little collaborate with the transformation of the country: “The level of development reached by contemporary society places the demand for a minimum collection of systematic knowledge, without which one cannot be a citizen, that is, one cannot actively participate in the life of society” (SAVIANI, 2007, p. 160, our translation).

In today's society, the school and other educational institutions have become important agents for the formation of the working class, in view of the qualification requirements of the productive processes. With the advancement of microelectronics and, later, access to information, leading to the so-called Network Society (CASTELLS, 2000), currently, the formation process of workers has been increasingly demanding with regard to the necessary requirements to maintain employee, involving intellectual and behavioral aspects.

Despite the issues of labor exploitation in the society of traditional capitalism that will not be discussed here, the fact is that the search for increased profitability is at the root of this society. With this, there is a continuous search for scientific-technological development in order to create technical, technological and/or methodological mechanisms that transform production processes in their quantitative and qualitative dimensions for the better, so that they can re-signify the gains. For these reasons, economic development has close links with educational processes: “only the increase in qualifications resulting from a more complex formation of the worker allows the introduction of innovations and guarantees that they work effectively with them, enabling productivity gains” (BRUNO, 2011, p. 549, our translation). This reality triggers the constant demand for professional qualification and requalification, which reinforces the importance of schools and technical and higher education institutions as the main means of formation of working citizens.

Cazarotti and Bernardes (2018), when researching the relationship between higher education in Brazil and the possibilities for students to enter the market, add that, although it is important to keep formation linked to the socioeconomic reality to prepare for the job market, approaching critical and social formation also brings losses:

> It is important to note that there is an evident mismatch between the university and the Brazilian social reality. On the one hand, because the university has not assumed its role as a strategic agent of national development. On the other hand, because it has also not contributed, to a certain extent, to the criticism about the development models implemented in an authoritarian way in the country until today (CAZAROTTI; BERNARDES, 2018, p. 1026, our translation).

In this reality, it is relevant to analyze the situation of graduates, that is, students who have completed professional formation courses in a particular institution, in order to verify whether such formation has contributed to their social transformation and, consequently, to the society in which they live, in addition to from the verification opposed to the reality of the world of work to serve as a subsidy for decisions related to the formative curriculum of these professionals. At the same time that one cannot have a curriculum restricted to the needs of the labor market, it is also not appropriate to offer formation that denies them, since it is in this market that citizens will work, which places the minimum requirement of having to attend to it. Care must be rigorous in not sticking to this minimum of technical and technological skills and competences, but enriching the curriculum with the scientific and humanistic formation necessary for the critical and creative development of the citizen:

> Only the technical knowledge acquired during academic formation is not enough for an effective performance in this moment of globalized and decentralized economy of the capitalist economy, in addition, a set of skills and behavioral competences are necessary. (IEGER, 2014, p. 113, our translation).

Machado (1989, p. 117, our translation) adds that "[...] education, although it can help to correct eventual imbalances in the labor market, it cannot, by itself, change the occupational structure nor the social structure, which is determined by the relations of production".

Economist Mariana Mazzucato (2014) explains that it is necessary for the State to assume its already existing and intense interventions in the market, especially with regard to technological innovations, and also to invest in the creation of markets. For the author in question, according to Santos (2017), in terms of innovation, the State's action encourages the engagement of the business community, by creating investment conditions. Along these lines, Mazzucato (2014) shows how significant public investments in research for innovation are and that this is an important path to be followed through symbiotic public-private partnerships, in search of sustainable development motivated by innovation, since the State has the premise of reducing risks and creating incentives giving conditions for development. In turn, this process generates jobs that demand qualification and gives movement to the wheel for progress.

As society has transformed its production modes, workers' formation demands are changing. This is one of the reasons that justify this type of research with graduates: to verify, in terms of employability, how the formation offered has contributed. This verification

becomes even more relevant when the provider institution belongs to the public sphere, as it is essential to monitor public investments and their return to the population itself.

In this sense, Fernandes (2012) assesses employability in two dimensions: broad, which refers to employability in any area; and strict, which refers to the analysis of employability in relation to the formation area. For the purposes of local and regional transformation, it is necessary to verify strict employability and analyze the role of the educational institution that trains professionals within the social totality in which it is inserted.

Researching graduates of a course, therefore, means seeking an understanding of their reality as opposed to that found for the exercise of citizenship and for professional practice, providing knowledge to rethink the complex relationships between education and work, and subsidizing decisions regarding the formation offered to society.

Research methodology

Systematic Literature Mapping (MSL), also known as State of the Art, is essential to guarantee scientific credibility, the assumption that scientific advances are a process of continuation of the activities of the scientific community and not competition among themselves and for themselves, and also serves to explore the existing knowledge in the researched area, in order to better formulate the research problem, its objectives and, later, the methodology to be used.

A systematic literature review research results in an analyzed bibliographic survey of completed research on a outlined topic, aiming to identify gaps that still need further research to find more refined results or to bring new knowledge about the relationships between the conclusions already found in that set of research analyzed (DERMEVAL; COELHO; BITTENCOURT, 2020; HULLEY *et al.,* 2015).

The systematic, in-depth and rigorous mapping of a topic to be researched is a mandatory phase that aims to explore the scientific knowledge already produced in that area, provide the production of innovative knowledge and, then, substantiate the credibility of scientific research and its results.

In order to develop methodological procedures with the aforementioned scientificity, a bibliographic survey was carried out, followed by systematization and critical analysis.

To carry out the initial bibliographic survey, a search was carried out on Google Scholar, on the website of the Brazilian Journal of Informatics in Education (*Revista Brasileira de Informática na Educação* - RBIE) and on the bases of the Brazilian Congress of

Informatics in Education (CBIE), with the following composite descriptors: graduates of informatics courses, employability graduates of computer courses, professional status of graduates of computer courses, monitoring of graduates of computer courses and the Brazilian Congress of Computer Science in Education (CBIE) graduates of computer science, with a period of delimitation from 2011 to 2019, in order to retrieve more up-to-date research. RBIE and CBIE are the main vehicles of scientific communication of the research area Informatics in Education in Brazil. For this reason, they were included in the databases for this systematic review.

As a selection criterion, the titles and abstracts of all the researches returned from the first 30 pages of the search portal were read, and those publications that had the word "*técnico*", "*técnico integrado*", "*EJA*" or "*superior*" (technical, integrated technical, youth and adults education or higher) were selected. in association with another word that indicates that the research was analyzing graduates and not the graduates' profile. This means that studies that dealt only with the profile of the graduates were excluded, that is, without a focus on the student who had already graduated.

In the RBIE, only four articles were found that dealt with graduates, namely: two on continuing education for teachers from different areas; one about dropout in a Computer Science course; and one on curriculum analysis in the same qualification. None of these articles were selected because they do not deal with graduates of computer courses.

In Google Scholar, with the last descriptor three research publications were selected. From the first descriptor, five were selected and from the second descriptor, only two.

Published in the CBIE events, an article was found about graduates of the Teaching Degree in Computing, published in 2013, which met the inclusion criteria of this mapping.

Altogether, 11 scientific texts were selected, as shown in Frame 1, to be analyzed in this research.

Frame 1 – Scientific papers selected for MSL on graduates of informatics

Research title	Researched institution/year of publication	Researched Level/Course
Da qualificação ao mercado de trabalho: um estudo de caso com egressos de um curso superior de informática no Paraná (From qualification to the job market: a case study with graduates of a computer science course in Paraná)	Federal University of Paraná (UFPR) – Curitiba (PR) – 2014.	Technology in Systems Analysis and Development
Empregabilidade dos egressos tecnólogos do curso de Análise e	Federal Mining Institutes - from 3 cities in the interior	Technology in Systems Analysis and Development

Desenvolvimento de Sistemas nos institutos federais mineiros (Employability of technologists graduating from the Systems Analysis and Development course at federal institutes of Minas Gerais)	of Minas Gerais: Bambuí, Januária and Uberaba (MG) – 2016.	
Educação tecnológica e empregabilidade: revelações de egressos (Technological education and employability: revelations from graduates)	Federal Institute of Goiás (IFGoiano) – Urutaí (GO) – 2012.	Technology in Systems Analysis and Development
Educação tecnológica e empregabilidade: revelações de egressos (Technological education and employability: revelations from graduates)	University of Brasília (UNB) – Brasília (DF) – 2017.	Teaching Degree in Computing
Caminhos do Licenciado em Computação no Brasil: Estudo de Mercado a Partir de uma Pesquisa com Egressos (Paths of the Computer Graduate in Brazil: Market Study from a Survey of Graduates)	State University of Paraíba – Campus I – Campina Grande (PB) – 2013.	Teaching Degree in Computing
Empregabilidade dos egressos: a educação profissional integrada ao ensino médio no extremo norte da Amazônia (Employability of graduates: vocational education integrated with secondary education in the extreme north of the Amazon.)	Federal Institute of Roraima (IFRR) – Câmpus Boa Vista (RR) – 2018.	Technical courses integrated to high school in Secretarial, Electronics, Electrotechnics and Informatics.
O papel do instituto federal de educação, ciência e tecnologia (IFRN) para a qualificação e empregabilidade: um estudo dos egressos do curso de informática do IFRN em Currais Novos/RN (The role of the federal institute of education, science and technology (IFRN) for qualification and employability: a study of graduates of the IFRN computer course in Currais Novos/RN)	Federal Institute of Rio Grande do Norte (IFRN) – campus Currais Novos (RN) – 2011.	Technician subsequent to High School in Computer Science
Itinerários dos egressos do nível médio integrado do IFBA - Câmpus Jacobina (Itineraries of graduates of the integrated high school level of IFBA - Câmpus Jacobina)	Federal Institute of Bahia (IFBA) campus Jacobina – Jacobina (BA) – 2018.	Integrated technician in Mining, Electromechanics and IT
Programa de mapeamento de egressos relatório 2015-2016 (Graduate Mapping Program Report 2015-2016)	Federal Institute of Santa Catarina – Campus Videira – Videira (SC) – 2017.	Graduates of 2015-2016
O acompanhamento de egressos como ferramenta de inserção no mercado de trabalho (Monitoring graduates as a tool for entering the job market)	CEFET Rio de Janeiro - Maracanã Unit (RJ) – 2014.	Graduates fo 2012

Em busca do "tesouro": inserção profissional e inclusão digital nas trajetórias de egressos/integralizados de um curso de técnico em informática – ProEJA (In search of the "treasure": professional insertion and digital inclusion in the trajectories of graduates/integrated students of a computer technician course – ProEJA)	Federal Institute of Rio Grande do Sul (IFSUL) Charqueadas(SC) – 2011.	Computer Technician integrated into High School in the Youth and Adult Education modality

Fonte: Devised by the authors from the research data

As can be seen in Frame1, of the 11 selected texts, five refer to higher education, three of them technological in Systems Analysis and Development and two of Teaching Degree in Computing. Among the other six texts, two analyze graduates per year, without separation by level, three deal with graduates of technical courses integrated into High School and one addresses the case of graduates of an integrated technical course formed by the Youth and Adult Education system (YAE).

Despite not having been placed as a criterion, the public sphere as a field of investigation is present in all the research selected here, with the participating courses and graduates formed in federal centers of technological education, federal institutes and state and federal universities. Although there are differences between the objectives of university institutions and federal institutes and centers of technical and technological education, for this mapping, the focus is not on the differentiation between these institutions, but on the verification of approximations of employability of graduates of computer courses, regardless of of being from technical or higher courses. In addition, despite the greater emphasis of federal institutes in technical formation, their political-philosophical orientation differs from institutions of rapid professional formation, such institutes being defenders of the complete training of workers (COSTA; LIBÂNEO, 2018), that is, human and scientific-technological, which indicates similarities with university institutions.

Data analysis was guided by the Historical-Dialectical Materialist method (MHD), that is, the relationships between each particular case and in relation to the inserted totality were explored in the texts, as well as an attempt to highlight the contradictions and mediations that characterize the observed object: the relationships between offered qualification, employability potential and location of the institution. Thus, these three aspects constitute the empirical categories explored in this research in a way guided by the constitutive characteristics of the MHD method (COSTA; SOUZA; THEREZA JUNIOR, 2020).

Technical and higher education in informatics and employability potential

Of the five surveys found carried out with graduates of IT courses at a technical level, four dealt with graduates of federal institutes and one with a Federal Center for Technological Education (CEFET).

The research carried out with graduates of the Instituto Federal de Roraima (IFRR) (CARDOSO, 2018) had as a field the testimony of 20 graduates of technical courses integrated to the High School of the Boa Vista campus, formed from 2014 to 2016. This campus is located in the city of Boa Vista, capital of the State of Roraima, and has approximately 500,000 inhabitants (CARDOSO, 2018).

Cardoso (2018, p. 172) concludes that the local market does not offer jobs for those formed in the areas of Secretarial, Electronics, Electrotechnics and Informatics, highlighting the finding that "90% of these graduates do not work, nor do they work in the area of their technic formation". On the other hand, it highlights that among those 90% who were diverted from the area of technical training, 41% continue to study higher education at the Federal University of Roraima, in different areas.

It was also found in this research that "most graduates were satisfied with the knowledge acquired at the institution, despite recurrent unemployment and precarious occupations in different areas of formation" (CARDOSO, 2018, p. 170, our translation). If, on the one hand, there is personal satisfaction with the learning acquired, on the other hand, on the market side, there is no equivalent. In this regard, the author also states that the "institution could discuss this situation of non-insertion of graduates with the internal and external communities, in order to present alternatives to this process". This position links with the defense of Mazzucato (2014) about the necessary intervention of the public power for the creation of markets that, in fact, employs the locals, since only offering training is insufficient for their permanence and development in the region.

The research carried out at the Currais Novos campus of the Federal Institute of Rio Grande do Norte, was developed through questionnaires applied to 57 graduates of the Computer Science Technical Course, graduated from 2008 to 2010 (VIEIRA; GOMES; SILVA, 2011). The municipality of Currais Novos is located 172 kilometers from the capital Natal and has approximately 50,000 inhabitants.

Vieira, Gomes and Silva (2011) compared the situation of the graduates at the time of the research with their situation prior to such formation. They concluded that the 10% who had formal work before the course had risen to 62% and the 42% who were unemployed now

represented 10%. In addition, 75% of the participants highlighted that their current job was in the area of computing. In this sense, it can be said that, for the researched period, there was strict employability in the area of formation of graduates (FERNANDES, 2012), which endorses the importance of the course in question for the regional society in question regarding the demand of manpower.

Another important finding about the graduates of Currais Novos was that 90% of the graduates surveyed said they were satisfied with the expectations of the knowledge acquired in the area of computing (VIEIRA; GOMES; SILVA, 2011).

At the Jacobina campus of the Federal Institute of Bahia (IFBA), a survey was carried out with graduates from the year 2016 of the integrated technical courses in Mining, Electromechanics and Informatics (SANTOS *et al.*, 2018). An online questionnaire was sent to 77 graduates, 66% of whom sent their answers to the researcher. The city of Jacobina is located in the extreme north of Bahia, 339 kilometers from the capital Salvador and its population is just over 80,000 inhabitants.

Of the graduates surveyed, during their studies at the IFBA Jacobina campus, 70% lived in the same city and 30% in neighboring cities. It was also found that 72% of respondents continue their studies at higher education, even though only 12% are working in the same area of their technical formation. Santos *et al.* (2018) infer, then, that although technical formation contributes to employability, it occurs in a broad sense (FERNANDES, 2012), and it is not possible to confirm the relationship between formation and meeting the region's labor needs, nor its contrary.

In this sense, the authors conclude that the technical formation received has contributed more to the integrated general formation, serving the training qualification to reach the higher level. This can be corroborated by the degree of satisfaction reported by the survey participants, which, on average, is above 65% (counting those who scored from average onwards): Electromechanics, IT and Mining with High satisfaction at 66.7%, 52, 6% and 47.4%, respectively (SANTOS *et al.*, 2018).

Santos *et al.* (2018) found that there is low employability for the technical areas surveyed and that one of the aspects that may explain this is the weak articulation of partnerships to link young people to their first job: “Such initiatives need to be carried out in partnerships between Federal Institutes, local productive arrangements and other public and private agents” (SANTOS *et al.*, 2018, p. 78, our transaltion). From this perspective, the need for public state intervention appears again to articulate and create markets in the peripheral regions of large centers, as recommended by Mazzucato (2014).

Regarding the research carried out by the Instituto Federal Catarinense (IFCatarinense) campus Videira, it should be clarified that the research is part of an institutional program for mapping graduates of the campus. This means that the results are, for the most part, general, without being funneled to the situation of graduates in the area of Informatics and without separation by level of education. In this report, the research involved graduates of technical and lato sensu postgraduate courses offered by the Videira campus, and who joined the institution in the years 2010 to 2013 (ROSTIROLA; OLIVEIRA, 2017). The Videira campus is located in the city of the same name, 415 kilometers from the capital Florianópolis and has a population of approximately 53,000 inhabitants.

Of the 405 graduates invited to respond to the survey, 34% agreed to participate, with more than 40% graduated from technical courses. Of the total sample, 55% claimed to be working in the area, totally or partially (ROSTIROLA; OLIVEIRA, 2017). In addition, 81% said they were satisfied with their professional activities and more than half (59%) said they work in the city of the campus where they studied. Thus, the authors conclude that the IFCatarinense campus Videira offers courses in line with regional demand and the objectives of federal institutes. On the other hand, it is evident that of the 55% who work in the area of formation, only 38% said they were totally in that area, which makes it possible to infer that employability was treated in a broad sense. Along these lines, there may be questions about the relationship between training offered and local employability (FERNANDES, 2012).

Another important finding was that more than 63% of graduates at a technical level went on to a higher education course, which led Rostirola and Oliveira (2017) to also confirm the contribution of formation to academic ascendancy. Similar to the case of Currais Novos, despite both being far from their capitals, the graduates of the Videira campus showed good integration in the market and school advancement.

As for the research carried out by the Federal Center for Technological Education of Rio de Janeiro (CEFET-RJ), carried out with graduates from the year 2012 of the courses at the Maracanã Unit, without separation by level of education. 524 graduates were invited via e-mail. The total survey sample consisted of 342 respondents who accepted such an invitation, representing 65.27% of the total number of graduates (GUIMARÃES; SALLES, 2014).

Guimarães and Salles (2014) noticed that of the 57.6% of graduates who were working, 52% were in their area of formation, with 54% working with a formal contract. In addition, more than 83% said they were satisfied or very satisfied with the formation area and 75% said they would be interested in taking other courses at the school, especially if there was an exclusive selection process for former students.

An important aspect that appeared in the research by Guimarães and Salles (2014), due to having companies in the region in their field of research, was the fact that they declare that they are interested in accessing an institutional database of the school in question to analyze profiles in function of possible hires, since they analyze the hired graduates and consider the formation received at CEFET-RJ as excellent.

As for the research carried out with graduates of the Computer Technician course by the Youth and Adult Education Program (PROEJA) of the Instituto Federal Sul-Rio-Grandense (IFSULRS), Charqueadas campus, it was qualitative research (NUNES, 2011). Charqueadas is a city that is part of the metropolitan mesoregion of Porto Alegre, located 60 kilometers from this capital, and has approximately 38,000 inhabitants.

Nunes (2011) noticed that 73% of graduates work, however most are outside the area of technical formation. The graduates interviewed in this research reported that "they understand that despite the demand for services, there are few job opportunities, especially formal ones" (NUNES, 2011, p. 109, our translation). They clarify that many companies outsource their hardware and software maintenance demands to other companies in the region.

Nunes (2011) also interviewed managers of the Charqueadas campus and the course coordinator, who corroborated the testimonies of graduates, explaining that this lack of formal jobs in the city was one of the reasons for the course's termination. These managers report that the few job demands in the IT area refer to independent service provision activities, that is, as self-employed. In this sense, it emerged from the speeches that the dissemination of work as a self-employed person, via social networks, greatly influenced the insertion in the job market in the area of Informatics.

It is inferred from the aforementioned reality that the intervention of the public power is necessary for the creation of markets, as asserts Mazzucato (2014), and it is necessary to review the courses that have been offered and where, therefore, resuming Cazarotti and Bernardes (2018, p. 1026), the "Brazilian university needs to be careful not to be placed on the sidelines of social, political and economic processes, focused only on its internal objectives, oblivious to the needs and claims of the population". The combination of these two actions can lead to local development, promoting the de-agglomeration of large centers.

The perception that there are few formal jobs needs to be evaluated from several aspects, among them, at least, the action of the local public power articulated with the regional one to create markets that involve and distribute technological centers of the State, for example, Porto Alegre is one of the Brazilian cities that most concentrates companies in

the field of digital technology (JORNAL DO COMÉRCIO, 2020). This shows that intense local public action creates markets. On the other hand, if there is no intervention by a broader public power, this local concentration prevents distributed development. For example, what are the conditions of fast public transport for graduates in the area of Informatics to go to work in the capital? Or why not create these markets outside the capitals as well? These issues prevent the much talked about local and regional development, keeping it in large centers. In this sense, it contributes little to the formation of people in the interior of the country, because markets that generate jobs have not been created in these places. As Mazzucato (2014, p. 48-51, our translation) explains, instead, a

> directed, proactive, 'entrepreneurial' state, capable of taking risks and creating a highly articulated system that takes advantage of the best of the national private sector in a medium and long-term horizon. It is the State acting as the main investor and catalyst, which awakens the entire network for action and dissemination of knowledge. The State can and does act as a creator, not as a mere facilitator of the knowledge economy. […] The state is behind most technological revolutions and long periods of growth. This is why an 'Entrepreneurial State' is needed to take the risk and create a new vision.

Santos (2015, p. 7, our translation), based on Mazzucato (2014), adds:

> the transition in technological infrastructure, however, implies enormous costs. The market will not do it on its own, which makes an active role for the State essential. […] The private sector will only get involved effectively after the levels of risk and uncertainty are suppressed or, at least, significantly minimized, so that private investments have a more stable scenario for the return on investments. The State's leadership is expressed through public policies and investments aimed at the formation of knowledge, opportunities and stability required by actors working in the economic field.

Thus, the "State also needs to command the process of industrial development, creating strategies for technological advancement in priority areas" (MAZZUCATO, 2014, p. 71).

An important aspect highlighted by those who got formal employment in the area of formation was that such hiring occurred as a result of the internship period during the course. Thus, the lack of internship in a business environment not only affects formation, but the insertion of the professional in the formation area, feeding informal opportunities and without an employment relationship.

As for the predominance of job opportunities without an employment relationship, it is necessary to reflect, again, in relation to the totality of public actions with a view to social

transformation. If, on the one hand, there is a demand that is considered low, that is, only to meet what already exists in the market, it may need to be rethought, since public educational institutions, especially federal institutes, have, in their objectives, a strong appeal for local and regional development.

Nunes (2011) brings up an old and, at the same time, contemporary question: the area of Informatics, in Brazil, is not intended only for those with diplomas or certificates to do so. There are professionals who work based on their experiences and self-taught studies, which "further complicates the universe that characterizes the job market for this professional" (NUNES, 2011, p. 116, our trnaslation).

In view of this reality, combined with the low formal offer and greater performance as an autonomous professional, it becomes relevant to include content related to entrepreneurship for micro and small entrepreneurs in the training of information technology professionals.

Fernandes' (2012) research, carried out with 61 graduates of the Technological course in Systems Analysis and Development at the Federal Institute of Goiás, Urutaí campus, corroborates Nunes' (2011) questions regarding the potential for employability with local and regional development. Urutaí has just over 3,000 inhabitants and is located 170 kilometers from the state capital, Goiânia. It is located between Ipameri and Pires do Rio, which have 27,000 and 31,000 inhabitants, respectively.

Of the 61 egresses participating in the research by Fernandes (2012), 50.82% reported that they work in a municipality with a distance of up to 50 km from Urutaí, which can be represented mostly by the municipalities of Ipameri and Pires do Rio, which are the two larger cities within this radius and total 69.23% of the places of residence of such participants.

This finding, on the one hand, may indicate the institution's strategic role in its role of offering professional qualification courses in the region and, therefore, contributing to the establishment of graduates in the area. In general, there was a high rate of employability of graduates who graduated from the school in question, approximately 93.84%. However, it was also verified that only 29.51% carry out activities intrinsic to their area of technological formation. For Fernandes (2012, p. 191, our translation), these results allow "questioning the scope of the employability proposal, present in pedagogical discourses, public policies and the world of work".

Furthermore, it is relevant to note that 38.89% of the subjects surveyed reported residing in another state or country, being those who followed a career in the area of formation and had the highest salaries (FERNANDES, 2012). Therefore, "it is necessary to

relativize the discourses on the offer/demand of qualification x employability in this area" (FERNANDES, 2012, p. 188, our translation) since the employability rates are lower when the data of the municipality where the course is offered are crossed with information on where most graduates managed to pursue a career and settle down.

Regarding the research carried out with graduates of higher education, the investigation by Alkmin and Heijmens (2016) with graduates of the technological course in Systems Analysis and Development (ADS) was carried out in three different campuses in the interior of Minas Gerais: Bambui, Uberaba and January A total of 311 graduates who graduated between 2006 and 2013 were interviewed.

Alkmim and Heijmens (2016) noticed that almost 81% of graduates from the three campuses carry out their professional activities in the area of computing. It is important to note that "most graduates did not migrate to other states after completing their technological degree, that is, 88.71% carry out their professional activities in Minas Gerais" (ALKMIM; HEIJMENS, 2016, p. 2100, our translation). More than 50% of graduates from each campus are employed in their mesoregion, with emphasis on the Uberaba campus, which retained all respondents. Thus, more than half endorse satisfaction with the course.

Bambuí was the campus with the lowest retention, close to 50%. It is a municipality with approximately 23,000 inhabitants and an agricultural economy, mainly linked to mineral production, production of corn, coffee, soy, sugar cane, alcohol and sugar mill, milk and meat production (PREFEITURA DE BAMBUÍ, 2020).

The Januária campus is located in the north of Minas Gerais, approximately 580 kilometers from the capital Belo Horizonte. The city of Januária has around 70,000 inhabitants and an economy based on agriculture and livestock with strong production of sugar cane and derivatives. It has well-developed commercial centers and services sector, in addition to tourist investments and economic activities linked to mining companies in Minas Gerais (FRANÇA; SOARES, 2011). In addition, it is considered a university city with public and private institutions that seek to establish partnership relationships for research and development, mainly in areas linked to the activities of the municipality. These characteristics indicate that, despite its small population, the municipality has a political economic movement and relationships with university educational institutions that feed its micro-region, and these aspects are one of the explanations for the retention of its graduates in computing at just over 62%.

The Uberaba campus had the lowest unemployment rate in its mesoregion and the highest average salary for higher education. This can be explained by its location in the

Triângulo Mineiro, a region with many industries, agriculture and plants that employ high-level technologies and are concerned with sustainable implementations (BRASIL, 2019). In addition, Uberaba was considered the 2nd smartest and most connected city in Minas Gerais and the 6th most efficient in generating startups (ABSTARTUP, 2018). The particular analysis of the municipality in relation to its economic and social totality needs to be deepened, but these basic data show that there is a strong relationship between employability and investment in technologies, as explained by Mazzucato (2014), when addressing economic development driven by investments in technology and innovation to generate jobs and income.

The research developed by Ieger (2014) collected information from 66 graduates of a technological course in ADS at the Federal University of Paraná, graduated between 2004 and 2013, in Curitiba. More than 75% considered their higher education very important to be employed in their current position, stating their satisfaction. Around 25% already worked in the area before college and 50% were hired during the internship. Through this research, it was also noticed that 92% of the jobs were in small and medium-sized companies with Legal Entity contracts and other types of autonomous work prevail.

The high employability of the Curitiba region for the IT area can be explained by the existence of a technology park that at that time, 2014, had 24 companies in the Software park (IEGER, 2014), corroborating, once again, Mazzucato's thesis (2014), as the region invests in creating an innovation market and has produced employability in the formation area, which also endorses the role of the institution promoting formation (FERNANDES, 2012).

Despite the high potential for employability perceived in the region of Curitiba, the predominance of hiring for different types of autonomous service contracts in small and medium-sized companies caught the attention of researcher Ieger (2014) because it is not considered a formal job in terms of labor rights. However, the researcher explains that this may reflect the high need for qualified professionals who are difficult to find in the IT field (SOFTEX, 2013), which, on the other hand, raises hiring values; or, yet, it may be because large companies better hire more specialized professionals (IEGER, 2014).

As for the research carried out with graduates of Teaching Degree in Computing, the one carried out with graduates of the University of Brasília (UNB) (PINHEIRO, 2017) perceives high employability, but, on the other hand, opportunities that are not linked to teaching. The Federal District has large companies in the area of Informatics and in other areas, but which, in any case, have consolidated departments in that area, which explains the employability of all graduates in companies in the field. Salaries above the average of

4,000.00 reais, together with the feeling of security in relation to the job, lead the participants to reaffirm their satisfaction with the formation. However, those who would also like to work in teaching emphasize that it is essential to advance public policies to encourage the Teaching Degree in Computing.

The participants in the research by Pinheiro (2017) reinforce the testimonies of the Curitiba reality, saying that in their companies, regularly, there are open positions in the IT area that are not easily filled, remembering that 50% of them were hired right at the end of the internship.

Luciano and Santos (2013) researched graduates of the Teaching Degree in Computing at the State University of Paraíba, Campina Grande campus. This city has approximately 410,000 inhabitants and is located 133 kilometers from the state capital, João Pessoa. The 74 graduates of the course until 2012 were invited via e-mail. There was a return of 47 of them, which represented a sample of 64% of the guests.

The data revealed that only 3% of the graduates do not work in any area related to technology or education, with Informatics in Education, Educational Games and Distance Education being the most cited fields of work with 23%, 17% and 16%, respectively. In addition, it was possible to perceive that none of the participants was unemployed, 28% had an income above four minimum wages and 73% said they were satisfied or very satisfied with their work (LUCIANO; SANTOS, 2013). Unlike the case of UNB, there was high employability in the area of Teaching in Computer Science in the region of Campina Grande.

Final considerations

The mapping of surveys carried out with graduates of Informatics courses reported here were analyzed and discussed under scientific criteria and, from this, it was possible to perceive some characteristics regarding the relationship between the employability of such graduates and the region where it is offered:

- In cities with less than 70,000 inhabitants, job opportunities are more linked to technical assistance for computers and, in some cases, implementation and maintenance of small-scale computer networks;
- Jobs related to the areas of software development, those linked to the software industry responsible for the production of new products and their added services, are mostly

in large economic centers, that is, in capitals or cities with a high rate of economic movement from midsize companies onwards;

- Cities located further inland, when there are investments in industrial fabric and technological development, even though they are small, present more and better job opportunities;
- The internship is, in more than 50% of cases, the main point of hiring for the first job.

Confronting trends with the objectives of educational institutions to contribute to the strengthening of regional development, especially when it comes to a federal institute, offering courses focused on technical formation in networks and computer assistance, in part, serves the local market of inner cities. On the other hand, it contributes little to the regional expansion of economic activities, as they do not generate new products and services. In addition, the provision of maintenance services has been through autonomous services.

Most companies in less industrialized regions interested in regional research and development are micro and small companies and, in this category, there are few job opportunities and even less with formal registrations. Thus, the deviation from the formation area is greater for those who remain in the city, when it is small and has a low level of technological and industrial investment.

It is evident that the offer of training alone does not generate wealth or significant local transformation, although it contributes to the professional qualification of the local workforce. Contradictorily, this brings a disadvantage to those coming from smaller, less industrialized cities: with the high number of qualified people and few job opportunities, salaries remain low, favoring companies that hire a better qualified employee for lower prices (IEGER, 2014).

The formation offered at institutions in the interior is of high quality, as those who wanted to deepen their careers migrated to capitals or other regions with technological centers and are employed. Thus, from the formative point of view, the researched educational institutions provide free and quality education, but their isolated action from the local and regional government greatly reduces the transformative potential, because either the graduates will migrate or just feed the existing system. From the point of view of the educational institution, a dilemma is presented: Offer formation only according to existing demand? What about the generation of development and local wealth?

It was also observed, even in the places indicated as low employability, that the graduates are satisfied with the formation they received during the technical course or higher. As for personal transformation, they highlight several points such as cultural enrichment and interpersonal skills, which they recognize as a differential for the job they have won.

If, among the objectives of the educational institution, there is an intention to contribute to local and regional development in a transformative way, including to try to retain graduates in the interior regions, other forms of investment are essential, for example, investment in research and innovation even in small businesses, public-private partnerships and effective state and municipal action regarding the creation and attraction of industries that constantly aim at sustainable technological development, outside the capitals, which means forming mini-technological centers spread across the states.

Regarding public-private partnerships, what happens are high public investments to create markets in connection with research and innovation, but with little or no requirement for counterparts from private companies. It is lacking, on the part of public leaders, to better think about the geographical and categorical distribution of these investments and the fulfillment of counterparts, on the part of private companies, for the regions that provide the subsidies. In this way, the investment is of a different nature for each party, but it is shared, making the region reap the benefits as well.

Although, in most cases, qualification has led to employability, this needs to be questioned within the social totality, because, despite the propagated idea that the information technology area is promising and that there is a shortage of qualified labor, there is skilled professionals who are unemployed or completely outside the area of formation. These cases, not coincidentally, are located in small towns with low technological industrial development. It is concluded, therefore, that the analysis of employability confronted with professional formation necessarily needs to consider socioeconomic, political and geographical factors. From the point of view of social contribution to local and regional development, in conjunction with professional qualification institutions, there must be the corresponding public action to create markets.

ACKNOWLEDGEMENTS: To the IFG, for supporting the development of research and promoting scientific dissemination.

REFERENCES

ABSSTARTUP. **O momento da startup brasileira e o futuro do ecossistema de inovação**, São Paulo, SP: Absstartup e Accenture. 2018. Available: https://abstartups.com.br/PDF/radiografia-startups-brasileiras.pdf. Access: 18 July 2020.

ALKMIN, G. V.; HEIJMANS, R. D. Empregabilidade dos egressos tecnólogos do curso de Análise e Desenvolvimento de Sistemas nos institutos federais mineiros. *In:* WORKSHOP SOBRE EDUCAÇÃO EM COMPUTAÇÃO – WEI, 24., 2016, Porto Alegre. **Anais** [...]. Porto Alegre, RS: Sociedade Brasileira de Computação, 2016. p. 101-110. Available: https://sol.sbc.org.br/index.php/wei/issue/view/508. Access: 22 June 2020.

BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. **Levantamento sobre produção agrícola municipal**. Brasília, DF: MAPA, 2019.

BRUNO, L. Educação e desenvolvimento econômico no Brasil. **Rev. Bras. Educ.**, Rio de Janeiro, v. 16, n. 48, p. 545-562, dez. 2011. DOI: https://doi.org/10.1590/S1413-24782011000300002

CARDOSO, P. P. **Empregabilidade dos egressos**: a educação profissional integrada ao ensino médio no extremo norte da Amazônia. Tese (Doutorado em Sociedade e Cultura da Amazônia) – Universidade Federal do Amazonas, Manaus, 2018.

CASTELLS, M. **A sociedade em rede**. 8. ed. São Paulo, SP: Paz e Terra, 2000. v. 1. Available: https://perguntasaopo.files.wordpress.com/2011/02/castells_1999_parte1_cap1.pdf. Access: 18 Aug. 2020.

CAZAROTTI, M. L. B.; BERNARDES, S. T. A. Cursos superiores de tecnologia: fundamentos, controvérsias & desafios. **Revista on line de Política e Gestão Educacional**, Araraquara, v. 22, n. 3, p. 992-1046, set./dez. 2018. e-ISSN:1519-9029. DOI: https://doi.org/10.22633/rpge.v22i3.11368

COSTA, R. L.; LIBÂNEO, J. C. Educação profissional técnica a distância: A mediação docente e as possibilidades de formação. **Educação em Revista**, Belo Horizonte, n. 34, 2018. DOI: https://doi.org/10.1590/0102-4698180600

COSTA, R. L.; SOUZA, M. A. R.; THEREZA JÚNIOR, A. H. Materialismo histórico-dialético em pesquisas em informática na educação. *In*: JAQUES, P. A. *et al.* (Org.). **Metodologia de pesquisa científica em informática na educação**: abordagem quantitativa. Porto Alegre, RS: SBC, 2020. v. 2. (Série Metodologia de Pesquisa em Informática na Educação). Available: https://metodologia.ceie-br.org/livro-3/. Access: 14 Aug. 2020.

DERMEVAL, D.; COELHO, J. A. P. M.; BITTENCOURT, I. I. mapeamento sistemático e revisão sistemática da literatura em informática na educação. *In*: JAQUES, P. A. *et al.* (Org.). **Metodologia de pesquisa científica em informática na educação**: abordagem quantitativa. Porto Alegre: SBC, 2020. v. 2. (Série Metodologia de Pesquisa em Informática na Educação). Available: https://metodologia.ceie-br.org/livro-2. Access: 14 Aug. 2020.

FERNANDES, J. C. C. **Educação tecnológica e empregabilidade**: revelações de egressos. 2012. Tese (Doutorado) – Departamento de Educação, Pontifícia Universidade Católica de Goiás, Goiânia, 2012.

FRANÇA, I. S.; SOARES, B. Rede urbana regional: uma reflexão sobre as interações espaciais existentes entre a cidade média de Montes Claros e os centros emergentes de Pirapora, Janaúba e Januária no norte do estado de Minas Gerais, Brasil. *In*: ENCUENTRO DE GEÓGRAFOS DE AMÉRICA LATINA – EGAL, 13., 2011, Costa Rica. **Anais** […]. Costa Rica: Universidad de Costa Rica, 2011. Available: http://observatoriogeograficoamericalatina.org.mx/egal13/Geografiasocioeconomica/Geografiaurbana/092.pdf. Access: 15 Aug. 2020.

GUIMARÃES, M. A. M.; SALLES, M. T. O acompanhamento de egressos como ferramenta de inserção no mercado de trabalho. *In*: CONGRESSO NACIONAL DE EXCELÊNCIA EM GESTÃO, 10., 2014, Rio de Janeiro. **Anais** [...]. Rio de Janeiro, RJ: Inovarse, 2014. Available https://www.inovarse.org/node/2253. Access: 24 Aug. 2020.

HULLEY, S. B. *et al*. **Delineando a pesquisa clínica-4**. Porto Alegre, RS: Artmed, 2015.

IEGER, E. M. **Da qualificação ao mercado de trabalho**: um estudo de caso com egressos de um Curso Superior de Informática no Paraná. 2014. Dissertação (Mestrado) – Setor de Ciências Humanas, Universidade Federal do Paraná, Curitiba, 2014.

JORNAL DO COMÉRCIO. **Multinacional alemã Basf estuda implantar Centro Tecnológico em Porto Alegre**. 20 nov. 2019. Available: https://www.jornaldocomercio.com/_conteudo/economia/2019/11/713059-multinacional-alema-basf-estuda-implantar-centro-tecnologico-em-porto-alegre.html. Access: 23 Aug. 2020.

LUCIANO, A. P. C.; SANTOS, A. A. Caminhos do Licenciado em Computação no Brasil: Estudo de Mercado a Partir de uma Pesquisa com Egressos. *In*: CONGRESSO BRASILEIRO DE INFORMÁTICA NA EDUCAÇÃO (CBIE), 2.; SIMPÓSIO BRASILEIRO DE INFORMÁTICA NA EDUCAÇÃO (SBIE), 24., 2013, Campinas. **Anais** [...]. Campinas, SP: UNICAMP, 2013. Available: https://www.br-ie.org/pub/index.php/sbie/article/view/2530. Access: 23 Aug. 2020.

MACHADO, A. S. **Acompanhamento de egressos**: caso CEFET/PR – Unidade Curitiba. 2001. 150 f. Dissertação (Mestrado em Engenharia de Produção) – Departamento de Pós-Graduação, Universidade Federal de Santa Catarina, Florianópolis, 2001.

MACHADO, L. R. S. **Educação e divisão social do trabalho**: contribuição para o estudo do ensino técnico industrial brasileiro. 2. ed. São Paulo, SP: Cortez, 1989.

MAZZUCATO, M. **O estado empreendedor**: desmascarando o mito do setor público x setor privado. São Paulo, SP: Portfolio-Penguin, 2014.

NUNES, P. S. **Em busca do "tesouro"**: inserção profissional e inclusão digital nas trajetórias de egressos/integralizados de um curso de Técnico em Informática – PROEJA. 2011. Tese (Doutorado em Educação) – Universidade do Vale do Rio dos Sinos, São Leopoldo, 2011.

PINHEIRO, L. J. M. **Estudo com egresses da Licenciatura em Computação da Universidade de Brasília**: as influências do curso na vida profissional e pessoal dos ex-alunos. 2017. 63 f. Monografia (Trabalho de Conclusão do Curso de Ciência da Computação) — Universidade de Brasília, Brasília, 2017.

PREFEITURA DE BAMBUÍ. **Dados gerais do município de Bambuí**. Página atualizada em 2020. Available: https://www.bambui.mg.gov.br/dados-gerais. Access: 28 Aug. 2020.

ROSTIROLA, S. C. M.; OLIVEIRA, R. **Programa de mapeamento de egressos relatório 2015-2016 do Instituto Federal Catarinense – Câmpus Videira**. Videira, SC: Instituto Federal Catarinense / MEC, 2017. Available: http://videira.ifc.edu.br/wp-content/uploads/2015/11/relat%C3%B3rio-egressos.pdf. Access: 23 Aug. 2020.

SANTOS, L. **A capital da inovação**: arranjos institucionais do empreendedorismo inovador no polo tecnológico de Florianópolis. Tese (Doutorado) – Centro de Filosofia e Ciências Humanas, Universidade Federal de Santa Catarina, Florianópolis, 2017.

SANTOS, L. B. Resenha de O Estado empreendedor: desmascarando o mito do setor público vs. setor privado. **Publicações do Núcleo de Sociologia Econômica (NUSEC)**, 2015. Available: https://nusec.paginas.ufsc.br/files/2015/04/Leandro-resenha-MAZZUCATO.pdf. Access: 27 Aug. 2020.

SANTOS, M. R. P. *et al.* Itinerários dos egressos do nível Médio Integrado, IFBA - Campus Jacobina. **Ensino em Foco**, v. 1, n. 2, 2018. Available: https://publicacoes.ifba.edu.br/index.php/ensinoemfoco/article/view/486. Access: 23 Aug. 2020.

SAVIANI, D. Trabalho e educação: fundamentos ontológicos e históricos. **Revista Brasileira de Educação**, v. 12 n. 34 jan./abr. 2007.

SOFTEX. Associação para promoção da excelência do software brasileiro. **Overview do setor de tecnologia da informação brasileiro nos últimos dez anos**. Campinas, 2019. Available: https://softex.br/inteligencia/#toggle-id-3. Access 09 June 2020.

SOFTEX. Cadernos Temáticos do Observatório da Associação Para Promoção da Excelência do Software Brasileiro. **Software e Serviços de TI**. Campinas, 2012. Arquivo eletrônico. Available: https://www.softex.br/inteligencia/#cadernostematicos. Access 09 June 2020.

SOFTEX. Cadernos Temáticos do Observatório da Associação Para Promoção da Excelência do Software Brasileiro. **Mercado de Trabalho e Formação de Mão De Obra em TI**. Campinas, 2013. Available: https://www.softex.br/inteligencia/#cadernostematicos. Access 09 June 2020.

VIEIRA, M. S. O. C.; GOMES, D. C.; SILVA, J. M. T. O papel do Instituto Federal de Educação, Ciência e Tecnologia (IFRN) para a qualificação e empregabilidade: um estudo dos egressos do curso de informática do IFRN em Currais Novos/RN. **HOLOS**, ano 27, v. 1, 2011.

How to reference this article

COSTA, R. L. Systematic mapping of scientific literature on technical and superior computing courses and employability. **Revista on line de Política e Gestão Educacional**, Araraquara, v. 25, n. 3, p. 2673-2696, Sep./Dec. 2021. e-ISSN:1519-9029. DOI: https://doi.org/10.22633/rpge.v25i3.14353

Submitted: 14/08/2021
Required revisions: 20/09/2021
Approved: 15/11/2021
Published: 08/12/2021