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Submitted: 20 Jul 2020

Accepted: 30 Jan 2022

Published: 10 Agu 2022

[doi> 10.20396/riesup.v9i0.8660655](https://doi.org/10.20396/riesup.v9i0.8660655)

e-location: e023013

ISSN 2446-9424

Antiplagiarism Check



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Biomedical Engineering: Professional Choice and Teaching Trajectories¹

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ABSTRACT

Biomedical Engineering (EB) is a recent field in Brazil, a field of possibilities for professionals in Exact Sciences and Health. Undergraduate courses in EB started in the country in the 2000s and many teachers are still from different areas of knowledge. The aim was to get to know the profile and choice process of EB teaching professional. Qualitative study with a biographical-narrative approach. Eleven teachers of the EB course participated in the study, three women and eight men, from a university in the São Paulo. Sociodemographic and training data were obtained on the Lattes platform and confirmed during an interview based on the guiding question about choice and professional trajectory. Interview conducted in two moments, the report being free and feedback of the content produced. Recorded reports, transcribed and organized in biograms, allowing identification of moments that influenced the professional choice. Teachers were given pseudonyms, for their anonymity, had diversified academic backgrounds, were doctors, mostly male, average age of 43 years and teaching career time 9.3 years. Several teachers paths led to EB, career choice and possibilities for professional performance. Some people and events promoted proximity to the area. Despite not being the group's first career choice, EB proved to be an option and opportunity for professional performance. It is important to expand reflection on professional choice and training in EB, in order to promote, stimulate and share alternatives that contribute to the promotion and expansion of knowledge and favor the training of new professionals.

KEYWORDS

Higher education. Biomedical engineering. University professors. Professional choice.

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Engenharia Biomédica: Escolhas Profissionais nas Trajetórias Docentes

RESUMO

Engenharia Biomédica (EB) é área recente no Brasil, campo de possibilidades para profissionais das Ciências Exatas e Saúde. Cursos de graduação em EB iniciaram no país nos anos 2000 e muitos docentes ainda são de diferentes áreas do conhecimento. O objetivo foi conhecer perfil e processo de escolha profissional docente na EB. Do estudo, qualitativo e com abordagem biográfico-narrativa, participaram 11 docentes de um curso de EB, três mulheres e oito homens atuantes em uma universidade do vale do Paraíba paulista. Dados sociodemográficos e sobre a formação foram obtidos na plataforma Lattes e confirmados durante as entrevistas do tipo reflexivas (SZYMANSKI, 2011). Foram realizadas em dois momentos, sendo no primeiro um relato livre e no segundo a devolutiva do conteúdo produzido. Os relatos, gravados, transcritos e organizados em biogramas (BOLIVAR, 2002), permitiram a identificação de momentos que influenciaram na escolha profissional. Os docentes entrevistados tinham formação acadêmica diversificada, eram doutores, majoritariamente do sexo masculino, média etária de 43 anos e tempo de carreira docente 9,3 anos. Diversos caminhos os levaram os docentes à EB, como a escolha da carreira e possibilidades de atuação profissional. Acontecimentos marcantes promoveram aproximação com a área. Apesar de não ter sido a primeira escolha de carreira, EB se mostrou como opção de formação e oportunidade de atuação profissional. Os resultados indicaram a importância de ampliar reflexão sobre escolha profissional e formação em EB, de forma a promover, estimular e compartilhar alternativas que contribuam para promoção e ampliação dos saberes e favoreçam a formação de novos profissionais.

PALAVRAS-CHAVE

Ensino superior. Engenharia biomédica. Professores. Escolha profissional.

Ingeniería Biomédica: Elección Profesional y Trayectorias Docentes

RESUMEN

Ingeniería Biomédica (EB) es un campo reciente en Brasil, lleno de posibilidades para profesionales en Ciencias Exactas y Salud. Los cursos de pregrado comenzaron en Brasil en la década de 2000 y muchos maestros aún pertenecen a diferentes áreas de conocimiento. El objetivo fue el conocimiento del perfil y el proceso de elección profesional en EB. Estudio cualitativo con enfoque biográfico-narrativo. Once profesores del curso de EB, tres mujeres y ocho hombres, de una universidad en el valle de Paraíba de São Paulo participaron del estudio. Los datos sociodemográficos y la capacitación se obtuvieron en la plataforma Lattes y se confirmaron en entrevista basada en la pregunta guía, realizada en dos momentos, por medio de la narrativa libre y la devolutiva del contenido producido. Informes grabados, transcritos y organizados en biogramas permitieron la identificación de momentos que influyeron en la elección profesional. Los maestros recibieron seudónimos, por su anonimato. Los docentes tenían antecedentes académicos diversificados: eran doctores, en su mayoría hombres, edad promedio de 43 años y tiempo de carrera docente de 9.3 años. Personas clave y eventos promovieron la proximidad a la EB. A pesar de no ser la primera opción de carrera del grupo, EB demostró ser una opción de formación y una oportunidad para el desempeño profesional. Es importante reflexionar sobre la elección profesional y la formación en EB, a fin de promover, estimular y compartir alternativas que contribuyan a la promoción y expansión del conocimiento y favorezcan la formación de nuevos profesionales.

PALABRAS CLAVE

Enseñanza superior. Ingeniería biomédica. Profesor de la enseñanza superior. Elección de carrera.

Introduction

Biomedical Engineering (BE) is based on Engineering and aims to find solutions for health-related areas, developing products and equipment that seek to provide better conditions of medical treatment and quality of life for people with physical needs (PEREIRA, 2012). It emerged after World War II (1945), in a period when modern technologies emerged in the field of Medicine, from the promotion of knowledge and the development of new products. Thus, BE generated the need to employ professionals able to deal with these new demands (PEREIRA; FRANÇA; BATISTA, 2012).

The professional with a degree in BE applies knowledge of Engineering, adding principles from the areas of Exact, Biological and Health Sciences. They work in the construction, development, and improvement of techniques, treatments, therapies, rehabilitation, and diagnostics, and the practical applications in the health field. It develops prostheses, medical instruments and diagnostic equipment and acts in clinics, hospitals, or universities, including in the research area (CARRASQUEIRO; VIEIRA, 2010; ENDERLE; BRONZINO, 2012).

BE is characterized by its various subareas, in which professionals have a high degree of specialization and training, working in the so-called "frontier knowledge", bordering and intersecting knowledge between areas of knowledge, which gives it an interdisciplinary character (CARRASQUEIRO; VIEIRA, 2010).

From the 1960s, in the United States, training courses in the area of BE began. Since its emergence until today, although 60 years have passed, this area is expanding. The academic training in BE was started in Brazil in the 1970s, but only in the 2000s it emerged as an undergraduate degree, although still in a reduced form in the number of trained professionals and courses offered (UFPE, 2010).

Brazil had, in 2012, a framework with 14 graduate courses and 10 undergraduate courses, data from the area document of the Coordination for the Improvement of Higher-Level Personnel (CAPES), a small number in relation to the other Engineering (CONFEA, 2016). Currently, according to the (SBEB), there are nineteen undergraduate courses in the area in Brazil (SBEB, 2020).

Since the academic training is so recent, many professionals who work in teaching in BE are graduated in different areas of knowledge, requiring the performance of qualified teachers for the dissemination of specific knowledge. Thus, the aim of this study was to understand the profile and the process of professional choice of teachers in BE.

The narrative biographical method proved to be pertinent to the knowledge of this process, as it allows, from the narratives, to build a knowledge through the analysis and significance of the investigated subjects' speech (BOLÍVAR, 2002), making it possible to

know the relations established in the individual and social dimensions in the transformation processes of the subject and its social space (HUBERMAN, 2000; BOLÍVAR, 2002).

The individual, as a singular subject, understands, interprets and means the individual and collective, subjective and complex experiences and, in the narrative of his own history, seeks to give meaning to his experiences, updating and re-signifying his worldview from his reports, which enables the understanding of the events experienced during life (SOUZA, 2007; PASSEGGI, 2011; DELORY-MOMBERGER, 2012).

It is in this context of narratives and experiences that this study was developed, in which 11 teachers of the bachelor's degree, with academic training in the areas of Engineering, Exact Sciences, Biological and Health, three women and eight men, from a Federal University located in the metropolitan region of Vale do Paraíba Paulista and northern coast participated.

A survey of socio-demographic data and a mapping of the academic backgrounds of the participants was conducted by consulting the curriculum on the Lattes Platform of the National Council for Scientific and Technological Development (CNPQ), in which academic data (undergraduate and graduate courses), institutions attended and year of course completion were searched. This survey allowed the preparation of the biographical-narrative interviews, of the reflective type, which were based on the following triggering question: Throughout life we build a professional path. Tell me about your professional and teaching trajectory.

Based on this question, presented at the beginning of the first meeting, the interviewed teachers told their stories, without establishing a sequence of facts or a defined chronology, as recommended by Szymanski (2011). The interviews were conducted in 2017 and took place in two moments. In the first meeting, a free account of the teachers' professional trajectories was sought, and in the second, there was feedback of the produced content, in which the teacher rearranged, ratified, rectified, or complemented the narrated remarkable events. At the end of the interviews, the recorded accounts were transcribed and organized into biograms, defined as chronological schemes representative of the participant's professional career. (Bolívar, 2002).

Based on the biogram model used by Sá e Almeida (2004), this methodological resource was organized in six columns that represented: the year of the event, the vital age, the professional age, (time of professional performance), the meaning given to each event and the column in which excerpts of the subjects' narratives were reproduced (SÁ, 2004). It is understood that the biograms were characterized as an excellent way to map the professional trajectories, allowing the identification of the key events that influenced the professional choice.

In the second meeting, the teachers received their biograms and, in a process of feedback on the content of the interviews, they could change, confirm, or complement the information collected in the first moment. Subsequently, the final versions of the biograms were prepared and superimposed, allowing the identification of similar aspects present in the teachers' trajectories, who received pseudonyms to ensure anonymity.

The study was approved by the Research Ethics Committee of the University of Taubaté (UNITAU) under number 1.685.686.

Results and Discussion: Getting to Know the Teachers' Trajectories

The teaching staff of the university participating in this study consisted of 101 (one hundred and one) professors distributed among the undergraduate and graduate courses taught by the institution. Of these, ninety-seven (97) were permanent, three were temporary, and one substitute.

The group of 11 (eleven) participants was formed by teachers with diversified academic backgrounds in the Exact, Biological, Health, and Engineering Sciences. They also had post-graduate education in the *lato sensu* (specialization) and *stricto sensu* (master's, doctorate, post-doctorate) levels.

It is worth mentioning that all the teachers were PhDs, and that four of them did their PhD internships abroad, which provided the exchange of in-depth knowledge in the research area. One professor did his entire PhD course abroad. The opportunity to study abroad favored a differentiated academic education, enriching the curriculum. During post-doctoral studies, six faculty members took courses in Biological Sciences and four in Engineering, two of whom took specific courses in BE.

The participants' training reflects the history of the development of BE in Brazil, an area in which there are still few teachers with degrees, since the undergraduate courses in BE in Brazil are mostly concentrated in the Southeast region of the country. Since the establishment of BE training, not only at post-graduate level, but also at undergraduate level, and with the increase in the offer of vacancies, the number of professionals trained in specific courses in the area has increased, as well as the knowledge of BE and its importance for the promotion of knowledge in the area of Health.

Regarding the period of training, two teachers started their degrees in the 1980s (considered the most experienced), six in the 1990s (mid-career), and three in the 2000s (beginners). Since in Brazil the undergraduate course in BE started in the 2000s, none of the teachers who had access to BE at the time of choosing the undergraduate course sought training in BE in graduate courses, both *lato* and *stricto sensu*.

Seven teachers were in the age range of up to forty (40) years, two between forty (40) and fifty (50) years, and two older than fifty (50) years. Eight were male and three were female, reaffirming Engineering as a predominantly male area. The female teachers in the group started their education in the 1990s and graduated in different areas: Health Sciences, Exact Sciences and Engineering. In common, they pursued *stricto sensu* courses in the areas of Biological Sciences and BE. In research on women who pursue engineering education, such as those developed by Saraiva (2008) and Morais and Cruz (2018), gender issues are highlighted, related to overcoming stereotypes, such as the idea that it is necessary for the female gender to make more effort to acquire knowledge and skills.

On the other hand, the social prestige attributed to the teacher is lower compared to more traditional professions such as Medicine, Law, Engineering, etc., and it is not uncommon to find professionals coming from different areas of training who teach and who identify themselves first with their basic training - engineers, physicists, physiotherapists, etc. - and only later as teachers, as Pimenta and Anastasiou (2002, p. 35) state when discussing the identity of the teacher in higher education. The exercise of teaching at this level gives greater status compared to teaching in basic education, despite not requiring specific initial training (MEDEIROS, 2007).

The considerations of these authors in relation to teaching can be applied to women trained in BE, as they are part of Engineering and are within a group with a predominance of males and of training in Exact Sciences and other Engineering. Thus, in higher education teaching, they would have a higher status in relation to the other levels.

The interviewees belonged to the teaching staff of a public institution, with equal access and an equal career progression. Teaching in higher education may eventually present a more flexible character, allowing the compatibility between career and personal life, since culturally women still have more responsibility in the performance of domestic issues. Although there has been an expansion movement for women in the engineering field, there are still well-defined spaces of performance and power.

In this sense, Lombardi (2006, p. 189), in a survey with 33 female engineers in the construction sector, points out that "the representations of the service sector emphasize the "relational" character of these activities in detriment of their technical content. [...]. For the author, "Brazilian female engineers seem to have taken good advantage of this gap authorized by the stereotype, to occupy spaces in the labor market". In relation to BE, there may be, implicitly, a link between the "relational" role of women and the choice of field of work, since the attribution of conceptions of the female role as the area relates to the Health and Biological Sciences in the development of solutions, equipment, therapies, and prostheses.

The Professional Choice Process

The choice of the undergraduate course proved to be important as it determined the transition to adulthood and the beginning of the world of work. This, however, is not a process free of interferences. In the choice of profession, characteristics such as aptitude, vocation, skills, social, cultural, economic, educational elements, and the historical moment also influence this choice (VALLE, 2006). Such elements were found in the teachers' narratives.

Cesare, a beginning teacher, graduated in Control and Automation Engineering, with a doctorate in Health, reported an aptitude developed since childhood in handling electronic equipment - a hobby - which manifested itself in his professional choice:

[...] I decided this course because I always liked to work with Robotics, since before graduation... and I always liked to work with programming... I have always been a programmer... even before college... so I already had something in mind in the Exact area... Mechatronic Engineering came because at that moment it seemed interesting to me since it directly involved Robotics. (Cesare)

The dispositions, representations, and experiences acquired prior to the choice process brought the desire to develop activities that would not only guarantee remuneration but would also be a source of satisfaction.

Alan, a physicist with a doctorate in Biological Sciences, also reported that the choice for the area was due to taste and affinity:

[...] the first interest was more basic science...let's say, this motivation to deal more with these more basic questions of nature and that involved more mathematics. (Alan)

For Rachel, a physical therapist with a master's and PhD in Biomedical Engineering, the dispositions about the profession she would like to follow were not strong enough to be maintained. Despite her liking for engineering, she did not recognize herself in her work as an engineer, and ended up opting for the health area, graduating in Physical Therapy:

[...] I had a doubt... if I would do the health area or if I would do the Engineering area, because I liked Exact Sciences a lot, but at that time I didn't see myself in Civil Engineering, in Electrical Engineering. (Rachel)

The expectations regarding the professional future are full of feelings, hopes, and insecurities, not only for the young people, but also for those who live with them, usually related to the fulfillment and happiness that the profession can make possible. Projecting the future can become difficult for those who find themselves in this decisive moment.

The family, as the primary group of socialization, exerts influences that show themselves as a set of dispositions and references that reproduce family expectations, such as the father's and mother's desires to see their son as a doctor, writer, engineer, lawyer, etc., as

well as the son's desires to see himself - mirrored in his mother, father, uncle - as a future architect, lawyer, administrator, etc. (LAHIRE, 2015). This is the case of Gregor, who has a degree in Biological Sciences and a PhD in Biomedical Engineering and based his choice of degree on family references:

[...] I really wanted to be like him [uncle], to have the routine that he had... I did not even know what Biochemistry was, really... I chose for him. [...] and I chose Biochemistry, I wanted to study it, I wanted to be like him, I had a lot of admiration. (Gregor)

When reporting his uncle's lack of knowledge about his area of activity, Gregor expressed his desire to "be" like him. The representation could not only be associated to the profession, but also to the ideal of life to be followed. Only at the effective moment of the choice, about to enroll in the vestibular, Gregor became aware of the profession and realized that it was not what he wanted, opting for the Biological Sciences course:

[...] that is Biochemistry, but I don't want it. [...] I didn't want that, and I put Pharmacy and Biological Sciences there. (Gregor)

In the same way, Ada, engineer, and PhD in Biological Sciences, when she chose Electrical Engineering, realized during the course that she lacked something that would bring her personal satisfaction, especially in relation to the expectations and projection of her future role in society. For her,

[...] it seemed that something was missing... I thought, I think I must do another college, it's not cool, I'll do something else. (Ada)

The search for satisfaction in the professional choice by the family may be the result of projections relived by parents, who see in their children the possibility of seeking alternatives and opportunities different from those they faced, overcoming frustrations, fears, doubts, and insecurities. Eventually, these dispositions may not meet the individual's desire, leading to conflicts of expectations between personal and family desires, which are reflected now of choice (SOARES, 2002). Thus narrates George, with undergraduate, master's, and doctorate degrees in Electrical Engineering:

[...] And then in my youth, when I went to take the vestibular, I had first decided to take Philosophy, but as always happens, I was persuaded by my parents, for the sake of the future. How was I going to support myself? So, I was strongly advised to take some traditional courses. (George)

The advice of George's family, besides the concern with professional and economic success, may have association with the conceptions of social environments with which he lived, which influenced the choices, expectations, conflicts, and ability to manage them (LOUZADA; SILVA FILHO, 2008).

Moreover, the differences perceived in society regarding prestige, social and economic valuation, can be activated or inhibited depending on the context in which they are presented. Eric, who has a PhD in Biological Sciences, when choosing to major in Physics, considered

his affinity with Electronics and Computer Science, areas he already knew. His mother's career proposals were also considered:

[...] the technical course in Electronics, I loved it, I liked it a lot, but before that, I already took a lot of computer courses, so I took all the programming courses.] When I was going to go to college, my mother would have wanted me to study architecture, design... then I looked around the region and people do not use it here as much, so I think it was a place that would suffer a little. So, I left the artistic side to do the exact side, which had these two things that I liked a lot. (Eric)

Although the processes of professional choice have greater influence of the family group, they are not restricted to it and suffer influences and pressures from secondary groups represented by teachers, friends, religion, sports, and others, with which the individual lives and assimilates dispositions (LAHIRE, 2015). This influence becomes clear in the speech of Marie, a physicist with a specialization in Science Journalism, a master's degree in Health Sciences, and a doctorate in Engineering. When narrating her choice to major in Physics, she highlighted the faculty members who influenced her:

[...] someone who motivated me... to leave school and start doing Physics were two professors, they were even retired at the time, they would go to school and invite the students who wanted to know the Physics laboratories. So, I went there to visit the labs. (Marie)

From the experience provided by the teachers at her school, Marie had the first contact with the area in which she would work. The opportunity to get to know how a physics laboratory works and the closer contact awakened her interest. The same occurred with Ada, who reported the disposition acquired through her high school teacher:

[...] In high school, in high school, I had a teacher who was very good, and she ended up motivating... I loved it, I thought it was beautiful, I loved her classes... So, the taste for Biology came up in high school classes, because there I was in doubt about what I wanted to do. (Ada)

The taste for Biological Sciences competed with Ada's inclination, since childhood, for the Exact and Engineering areas. At the moment of the choice, despite the doubt, the initial option prevailed: Engineering.

These acquired dispositions may vary according to the time and context to which people are exposed (LAHIRE, 2015; SOARES, 2002), such as the childhood wish of Nikola, an electronic engineer, with a master's and doctorate in Biomedical Engineering, whose initial dispositions changed during his journey:

[...] Initially I liked the Aeronautics area, but today I'm not doing any of that, it's not... but what I had in common between that childhood dream and what I do now, was you do two major areas of Engineering that was Mechanical and Electronics. (Nikola)

Nikola was exposed to other influences in the course of time, but some dispositions proved to be long-lasting as the maintenance of his preference for the Engineering area.

It can be observed in the reports, the various elements to which the individuals were exposed influenced their choice of profession. The professional choice is not a process that occurs suddenly, but is evolutionary and reflexive, permeated by feelings, expectations, and projections. The decision, however, is not definitive and is subject to new influences that affirm or transform the initial choice (SOARES, 2002).

In this sense, the interdisciplinary characteristics of training, in which subjects are presented to new fields of action and possibilities, points out that can promote professional mobility during the career, providing plurality of training and exercise of various professions during the trajectory (FAZENDA, 2011).

Despite being so unique, the reports show that the choice for teaching in the BE was made for different reasons, times, and means.

The professional choice for the BE area

The training of teachers in BE took place in the stricto sensu post-graduation, which influenced the development of professionals trained in the area over time, as it provided access to courses according to the training period. This was narrated by Alan, a mid-career teacher, when referring to his training and that of his colleagues:

[...] you don't find in professors, people who are biomedical engineers... they are physiologists, they are doctors, they are engineers in other fields... physicists... there are many physicists, so it is an area that you don't think: "I'm going to do Biomedical Engineering"... I didn't think at least in my generation. (Alan)

BE was still an unknown area around the 1990s and did not figure clearly among the possibilities of professional practice. As time went by, the courses became more accessible and reached other levels of education, as was the case of Artur, a beginning teacher, who started his studies around the 2000s.

He graduated in Electrical Engineering and was interested in BE right at the beginning of his education, although it was still little known. As he is from the younger generation, he had access to specific training courses in the area while still an undergraduate and decided to take a specialization course. The value of BE for the promotion of quality-of-life motivated Artur to seek more knowledge about the area.

[...] I was an undergraduate, but I was interested in that, to use all that knowledge of technology for the human part, to be able to create medical devices, this is very great, in my opinion it is very great... you can use technology to make weapons, you can use technology to increase the quality of life...increase your luxury and to supply basic needs in the Health area. (Artur)

Although BE did not figure as an option in the faculty members' undergraduate degrees, at one point it materialized as an alternative. Marie, in her narrative, showed that her approach to the area was initially due to her interest in the intersection between the Exact and Health areas and the possible applications that could arise from this union. It showed as a desire to act, although she didn't know about the existence of the BE area yet.

I went to do a research project on Experimental Optics... so I found it very interesting because it was a case of application of Physics in Medicine and then I became interested in looking for a research area that was related to Physics and Medicine, but at that time there was no Biomedical Engineering. (Marie)

For Marie, BE emerged as an alternative for applying the knowledge acquired in Exact Sciences. For the other teachers, the choice was related to opportunities to work in other areas. Ada, since she was a child, has shown interest in Exact and Health.

[...] I started to see that I could study Electrical Engineering, and then I could do post-graduation in the field of Biomedical Engineering... so I could combine the two things that I liked. (Ada)

BE also emerged as an alternative of continuing Rachel's career, who had few possibilities of continuing her studies in the stricto sensu in her area of education, since she had already expressed a desire to work in teaching and saw in BE a possibility:

[...] then I already did my master's degree in the area of BE, because at that time it was very difficult... there was only one master's and doctorate course in Physical Therapy in Brazil. So, people who finished Physiotherapy always did masters and doctorates in related areas, or they did them in the basic area. And then I found the B.Sc. interesting, because I thought: well, now I will be able to bring together what I liked before graduation...which would be Exact and Health. (Rachel)

George's choice for BE was linked to previous experiences that indirectly awakened his interest in the health area. The influence of family history was decisive for the choice:

[...] I don't know if because my grandmothers died very early, my grandmother died, both of them actually by medical error, so I always sought something of Medicine. [...] and then I glimpsed the possibility of entering the stricto sensu and working with something related to the medical field. (George)

Cesare was motivated to seek new knowledge and broaden his education by the influence of a co-worker. He opted for graduate courses related to "frontier knowledge", that is, at the intersection between areas of knowledge. He then discovered BE.

Nikola, from an early age, showed interest in biological areas, although his inclination was to become a professional in Engineering. During undergraduate studies, he had the opportunity to meet a professor in the biological area, which allowed him to approach BE, finding possibilities to apply his knowledge of Engineering in favor of health issues

[...] said that there was an area called BE that was exactly what I would like to do, he was my mentor. [...] I found out that it had a lot to do with solutions for the biological area and consequently the health area as a whole. (Nikola)

Alan, in a moment of career redirection, met a research group and opened himself to new professional opportunities, which culminated in the possibility of pursuing a PhD in BE.

[...] I ended up by chance falling into BE, quite by chance, "connections" like that. (Alan)

The engineers' choice of BE was influenced by multiple factors, reaffirming that everyone's choices are composed of a set of factors, according to the context in which they are inserted. (FERRETTI, 1992, BARTALOTTI; MENEZES FILHO, 2007). Thus, elements of affinity/interest in the area and the alternative/opportunity for professional performance were interrelated.

Teachers who were engineers did not attend a course in BE, and their training in the area resulted from a new option or professional resumption of factors, some of which were linked to external stimuli such as the greater number of vacancies offered, higher pay, professional status, practical work, etc.

In this sense, it is reaffirmed that the professional choice and/or the process of rechoosing does not happen without interference, since factors (political, social, economic, personal) influence individual choices. Moreover, in today's increasingly globalized world, the choice of profession is becoming less and less definitive. (SOARES, 2002; BARTALOTTI; MENEZES FILHO, 2007).

The constant changes in the world of work indicate that a larger number of people will undergo career transformations, related to adaptation to modern technologies and labor market policies, which makes continuing professional education as important as the initial one (DUBAR, 2012).

Satisfaction aggregates personal and contextual aspects, present in the lifelong learning process, involving identification and commitment to professional performance. The personal/professional dissatisfaction can be related to the change processes, such as the search for a new profession to meet the expectation regarding the future in the career (SILVA; CARNEIRO, 1993; HOTZA; LUCCHIARI, 1998). Negative feelings regarding satisfaction may also result from poorly made choices, which may lead to a professional review process (BARDAGI *et al.*, 2006).

Alternative and opportunity for professional performance, firstly, and affinity and interest in the area, secondly, defined the choice for the BE, elements that were also related to personal satisfaction, one of the most cited factors in relation to teaching in the area.

The interdisciplinary characteristic of BE encompasses and combines several areas and, consequently, expands the professional scope. This relationship is exemplified in the words of Ada, who, during the Engineering course, sought BE as an alternative activity, considering the affinity and interest that provided personal satisfaction.

[...] I ended up following Engineering, but then this doubt arose, is this what I want?
[...] I thought I had the BE course, in fact, I was always interested in the medical area, I always liked Biology. (Ada)

However, choices were not always defined by individual dissatisfaction or expectations, but were determined institutionally, as Nikola points out:

[...] what motivated me to go into teaching was an imposition of the university itself, you cannot be a researcher without being a teacher. They did not come to ask. [...] Today I see that if it were not mandatory for teachers to teach at school, I would have taught anyway, simply because that is where you are working with what matters. (Nikola)

Despite the different influences for individual choices, teachers defined what brought them the most personal/professional satisfaction. The career is shown as a socialization process, since the knowledge for professional performance is incorporated and produced by interactions with the various socializing elements (family, school, religion, sports, etc.) (TARDIF, 2010).

The professional choice process was permeated by several influences of the context and related factors, which interacted in defining the professional path. The influential elements in this choice were not always convergent, because every profession has positive and negative aspects, considered in greater or lesser intensity at the time of professional decision (SOARES, 2002).

The motivators in relation to BE presented themselves as an option of continuing or changing the career and teaching as an opportunity or option of professional performance. The teaching trajectories presented relevant elements in the process of career definition and construction of the professional path, and as in other professions, it was coated with representations and dispositions that acted consciously or not in the decision process, contributing to the construction of the trajectory (SOARES, 2002; LAHIRE, 2015).

Thus, the choices were influenced by people and events that represent significant and transformative milestones or experiences in the construction of the personal and professional trajectory.

Final Considerations

Although the history of BE is still recent in Brazil, its performance in a globalized and industrialized world is important in the development and application of technologies and more effective solutions in health treatments for society.

The narratives revealed a mostly male group. The female group, although a minority, finds space in the teaching of BE, especially because of the relational aspect's characteristic of the health area. Regarding education, they had diverse backgrounds, distributed among the areas of Engineering, Biological Sciences, and Health, with a greater concentration in the Engineering area.

The paths that led the teachers to the BE were diverse, as well as the motivations for the career. Although the professional choice has its apex now of entering undergraduate studies, the decision process started much earlier through primary and secondary socialization.

The socialization started in the family nucleus imposes a set of values and representations that are assimilated and carried by the individual, but which are not immutable. Thus, the reports showed that personal, family, group, social and economic factors with which the teachers had contact exerted influences in different scales in the professional choice processes. Personal encounters proved to be important events for the choice of a career in BE, in the same way that the doctorate and the teaching career stood out for their representativeness and importance for the group.

Despite the various influences on which the individuals were exposed over time, the personal element predominated over the others. This, at first, was justified by the search for an activity in which they manifested their affinity and interest, which proved to be one of the elements most valued by the group.

Considering that the teachers did not take a degree in BS, the training in the area was due to a new choice process for the continuation of the career, which may have been caused by the need for readaptation due to satisfaction or dissatisfaction, and/or the search for a new profession. Although the choice of profession is becoming less and less definitive nowadays, justifying the presence of the alternative/opportunity element, in BE they represent new possibilities of professional performance provided by the expansion process of the area. Moreover, throughout their trajectories, the teachers remained exposed to other elements even after entering the job market, which indicates that the choice was only the first step, and that from there on a range of possibilities and opportunities opened in the professional path.

The trajectories, therefore, presented relevant elements in the process of career definition and construction of the professional path, and, as in other professions, was coated with representations and dispositions. It is important to reflect on the training of these teachers

in order to promote, stimulate, and share alternatives that contribute to the promotion and expansion of pedagogical knowledge in Primary Education. This is an area that continues to expand rapidly and that the applied knowledge is important for the development of products, equipment, and policies employed in Health, providing improvements in the quality of life of the population in general.

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