

Building an Open Educational Resource: Have You Taken Care of Your Foot Today?—Self-Care of the Feet of People with Diabetes

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Open Access

Abstract

The use of educational resources as an integrative tool of health education for the prevention of diabetic foot facilitates the process of knowledge and adherence to self-care. The current study aimed to present the process of building an Open Educational Resource (OER) on self-care of the feet of Diabetic people entitled “Have you taken care of your foot today? **Materials and Methods:** This is an exploratory, descriptive study, with a qualitative approach, conducted from November 2019 to March 2020. The five stages of construction of the educational resource in E-book format were described and validated as a product of the Professional Master in Health and Technology Teaching at the State University of Health Sciences of Alagoas—UNCISAL, integrating the master’s thesis of the corresponding author. **Result:** Description of the educational resource’s building in the form of e-book, elaborated as a product of the master’s in education in Health and Technology. The construction was composed of five stages, comprising from the systematization of the contents to the insertion in the CAPES repository. **Conclusion:** The educational resource achieved the theoretical, methodological, and operational dimensions. The relevance of educational resources cannot be denied in the context of health education and must be regularly rethought and elaborated to keep up with the demands of socio-cultural changes. Beyond the construction of educational resources, it is essential to propose a reflection about the obstacles that still limit the accessibility and implementation of these resources to the public, thereby they can effectively contribute to health promotion and prevention strategies.

Keywords

Diabetes, Diabetic Foot, Educational Resource, Prevention

1. Introduction

Diabetes Mellitus (DM) refers to a group of metabolic conditions characterized by hyperglycemia with heterogeneous etiopathology, including defects in insulin secretion, insulin action, or both, and disorders of carbohydrate, protein and fat metabolism, which in a long term, can cause retinopathy, neuropathy, nephropathy and other complications (World Health Organization (WHO), 2019). Estimates point that, in 2045, there will be 62% more cases of diabetes in Brazil International Diabetes Federation [IDF] (2019).

One of the most frequent and debilitating complications of DM is the diabetic foot, defined as infection, ulceration and/or destruction of deep tissues associated with neurological abnormalities and varying degrees of peripheral vascular disease in the lower limbs (MHB, 2016). Among the complications of diabetic foot, ulcerations and amputations are the most serious and have a relevant socioeconomic impact (IDF, 2019). Importantly, diabetic foot is the most common cause of prolonged hospitalization, comprising 25% of hospital admissions in the United States of America, and 40% to 70% of all non-traumatic lower limb amputations in the general population (SBD, 2017). Only 2/3 of diabetic foot ulcers heal and up to 28% require some form of amputation. Annually, one million individuals with diabetes mellitus lose a part of their leg, totaling three amputations per minute around the world (Caiafa, Castro, Fidelis, Santos, & Silva, 2011).

It is estimated that, in developing countries, 25% of patients with diabetes will develop at least one foot ulcer in their lifetime. Nevertheless, there is still a lack of evidence on the epidemiology and costs of the “diabetic foot” in Brazil and in the world. Remarkably, the health costs are five times higher in individuals with diabetes and foot ulcers when compared to the absence of ulcers in Sociedade Brasileira de Diabetes (SBD), 2019. In Brazil, in a hypothetical model for a population of 7.12 million individuals with type 2 diabetes mellitus (DM2), 484,500 ulcers, 169,600 hospital admissions and 80,900 amputations are calculated, of which 21,700 would result in death (Sociedade Brasileira de Diabetes (SBD), 2017). In the state of Alagoas, more than a thousand amputations are performed each year, which is considered a national record, according to the Brazilian Medical Association.

Studies reveal that diabetic foot ulcers are responsible for 85% of morbidity and mortality, prolonged hospital stays and high hospital costs (Vargas, Lima, Silva, Schoeller, Vragas, & Lopes, 2017). Approximately 80% - 90% of ulcers are preceded by extrinsic trauma, in general, inappropriate shoes. In 70% - 100% of cases, lesions show clear signs of neuropathy and only 10% of ulcers are strictly vascular (SBD, 2017). It is worthwhile noting that these complications of the diabetic foot, especially amputations, are largely preventable. However, in developing countries, the diabetic foot still needs to be elucidated, considering an even greater and growing prevalence, owing to the precarious living conditions, difficulties in accessing health services and the lack of integrality of promotion, prevention and treatment actions (MHB, 2013).

The Ministry of Health estimates that 50% of these cases can be prevented through health education actions for people with DM and their families, associated with the management of other risk factors (MHB, 2013). According to Yamaguchi, Barros, Souza, Bernuci, & Oliveira (2020), the level of education of an individual is related to health outcomes in adulthood, considering the reciprocal relationship between education and health.

Regarding the Health Policies and Programs and lines of care for people with diabetes, it is essential to address Health Education, considering that the adoption of discipline and healthy lifestyle habits are guiding factors in the management of the disease and in the prevention of complications (MHB, 2013). Thus, the educational approach to people with diabetes is considered the principal focus for preventing ulcerations in the lower limbs, according to the American Diabetes Association (ADA) (2019).

Open educational resources (OER) are tools with educational potential to promote the teaching and learning process (Meier, Silva, Fornari, & Leal, 2018). They are openly available and licensed, allowing full or partial use, to provide access to educational resources for collaborative education and encourage production (Silva & Pereira, 2018). This educational demand can be met with the specific proposal of prevention and health promotion with greater reach to the population.

The construction of the educational resource was based on the CTM3 method in order to reach the systemic aspects, and the technical aspects previously mentioned. The acronym CTM3 corresponds to three stages: C—Conception of the Product, T—Theoretical Reference, and finally, M—Methodological Reference. The last stage consists in gathering as many elements as possible to access the five senses, the three ego states and the anchors (Santos, Alves, Warren, & Wyszomirska, 2019), and is based on three theories:

1) Personality Theory and Transactional Analysis: Eric Berne described the structure of personality as being formed by ego states. This term designates states of mind associated with patterns of behavior Passos (2019). Accordingly, ego states represent how we behave due to emotions. The father ego state represents the patterns learned throughout the life of father figures and expresses through care, norms, and limits. The adult ego state represents the rational, critical and logical side. Finally, the child ego state is represented by sensations, emotions and creativity. Thus, every human being carries the three components of ego states that bring together emotions and thoughts responsible for exchanges, behaviors and transactions between individuals (Santos, Teixeira, Warren, & Rocha, 2019).

Understanding the personality theory is pivotal to define which ego state is the most prevalent in the group to which we intend to communicate. Considering the difficulty of this definition, it is worth contemplating the three ego states in the construction of the educational resource.

2) Theory of the senses: The resource was developed with the aim of reaching the six apprehension channels: vision, taste, hearing, kinesthetic, touch and smell, corresponding to the theory of the senses (Santos, Alves, Warren, &

Wyszomirska, 2019).

3) Anchor: When we go through an experience and it is repeated in everyday life, we can affirm that we structure anchors, considered current stimuli that evoke an original experience O'Connor & Seymour (1995) cited by Santos, Alves, Warren, & Wyszomirska (2019).

In this context, the aim of the study was to outline the steps in the construction of an open educational resource (OER) on self-care of the feet of individuals with diabetes entitled "Have you taken care of your foot today?" The need to develop the OER was raised from the perceived lack of knowledge about the prevention of "diabetic foot" among people with diabetes.

In this perspective, it is assumed that the description of the process to elaborate the open educational resource (OER) considering the self-care with the feet of people with diabetes will collaborate to stimulate and guide health professionals and students in the construction and development of other open educational programs that deal with this subject, in order to meet the future demands, since knowledge is dynamic and technologies tend to obsolescence.

2. Materials and Methods

2.1. Materials

To make the resource used: 1) Notebook; 2) Software for the elaboration of the e-book; 3) Sketchbook with illustrated images; 4) Brushes. The script was composed of the following topics: 1) What is Diabetes (Definition and what are the major complications); 2) What is the diabetic foot? (Definition, warning signs and symptoms, risk factors, complications); 3) How to prevent diabetic foot? (Periodic examination of the feet, how to perform a self-examination of the feet, the importance of glucose control, cleaning and hydration of the feet, how to select appropriate socks and shoes, how to perform nail trimming, care for calluses); 4) What are the warning measures?

2.2. Method

This is an exploratory-explanatory study with a qualitative approach, developed from November 2019 to March 2020. The five stages comprised from the systematization of content to insertion in the CAPES repository (Coordination for the Improvement of Higher Education Personnel). The E-book format was chosen, with proper ISBN registration, and the OER was validated as a product of the Professional Master in Health and Technology Teaching at the State University of Health Sciences of Alagoas—UNCISAL, also being part of the dissertation of the corresponding author.

The production of the educational resource in the e-book format consisted of the following stages:

Stage I: It consisted of planning. The study started with the identification of the perceived problem and the definition of the resource theme and its target audience. Thereafter the required resources, costs and the format of the educa-

tional resource needed, including the type of language and terms used. Subsequently a bibliographic survey was carried out based on the latest publications and guidelines, including the preparation of the script, the prototype and the hiring of a professional graphic designer and illustrator. It is worth noting that during the planning phase, the guiding questions for making the resource were answered objectively:

- 1) What format? An educational resource in e-book format on the self-care of the feet of people with diabetes;
- 2) For what? A tool to guide the self-care necessary for the prevention of “diabetic foot”;
- 3) For whom? A target audience of people with “diabetes mellitus”, as well as their family members and caregivers.

Stage II: It consisted of elaborating the educational resource in e-book format with the professional graphic designer following all the author’s guidelines. Images, figures and colors were selected to achieve the proposed objective and offer an attractive resource for the reader.

Stage III: The preliminary content was revised by the author followed by some adjustments, thereby resulting in the 1st version of the e-book.

Stage IV: The product was enrolled and submitted to the validation session of educational products of the Professional Master in Health and Technology Teaching at the State University of Health Sciences of Alagoas (UNCISAL) on November 12, 2019. During the validation process, the OER was evaluated as to the: social relevance of the topic, creativity and visual quality of the resource, easy & accessibility of language and logical sequence, applicability, achievement of educational objectives and suitability for the target audience, learning potential, together with content and form and theoretical and methodological basis. Some adjustments and adaptations were proposed by the evaluators to be performed within 15 days as a requirement for validation. Obeying the recommendations, the second version was produced, and the product met the required criteria and was duly validated without restrictions.

Stage V: For the final stage, the educational resource was sent to a publisher in order to be registered with an ISBN (International Standard Book Number). The system that numerically identifies books according to the author, title, country, publisher and edition. Following the issue of the ISBN by the publisher, the educational resource was sent to an advisor, who was responsible for final structural review. Finally, the registration was made in Creative Common (CC) and the e-book was added to the CAPES repository, making it available to the general public (**Figure 1**).

3. Results

For the implementation of such an open educational resource, it was essential to establish well-defined steps as well as a description of the [resources] used. The implementation comprised five steps: the selection of sites and [biographical].

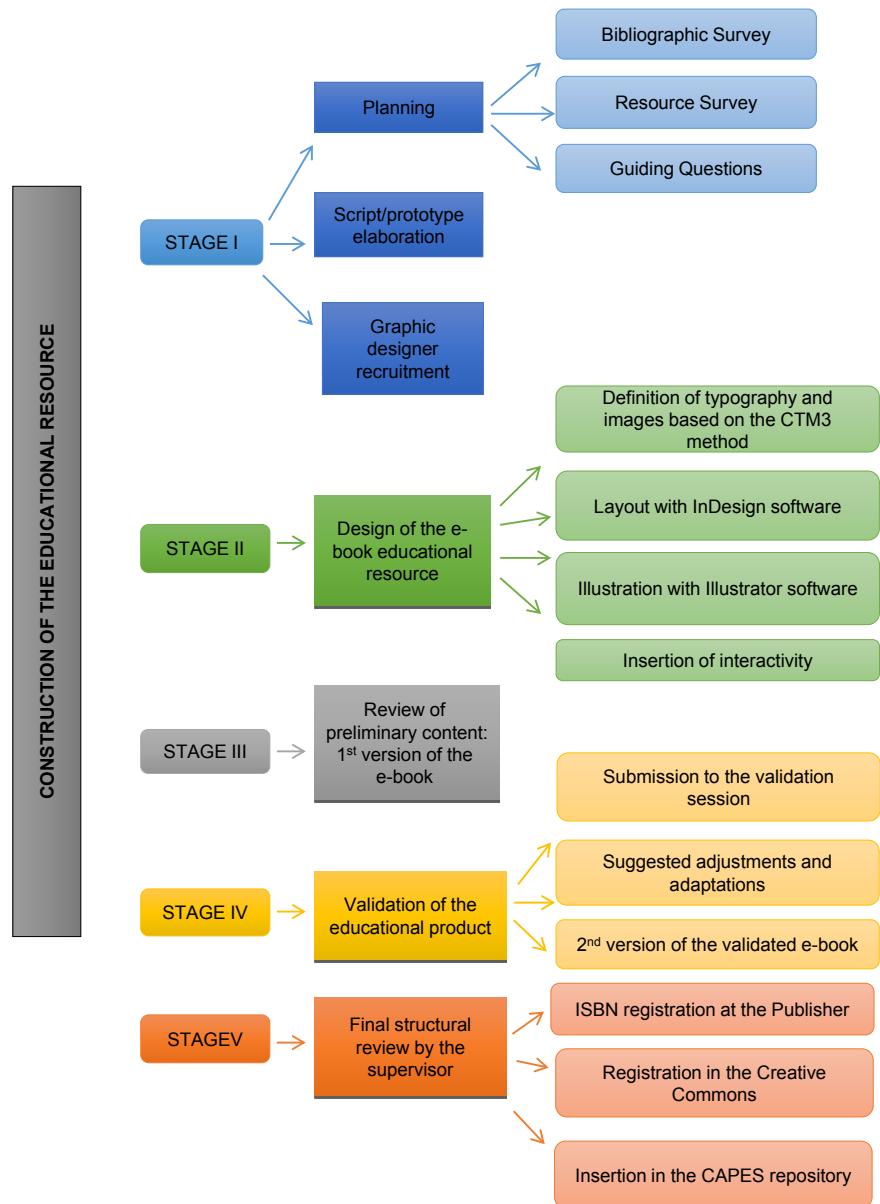


Figure 1. Flowchart of the construction of the educational resource. Source: The authors.

3.1. Stage I—Selection of Sites and Bibliographic References for Consultation

From the finding of the high incidence of diabetic foot related to lack of self-care for the feet, and the fragility of health services regarding the integrative and preventive approach of this theme inserted in the work processes in a systematic way (MHB, 2016), the literature searched for materials that could support the construction of an educational resource. In this process, the following sites established on this subject were consulted: (Table 1).

3.2. Stage II—Selection and Preparation of Illustrations

The illustrations and the type of language were based on the CTM3 method in

Table 1. Documents used to compose the E-book.

Types of Documents	Disposition
https://www.diabetes.org.br/	Establishes the importance of the educational approach as the main focus in preventive measures for diabetic foot.
https://www.diabetesjournals.org/	Presents the latest guidelines for the Diabetes Education program (2020).
https://saude.gov.br/	Describes the frequency of foot examination with the health professional, self-examination and foot self-care measures (2016).
https://www.endocrino.org.br/	Defines diabetic polyneuropathy, diabetic foot, signs and symptoms.
http://www.idf.org/diabetesatlas	Describes the epidemiology, statistics and economic impact of diabetic foot complications (2017).
https://www.who.int/health-topics/diabetes	Conceptualizes diabetes and describes the pathophysiology of macro- and micro-vascular complications (2019).

Source: Aforementioned sites.

order to ensure the greatest possible number of elements to access the five senses, the three ego states and the anchors (Santos, Alves, Warren, & Wyszomirska, 2019).

1) Ego states: In the E-book, the child ego state is identified through the creativity explored in the illustrative images and in the risk-prone phrases, requiring due care and protection. In turn, the father ego state refers to the personality that establishes what is right and wrong, thus, the individual reproduces some behavior established as guidance or rule. In the written content of the e-book, it is possible to perceive it in the guidelines and prevention measures, always with the verb in imperative. Finally, the adult ego state, in which the individual is rational and realistic, adopts preventive measures and is aware of risks and what to do for the well-being. The self-care proposal of the e-book already evokes at all times the need for the adult ego state to achieve the health, well-being and autonomy of the individual, capable of preventing diabetic foot and the physical disabilities resulting from adoption of certain behaviors.

2) Theory of the senses: illustrative images were used to stimulate the sense of sight; the image of sweets stimulates the taste, the figures of needles and bruises on the feet providing kinesthetic and touch. Thus, most senses were invoked, hence favoring the teaching-learning process.

3) Anchor: In this resource, the anchor is the picture of the feet with little eyes with the purpose of reminding them to examine the feet.

3.3. Stage III—Content Layout

After selecting texts and describing the desired images, the material was sent to a graphic designer for the creation and layout of the e-book. The professional used the InDesign software for the layout, while the illustrations were created and altered in the Illustrator program. Posteriorly, the layout focused on digital artifacts and the insertion of interactivity for the e-book version. The confection

considered the colors, the disposition of the images aligned with the message intended to communicate in an accessible, attractive and objective way. The e-book contains a system of links that conduct the reader to complementary information on reputable websites, including the Brazilian Society of Diabetes and the Ministry of Health website. Finally, the text was reviewed and the material was saved in PDF format (Portable Document Format) (Figure 2).

Above, the cover illustration of the open educational resource (OER) on foot self-care for people with diabetes entitled: have you taken care of your foot today?

3.4. Stage IV—Validation

The educational resource was exposed to the educational products validation session of the Professional Master in Health and Technology Teaching at the State University of Health Sciences of Alagoas (UNCISAL) on November 12, 2019. The evaluation process consisted of 10 items: social relevance of the topic, creativity, audiovisual or visual quality, easy and comprehensive language and logical sequence, applicability, perception of educational objectives, suitability for the target audience, learning potential, content, interest-arousing strategy, use of theoretical and methodological references in the elaboration. Each item received a score from 0 to 10. Some adjustments and adaptations were proposed

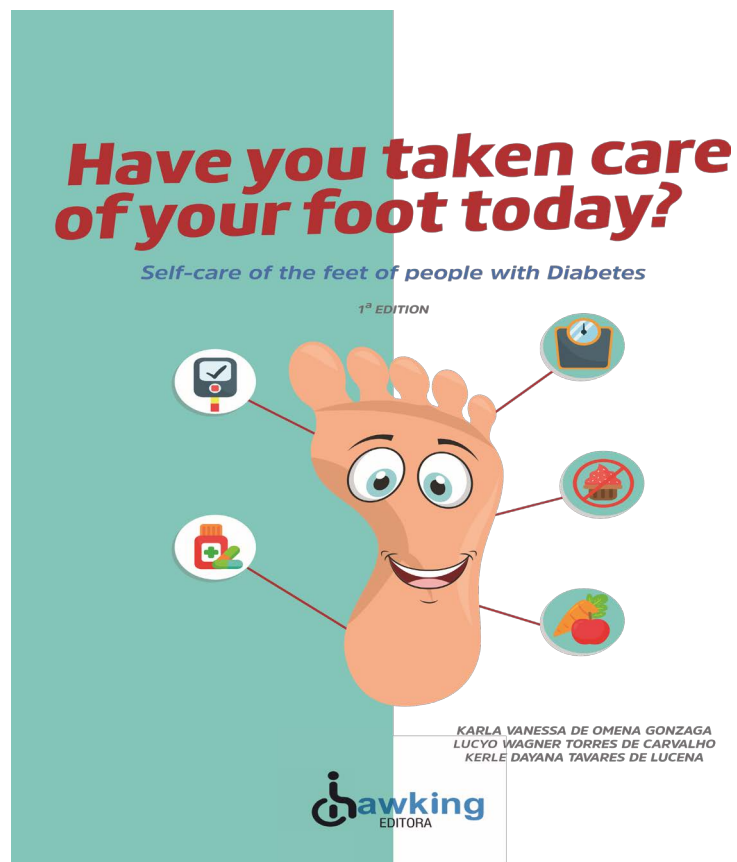


Figure 2. Illustration of the e-book cover. Source: Archive of the researchers.

regarding the use of images and figures in order to access the six senses, as well as meeting the minimum number of pages established for the e-book. Following the recommendations, the corrections were conducted, resulting in the second version of the e-book, which met the criteria and was properly validated without restrictions.

3.5. Stage V—Insertion in the CAPES Repository

The resource was sent to a publisher with the aim to register it with the ISBN (International Standard Book Number). This consists of a numerical identification system of books according to title, author, country and publisher. After the ISBN registration (978-65-81683-24-5), the e-book was sent to the advisor, who performed the final structural review, registered in the Creative Commons (CC) and inserted in the CAPES repository, thus making it available to the general public interested in the subject.

4. Discussion

The availability of educational resources for prevention and health promotion in the virtual environment has achieved significant growth. Currently, with technological advances and the consequent transformation of behaviors and sociocultural changes in the way of acquiring knowledge, the production of open educational resources is an alternative with massive reach and ubiquity. Therefore, it is imperative to consider the methodological and theoretical process for the development of these educational resources in order to offer quality resources with insightful sources in the virtual environment.

Open educational resources are teaching materials, whose peculiarity includes the dissemination and sharing of knowledge, making it possible to reach more people, contributing to the democratization of education worldwide (Teodoroski, 2018). Besides being a teaching and learning resource, its differential consists in the public domain or availability with an intellectual property license, thereby allowing its use and adaptation by third parties (Santos, 2012).

Education and health activities, being a dynamic process, are subsidized with the use of these tools. Health education consists of a set of essential activities characterized by institutional and community tools in the pursuit of health, because it proposes changes in behavior, the awakening of critical awareness through information and aims to promote a better quality of life for people (Áfio et al., 2014). For its effectiveness, the uses of educational technologies help in the planning, implementation and evaluation of the teaching-learning process, contributing to the construction of knowledge between the student and the educator (Moreira, Sabóia, Camacho, Daher, & Teixeira, 2014).

Faced with the problem of the high incidence of diabetic foot in Brazil, which ranks 1st among the various complications of diabetes with irreversible damage, such as amputations (SBD, 2019), and knowing the possibility to transform these statistics and reduce it by up to 50% of the cases with prevention strategies

adopted with health education activities [IDF \(2019\)](#), we perceived the need to develop an educational resource in e-book format for foot self-care and prevention of diabetic foot that can be accessed by any time, place and by anyone interested in the subject, considering diabetics, caregivers and even health professionals. Interestingly, there are numerous educational resources that deal with this theme, despite complex technical languages, aimed exclusively at health professionals and others with extensive content, not presenting an effective reach in the communication of the message, and not reaching the objective to inform and to change behavior for the prevention of diabetic foot. [Galdino, Moreira, Marques, & Silva \(2019\)](#) reported the need to use educational technologies to promote knowledge and incorporation of care for the prevention of complications related to the feet of people with DM, and affirmed that these technologies are suitable for cultural and social reality.

The high incidence of diabetic foot reflects a gap in the comprehensiveness of prevention and health promotion ([Silva, Viana, Barreto, Sousa, & Penha, 2019](#)). Education and health actions are not systematically inserted in the work process of health services, thus curative activities reach a priority place to their detriment.

During the planning, the construction of a resource was thought to serve the target audience, specifically not from the health area, with understandable language, objective and sequenced content, which would promote the importance and adherence to self-care of the feet. These criteria are in agreement with [Marques et al. \(2017\)](#), who stated that the content of educational resources must respect the characteristics of the target population, socioeconomic and environmental conditions to motivate positive behavior change. Therefore, this explains the emphasis on exploring the neurolinguistic methodological elements, and with these characteristics, obtain an effective educational product.

Importantly, addressing such a relevant topic in the current epidemiological scenario about diabetic foot through an OER means contributing to the accessibility of information and supporting the prevention and health promotion policy. Regarding the theoretical reference that composed the OER of 50 illustrated pages, distributed in seven chapters, the definition of diabetes and the major complications were addressed in the first chapter, emphasizing the relationship of neurovascular alterations of the feet with uncontrolled diabetes; the second chapter defined the diabetic foot, warning about the risk of amputations, and primarily reporting a positive message that it is possible to prevent it with the adoption of basic care. In chapter three, the ten main risk factors for the diabetic foot were considered, emphasizing hyperglycemia and the importance of controlling blood glucose levels. In chapter four, the seven items that must be observed when examining the feet were described (nails, skin, hygiene, calluses, cracks, wounds and deformities) and the self-care techniques for each one of them, whose content is explanatory. In chapter five, the emphasis was on how to take care of the feet. In chapter six, the regular period that the feet must be examined by a professional was exposed, according to the protocols of the Ministry

of Health (MHB, 2016). However, the periodic examination of the feet is a despised procedure during consultations with the person with diabetes, and should be performed regularly to prevent complications, but they are occasionally examined when the patient reports a complaint and already has some important alteration (Teston, Senteio, Ribeiro, Maran, & Marcon, 2017; Santos & Cazola, 2012). Finally, in chapter seven, it is alerted about the changes and what to do in cases of foot injuries and the importance of looking for a health professional.

Considering the type of license used, the Creative Commons (CC) was chosen, which consists of several public licenses granting some rights to use the copyrighted work. Licensing requires access to the CC website by anyone interested in licensing a production, resulting in the receipt of six licenses after answering a few questions (Gonsales, 2016).

Regarding the selection of the type of resource, the e-book or electronic book format was chosen due to the various possibilities it provides, which includes the ease of dissemination of intellectual information, quick research and facilitated acquisition. Additionally, it is a sustainable way that contributes to environmental preservation in comparison to printed books (Reis & Rozados, 2016).

In the area of public health, access to open educational resources is still very unusual for service users, for several reasons. According to previous studies, the epidemiological profile of diabetics in Brazil is predominantly composed of people with low education, low income and the elderly (Flor & Campos, 2017; Filho et al., 2017) characteristics that limit and hinder the use of technologies, called technological illiteracy by Reis & Rozados (2016), which also mentioned economic issues as a limiting factor that permeates this process. In order to transform this reality, the user of the health system must be aware of the existence of the tool that can help in health care, and as this educational tool is attractive and understandable, it is possible to arouse interest in developing skills with the technology, including the use of smartphones, internet, and others. Indeed, as stated by Mantovani (2009), the importance of a teaching material only exists because of the use made of it. Finally, it is worthwhile noting that the use of technology alone is not an effective guarantee of learning, requiring the mediating intervention of teachers (Santos, 2012). In this syllogism, considering the health education process, it is not enough just to make educational resources available, but it is essential that health professionals are available to resolve doubts and provide clarifications, as well as, in other opportunities, organize systematic activities with the use of educational technology.

With regard to the future perspectives, this study demonstrated the possibility of developing other educational products on this theme that accompany the changes of the new digital age, in other formats and media, besides other products suitable for different social and professional contexts.

5. Conclusion

The educational resource presented met the theoretical, methodological and operational dimensions. The relevance of educational resources to favoring the

teaching-learning process is undeniable, especially in the context of health education. These must be regularly rethought and elaborated in order to keep up with the demands of sociocultural changes, optimizing the ways of consuming information. This study also evidenced that, in addition to building educational resources, it is essential to propose a reflection on the barriers that still limit the accessibility and implementation of these resources for the most interested public, identifying and solving these challenges, to effectively contribute to the health promotion and prevention strategies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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