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Increasing knowledge of food deserts in Brazil: The contributions of an interactive and digital mosaic produced in the context of an integrated education for sustainability program

Isabella Cruvinel Santiago | Fernanda Cassab Carreira | Ana Carolina Pires de Aguiar | Mario Prestes Monzoni

Center for Sustainability Studies (FGVces), Fundacao Getulio Vargas Escola de Administracao de Empresas de Sao Paulo, São Paulo, Brazil

Correspondence
Fernanda Cassab Carreira, FGVces, Fundacao Getulio Vargas Escola de Administracao de Empresas de Sao Paulo, Avenida Nove de Julho, São Paulo, Brazil.
Email: fernanda.carreira@fgv.br

As efforts to end hunger, food insecurity and malnutrition evolve within the context of United Nations' Global Compact and Sustainable Development Goals; such problems remain far from being solved due, in part, to their complex nature. Brazil exemplifies such multifaceted scenario as the country has left the "hunger map" in 2014 but now faces another issue: The quality of the food available to its population. Physical, social, economic, cultural, and political factors have impacted the Brazilian food environment, shaping new eating habits such as the replacement of traditional local food for processed foods. Within this context, educational institutions may play an important role in spreading knowledge about major social challenges such as this and their interdependent causes. This paper presents the case study of a project conducted by business and public administration students in a discipline called Integrated Education for Sustainability (FIS), offered to undergraduate students at one of Brazil's most important management schools. In 2017, the project worked on the topic of Food Deserts, challenging the students to develop a digital and interactive mosaic that uncovers the situation of the food deserts in São Paulo. Data were collected from participant observation, field trips, events, and interviews conducted in class with 18 professionals working on several areas related to the topic. The article provides insights into (a) the importance of education to tackle the sustainability challenges, (b) lessons learned from the 14th edition of FIS course, and (c) the several barriers to food access in the city of São Paulo.

1 | INTRODUCTION: FOOD AND NUTRITION SECURITY IN BRAZIL

According to the Food and Agriculture Organization (FAO, IFAD and WFP, 2014), the malnourished Brazilian population decreased by 82% from 2002 to 2013. Brazil left the hunger map in 2014, with less than 5% of the population ingesting less calories than recommended, but it now faces another issue: The quality of the food available to its population.

The historical process of the second half of the twentieth century, marked by the Scientific-Technical Revolution, evidences the impacts of urbanization and population growth on production patterns, including on food production. Kitchen chores such as cooking meals have been passed on to the industry, and the consumption of industrially processed foods is increasing as a consequence (Leite, 2006).

According to the 2010 Brazilian Institute of Geography and Statistics census (IBGE, 2010), Brazilian families have substituted calories that typically came from traditional Brazilian food (such as rice, beans, and cassava flour) for the consumption of processed foods (such as cookies, soft drinks, and ready-made meals). More recently, a survey conducted by the Brazilian Ministry of Health indicates that less than 25% of the Brazilian population eats the amount of fruits and

vegetables recommended by the World Health Organization (Vigitel Brasil, 2015). In addition, food acess is still a problem among various groups that depend on public policies and cash-transfer programs (Cuerbas & Lucas, 2017).

Although access to adequate food is as a human right according to the United Nations Universal Declaration of Human Rights,[1] and achieving food security and improved nutrition is one of the UN Sustainable Development (SD) Goals,[2] the concept of food and nutrition security is constantly being reviewed, since it is directly related to public policies and the cultural and socioeconomic structure of each country.

In Brazil, Law Number 11,346/2006[3] instituted the National System of Food and Nutrition Security and defined it as "the realization of the right to regular and permanent access to high-quality food in sufficient quantity, without compromising access to other needs, based on health-promoting practices that are environmentally, cultural, economically, and socially sustainable." In 2010, the Brazilian Congress approved the 64th constitutional amendment, which includes food as a social right in the sixth article of the Brazilian Federal Constitution. However, such legislation does not guarantee the implementation of these rights in practice. Although there are public policies focused on food sources in place, the so-called food deserts are still an issue faced by the Brazilian population.

The term "food deserts" was first used in the 1990s (Cummins & Macintyre, 2002), and it has been widely adopted (Walker, Keane, & Burk, 2010) by academics and public managers since then. Although it is not a single or closed concept, the term refers to the idea of urban or rural areas with limited access to a healthy diet. This limitation is sometimes physical, either because of the lack of restaurants and supermarkets selling fresh foods or because of the excess of facilities that sell "junk food" (Cummins, Flint, & Matthews, 2014). It may also be an economic barrier, such as low income that limits access to fresh food. However, the challenge goes much further, also embracing mental barriers, named as "attitude problems" such as "culturally based prejudices against certain foods, lack of knowledge about how to prepare and cook some foods, or unwillingness to find time in a poor, but cash-rich lifestyle for cooking fresh vegetables" (Shaw, 2006).

This food environment depends, therefore, not only on efficient logistic structures, regulation of the food industry, and public supply programs and policies but also on educational processes that raise awareness in order to promote behavioral and attitude changes. Hence, this article describes the results of a project conducted by students of an elective course at FGV EAESP (School of Business Administration of São Paulo), called Integrated Education for Sustainability (FIS), which focused on food deserts in the city of São Paulo.

The remaining sections of this paper provide a brief literature review on the following topics: (a) Definitions of Food Deserts: Current definitions and concepts; and (b) Education for Sustainability: A brief discussion on how new educational models have been developed as a way of dealing with complex social issues. Then, we introduce our research method, followed by the data analysis and findings of the project.

2 | DEFINITIONS OF FOOD DESERTS

The term food deserts was first used in the 1990s in Scotland, but although it is being used increasingly year after year, it remains a concept under construction. And, this could be partly explained by the fact that research of its causes is still being conducted, and the variables that can compose their definition are still being analyzed. To illustrate that, we share some definitions on food deserts and its variations.

Food deserts can be defined as "areas characterized by relatively poor access to healthy and affordable food, that may contribute to social disparities in diet and diet-related health outcomes, such as cardiovascular disease and obesity" (Beaulac, Kristjansson, & Cummins, 2009). We see in this definition not only the probable causes of a food desert but also its consequences on human health. Other authors find important to stablish the size of the food desert areas, and this can vary from country to country, as well as from author to author. For instance, food desert can appear as "an area, typically at the scale of the neighborhood or greater, where residents have highly limited access to adequate retails sources of healthy and affordable foods" (Russell & Heidkamp, 2011). The United States Department of Agriculture (American Nutrition Association, 2010), on the other hand, uses the definition of food deserts as "parts of the country vapid of fresh fruit, vegetables, and other healthful whole foods, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmers' markets, and healthy food providers."

For the present study, we adopted the view and the framework proposed by Hilary Shaw (2006) as the author tries to amplify the causes of the food deserts and not to use a specific definition. For her, "food deserts remain contested theoretical territory at least partly because no firm definition has been proposed." Shaw argues that "the barriers to consumption of a healthy diet may be classified according to whether such barriers are financial, physical, or derive from the mental attitude and knowledge of the consumer." Therefore, she proposes three factors that contribute to classify food access problems in the United Kingdom: Ability, asset, and attitude. Whereas ability problems are the ones related to physical barriers that prevents access to healthy food, asset problems are related to economic barriers, and attitude problems are the psychological and knowledge barriers that prevents the consumer from accessing a healthy diet. This amplified view is aligned with the methodology used in the FIS course that investigated food deserts in the city of São Paulo.

3 | EDUCATION FOR SUSTAINABILITY AND THE CHALLENGE OF COMPLEX PROBLEMS

The challenge of combating food deserts is a complex, multifaceted problem that addresses issues that have been discussed by the UN SD Goals. At the same time, SD issues can only be understood by a type of education that helps us understand reality in all of its complexity (Dieleman & Huisingh, 2006). As "children of the Enlightenment," we have learned to take things apart in order to analyze them,

[1]https://www.unicef.org/brazil/pt/resources_10133.htm

[2]http://www.itamaraty.gov.br/images/ed_desenvsust/ODSportugues12fev2016.pdf

[3]http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/lei/l11346.htm

becoming "poorly equipped to reconstruct the whole" (Dieleman & Huisingh, 2006). Key challenges of SD education then would include not only increasing public awareness of SD issues but also developing a "systems thinking" language (Dieleman & Huisingh, 2006), overcoming the primacy of fragmented knowledge (Morin, 2011) and acquiring critical thinking and new values, such as collaboration (UNESCO, 2005). Within the business school context, there is a need for more critical and reflexive thinking as our global challenges, and recent crises have presented us with the evidence that "management carries with its decisions an important (positive or negative) social impact. Hence, infusing in future leaders and professionals the sense of responsibility towards the social and environmental impact of management decision-making should be considered a central concern in business education from now on" (Rasche & Escudero, 2010a, 2010b). In the case of public administrators, this is even more evident.

In response to such challenges, the United Nations launched the Principles for Responsible Management Education (PRME) in 2007, providing a voluntary engagement structure for academic institutions to advance social responsibility by incorporating universal values into curricula and research,[4] allowing schools to a free experimentation and innovation process, according to their circumstances. Research and publications on Responsible Management Education and Education for Sustainability sustain the challenge of more integrated educational models (Carreira, Aguiar, Onça, & Monzoni, 2017).

São Paulo Business School of Getulio Vargas Foundation (FGV EAESP) signed PRME in 2009, and, through its Center for Sustainability Studies (GVces), created an elective discipline for undergraduate students of business administration course called FIS (in the Brazilian Portuguese acronym) that aims to create conditions for the emergence of business and public managers who are more aware and attentive of their reflective and creative potential and more autonomous in their personal and professional practices, by extending their perception and interpretation of the reality and the building of higher quality relationships—of learners with themselves, with others, and with the global context they belong to.

In order to achieve that, the students work on two projects throughout the semester. One is the Reference Project, a challenge proposed to the group in the beginning of the semester. The second one is the Your Self Project, which allows learners to have more contact with themselves, through self-reflective, experiential, and interpretative activities.

There are, also, two immersion trips. The first one is called Micro Immersion, a two-day trip in the beginning of the semester with the objective of integrating the group and conducting activities related to the Reference Project. The second one is the Macro Immersion, a one-week trip with the goal to have deeper contact with the Reference Project reality and dive into the Your Self Project activities.

The course applies principles of transdisciplinarity throughout the process that intertwine the sensitive, experiential, and formal reasons (Aguiar, Carreira, Góes, & Monzoni, 2016). Furthermore, as a framework for the educational process, the Theory U is used in order to increase the quality of individual perception and to bring more innovative results to complex challenges.

[4]PRME website: http://www.unprme.org/

4 | THE CASE OF FIS 14: RESEARCH ON FOOD DESERTS IN SÃO PAULO

In the 14th edition of FIS, between February and May 2017, students were challenged to build a digital and interactive mosaic (platform) to reveal the situation of food deserts in the city of São Paulo and surroundings, raising discussions about their existence and how they affect individuals, relationships, public policies, and business.

It is important to emphasize that the students worked on the issue of food deserts in Brazil in an unprecedented way. Until now, there was no literature that discusses this topic in Brazil from an integrative and transdisciplinary perspective. For this reason, and because it is an open research process, students were challenged by the professors to create a digital and interactive mosaic.

By being digital and interactive, the mosaic is able to promote interactions and reach as many people as possible. Additionally, a holistic approach to cope with the sustainability challenges is needed (Robinson, 2012). Hence, the mosaic format is ideal for bringing up concepts, information, inspiring public and business initiatives, and mobilizing questions, whereas presenting an esthetic experience that sensitizes people about this issue.

The learning journey in the 14th edition of FIS sought the understanding of the phenomenon of food deserts in its complexity, mapping historical issues, data, public policies, business practices, and daily actions that built and maintain current eating habits in the city of São Paulo.

For that to happen, the course held 28 classroom meetings and two events open to the public. The former involved conversations and interviews with 18 experts on topics related to food consumption (Table 1), whereas the latter launched the challenge and presented the prototype built by the students, bringing together more than a

TABLE 1 Specialists interviewed in the classroom

Expert 1	Professor at the Institute of Health and Society of the Federal University of São Paulo (UNIFESP)
Expert 2	Postdoctoral scholar in Nutritional Epidemiology and in Public Policies of Food and Nutrition.
Experts 3 and 4	Experts in dialog for social innovation
Expert 5	PhD in social psychology
Expert 6	Sociologist with specialization in food sociology
Expert 7	PhD in public health and researcher in food and consumer protection
Expert 8	Family farmer
Expert 9	Agribusiness manager of an international supermarket chain
Expert 10	Former employee of CEAGESP
Expert 11	Public manager of São Paulo's City Hall in programs of school feeding and food security
Expert 12	Sociologist, board member of the Brazilian Forum of Sovereignty and Food and Nutrition Security (FBSSAN) and of the Municipal Council of Food and Nutrition Security of São Paulo (Comusan)
Experts 13, 14, 15, and 16	*Coordinators of the Bota na Mesa* project, carried out by the Center for Sustainability Studies at FGV, and whose goal is to include family farming in the food chain in large urban centers
Expert 17	Coordinator of the Center of Excellence in Logistics and Supply Chain at FGV

Source: Created by the authors

TABLE 2 Field research

Visit 1	Lab Hacker (social laboratory that works with technology)
Visit 2	Nestlé factory
Visit 3	CRESAN (Reference Center on Food and Nutrition Security) in *Vila Maria* and *Butantã*
Visit 4	IDEC (NGO of consumer protection)
Visit 5	Capão Cidadão and Horta Cores e Sabores (social projects of poor communities and neighborhoods in São Paulo)
Visit 6	CEAGESP (central food supply of the state of São Paulo)

Source: Created by the authors

hundred people representing companies, civil society, and government, who had different levels of involvement with the subject.

In addition to the conversations and interviews in the classroom, students were able to deepen the investigative process through field research in the immersion trips, visiting eight different districts of São Paulo in order to identify, explore, and map the food deserts by observing and talking to the residents. Moreover, they visited public and private institutions that work on the topic, as shown in Table 2.

5 | RESEARCH METHOD AND DATA COLLECTION

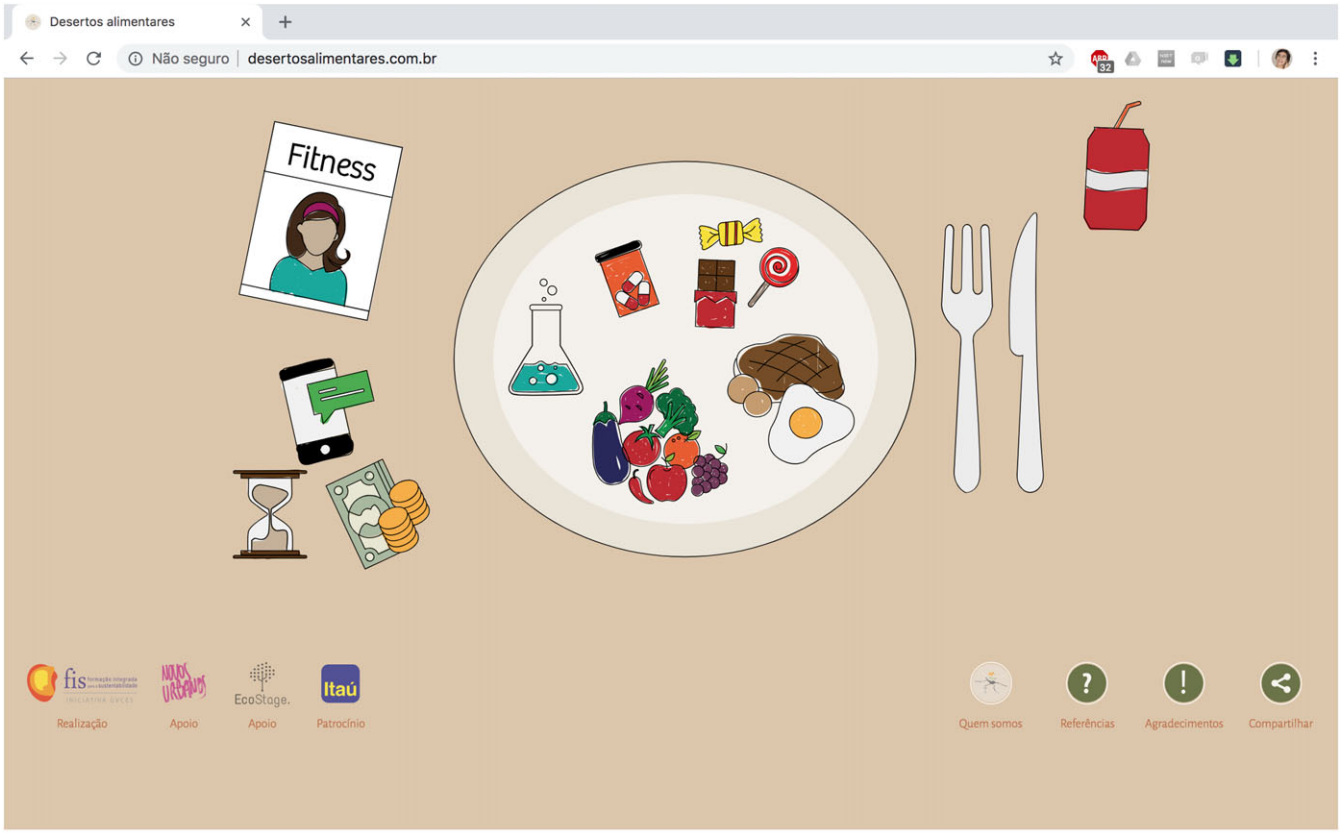
The present article is a case study about the project conducted by the 14th edition of FIS. This paper adopted a single case study approach based on Stake's (1998) intrinsic case study perspective. According to the author, an intrinsic case study is undertaken "because, first and last, one wants better understanding of this particular case." Therefore, it focuses on optimizing the understanding of the case, rather than seeking generalizations beyond it. Here, optimizing means to provide "thick descriptions" and to pay meticulous attention to the activities and complexities inherent to the case, focusing on its social and political influence within a given context.

As a method of data collection, secondary documents and transcripts of the classes, events, and interviews were read and analyzed. Because the students were not able to know before the classroom meeting who was the expert invited, the interviews were held in an unstructured way. In addition, we have the results of the participant observation made from the integral follow-up of the discipline by the authors of this paper (one as a student and two as teachers). Tables 1 and 2 show specialists that were interviewed and field visits that were taken, which enabled direct contact with reality and different actors of the Reference Project.

To present the final project built by the students, we crossed the information contained in each piece of the mosaic constructed by the students with the categorization of food deserts proposed by Hilary Shaw (2006), in order to understand if it fits in the Brazilian context.

6 | DATA ANALYSIS AND FINDINGS

Data analysis began with a thorough reading of the information collected, grouping them into emerging themes. No software for

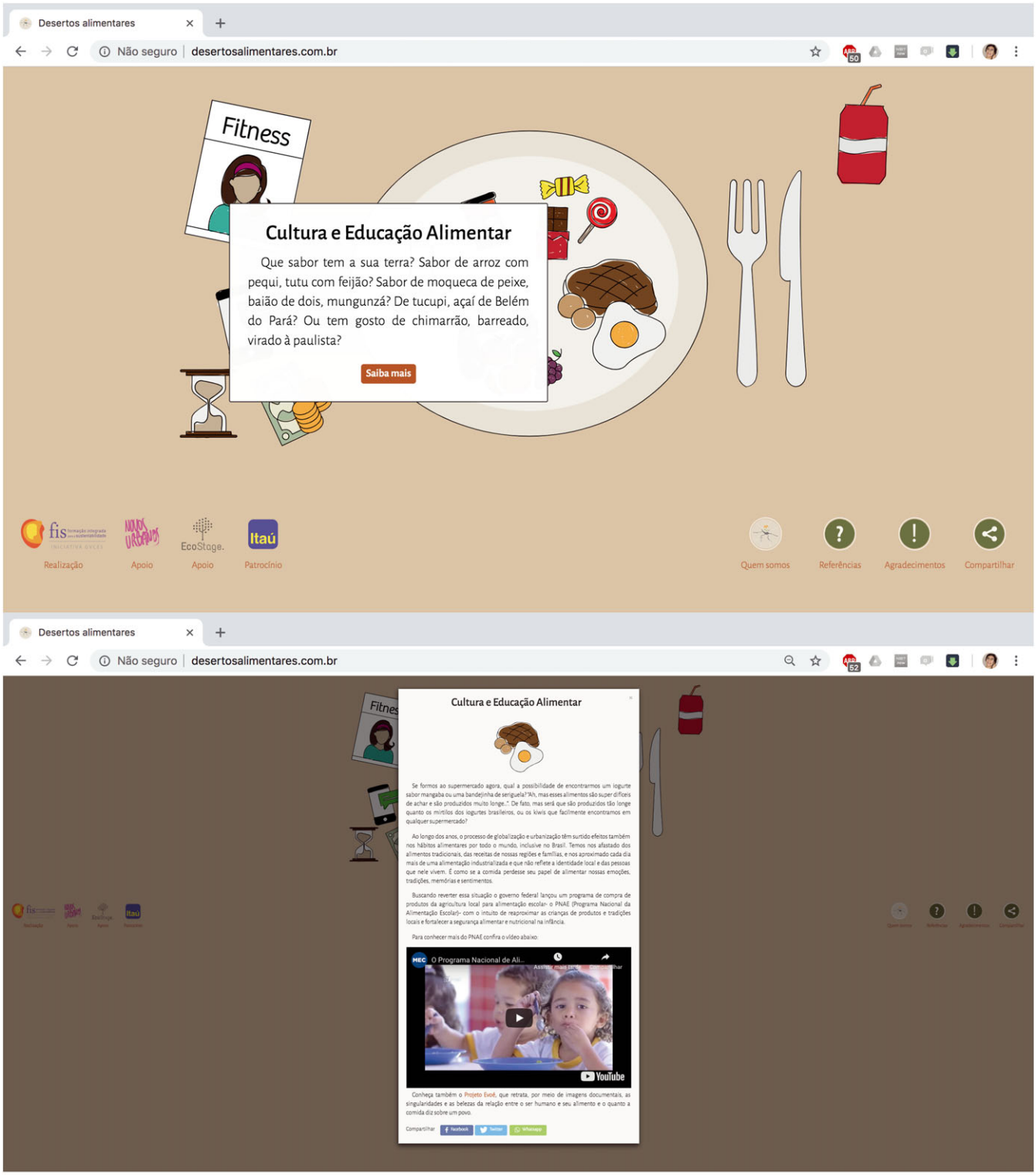


Source: www.desertosalimentares.com.br

FIGURE 1 Mosaic dashboard

formal coding system was used. Transcripts from interviews and field notes were compared and analyzed by students and professors, resulting in nine themes, which were summarized in different mosaic "pieces."

The mosaic created by the students can be accessed at www.desertosalimentares.com.br, also available in the mobile version. The students did not choose a specific target population, so the tool is available for anyone with access to the internet. As a first approach, the website seeks to sensitize its visitors and provoke their individual reflections so that they can investigate whether or not they live in a food desert. At the same time, this initial awareness already points to different variables that may constitute a food desert in the city of São Paulo. In a second moment, the user is faced with a dish-shaped mosaic, which contains nine pieces, as seen in Figure 1.



Source: www.desertosalimentares.com.br

FIGURE 2 Piece of the mosaic

Each piece was designed aiming to bring the concept of food deserts and the complexity of the food environment in the city of São Paulo to light in a playful way, consolidating information obtained in the field and in the classroom in a simple and accessible language to the general public. Upon clicking on a piece of the mosaic, the user finds an introductory text and can go deeper into the topic by clicking on "learn more" ("*saiba mais*," in Portuguese), as shown in Figure 2.

Crossing the framework proposed by Shaw (2006) with the pieces of the mosaic, we could see that the food deserts in the city of São Paulo are very similar to what the author analyzes in his work. The main findings during the research on food deserts in the city of São Paulo show that, in fact, the barriers to access healthy food are not only physical or economic but also socially and historically constructed mental barriers. Figure 3 illustrates the findings of the mosaic put into the framework proposed by Shaw. Next, we present each piece of the mosaic based on Shaw's categories: Ability (physical barriers to healthy food), attitude (psychological and knowledge barriers to healthy food), and assets (economic barriers to healthy food).

"From field to table": This piece of the mosaic talks about the difficulty faced by family farmers in rural regions so that their production reaches the plates of Brazilian families. In this case, ability and attitude problems were identified due to the lack of infrastructure in the distribution logistics and the population's prejudices towards the products. Not only are farmers struggling to distribute their production to the supermarkets—especially in the outskirts of the city, which creates a barrier for the marginalized population to access food—but they also have to compete with large producers who have access to equipment and additives for quick food production, failing to guarantee the size, shape, and quality imposed by the market.

"Culture and food education": This piece can be related to attitude problems. It addresses changes in dietary habits throughout Brazil, favored by globalization and urbanization, which have contributed to the greater consumption of ultraprocessed foods.

"The healthy industry": Also related to attitude problems, this one discusses the role played by food industries that foster discourses that "vilify" certain foods, overvalue unbalanced diets that contribute to poor nutrition, and promote the sale and consumption of ultraprocessed foods labeled as healthy.

"Food addiction," "Advertising," and "Illusion of choice": These three pieces address behavior problems caused by the influence of

Mosaic	Description	Shaw (2006) categories		
		Ability (Physical barriers)	Assets (Economic barriers)	Attitude (Psychological and knowledge barriers)
Advertising	Public exposed to – sometimes misleading – advertising that encourages unhealthy eating patterns.			
Culture and food education	Changes in dietary habits throughout Brazil, favored by globalization and urbanization, which have contributed to the greater consumption of ultraprocessed foods.			
Food addiction	Influence of the ultraprocessed food industry, which produces foods with a high concentration of addicting substances.			
Food and nutritional insecurity	A range of ultraprocessed products contributes to diabetes, high cholesterol, hypertension and obesity. This piece of the mosaic explains the Human Right to Adequate Food and the concept of Food and Nutrition Security in Brazil.			
From field to table	Difficulties faced by family farmers, such as lack of infrastructure in the distribution logistics, population's prejudices towards the products and competition with large producers who have access to equipment and additives for quick food production.			
Illusion of choice	Industries that control the food market and create informational barriers. Hence, even if there is availability of money and easy access to *in natura* food, people may be living in food deserts.			
The healthy industry	Role played by food industries that foster discourses that "vilify" certain foods, overvalue unbalanced diets that contribute to poor nutrition, and promote the sale and consumption of ultraprocessed foods labeled as healthy.			
Urban relations	Relationships we establish in urban centers, supported by mental models that privilege practicality, excess, and money, as people who live time poor but cash-rich lifestyle.			

Source: Authors

FIGURE 3 Mosaic X Shaw's (2006) framework

the ultraprocessed food industry, which (a) produces foods with a high concentration of addicting substances, (b) exposes the public to—sometimes misleading—advertising that encourages unhealthy eating patterns, and (c) creates informational barriers. Hence, even if there is availability of money and easy access to *in natura* food, people may be living in food deserts.

"Food and nutritional insecurity": This one consolidates the three categories (attitude, assets, and ability problems), by explaining the Human Right to Adequate Food and the concept to Food and Nutrition Security in Brazil, revealing the physical, economic, and cultural dimensions of the problem of healthy food access.

"Urban relations": This last piece also covers the three possible types of problems. It addresses the relationships we establish in urban centers, supported by mental models that privilege practicality, excess, and money, as people who live what Hilary Shaw (2006) calls "time poor but cash-rich lifestyle." The piece also provokes reflection on food waste in the city of São Paulo and brings up again the problem of logistics in peripheral areas, which generate physical and economic barriers for the most vulnerable population to access healthy food. Besides, it presents alternatives such as organic farmer's markets and community farms existent in the city.

7 | CONCLUSION

The contribution of the 14th edition of FIS course was to open a field of discussion in the Brazilian context and to increase the knowledge about the food deserts topic, raising discussions that can generate more disciplinary investigations afterwards.

Although it has some limitations, such as the fact that its content is static, not allowing the users to insert new data and information, the website is available for free, in an accessible and playful language that allows its incorporation into pedagogical methods on this topic. Besides, by searching "Desertos Alimentares" (Food Deserts, in Brazilian Portuguese) on the internet, the results (websites, news, and images) are related to the 14th edition of FIS or at least came after the beginning of the course.

One of the results of this paper is the understanding that we cannot talk about food deserts in Brazil without analyzing the social and cultural particularities that composes its food environment. By crossing the pieces of the mosaic built by the students with Shaw's (2006) framework, several barriers that are not physical or economic are found in the city of São Paulo, supporting what the author calls "the recognition of different types of food deserts." Because the barriers to access high-quality food can also be the behavioral ones, there is no way of mapping food deserts only from the geographical point of view.

More importantly, this paper contains new information about a pedagogical approach that helps students to build higher quality relationships and extend the paradigm of perception and interpretation of reality, which are crucial point to take into consideration when dealing with complex and multifaceted problems such as the Food Deserts one.

ORCID

Fernanda Cassab Carreira https://orcid.org/0000-0001-5716-9243

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AUTHOR BIOGRAPHIES

Isabella Cruvinel Santiago is a researcher at the Center for Sustainability Studies (Local Development Program) and finished Bachelor in Business Administration at EAESP FGV. As an undergraduate student, she was a trainee of RH Junior (strategic consulting in people management), project manager at GVcult (FGV art and culture center), and cofounder of the Entrepreneurship League and Enactus FGV (an entity focused on fostering and developing of social impact). Prior to joining FGVces, she was a trainee at Aoka Labs, a company that develops Social Innovation Laboratories, using collaborative methodologies such as U Theory and Design Thinking.

Fernanda Cassab Carreira attained Master's Degree in Management for Competitiveness with emphasis on Sustainability by FGV, where she also holds a postgraduate in Sustainability Management and a degree in Business Administration. Her master's dissertation examined the role of business schools in shaping CEOs for sustainability. Her postgraduate monograph has analyzed whether traditional models of Change Management used by companies in organizational transformation processes apply when the change in question is sustainability. She has worked at Significa, NGO's Prato Cheio Association, and Solidarity Franchise Association. Today, she coordinates the Integrated Training Program at the Center for Sustainability Studies at EAESP FGV (FGVces).

Ana Carolina Pires de Aguiar is a PhD student in Business Administration from FGV-EAESP, attained Master in Business Administration from FGV-EAESP in the line of Organizational Studies, specialization in management from the Harvard Extension School (Boston / USA), and Positive Psychology from the University of Pennsylvania. She has worked for Bunge, Unilever, and Natura. Today, she is a researcher at the Center for Sustainability Studies at FGV EAESP, working with Education for Sustainability. Her research interests include dialogue, dialogic organization development, responsible management education, and sustainability.

Mario Prestes Monzoni Neto is a PhD in Public Administration and Government by FGV-EAESP and attained Master in Economic Policy Management from the Columbia University School of International and Public Affairs (SIPA), New York, USA and Master in Public Finance from FGV-EAESP. He earned a Bachelor's Degree in Business Administration from FGV-EAESP. Specialist in Sustainability and Environmental Economics, Mario is a professor at FGV-EAESP and coordinator of the Center for Sustainability Studies at FGV-EAESP (FGVces). He has worked with the World Bank's Research Department.

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