


A Comprehensive Understanding of the Use of e-Learning in Continuing Education: Experiences of Pharmacists in a Public Health System

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Abstract

Introduction: The health and education sectors have experienced rapid technological development. In this scenario, the use of Internet technology has grown as an option for the expansion of continuing education (CE), as it allows professionals to develop educational activities with flexibility, autonomy, and convenience. E-learning has gained popularity and currently, thousands of online courses are being offered. However, studies of e-learning in professional training have presented only a few specific foci of study. **Objective:** to develop a comprehensive approach to understand both the experience and the complex scenario of the use of e-learning in the CE for pharmacists. **Method:** Field research in 10 Brazilian states through interviews and focus groups with alumni of a CE e-learning specialization course for pharmacists in public health. Data analysis used the model of socio-technical systems and was based on a framework with the components Objectives, People, Processes, Culture, Technology, Infrastructure, and Scenario. **Results:** The People and Culture components indicated the assimilation and normalization of technologies in the educational process. Although the infrastructure (technical and organizational) was deficient in some regions, the Technology component suggested that the characteristics of the course design, associated with the personal characteristics of the students, provided ways to overcome obstacles. The objectives of the use of distance education seem to be related to the possibility of greater accessibility and autonomy. The Processes component, in turn, revealed the burden that a e-learning course puts on the pharmacist. **Conclusion:** E-learning proved to be useful to enable and expand access to education, providing pharmacists with an opportunity for CE. On the other hand, e-learning contributes to the normalization of the precarious working conditions of pharmacists, attributing to individuals the sole responsibility for the CE even in an institutional CE program, which results in work overload.

Keywords

e-learning, continuing education, public health, pharmacists, technology

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What do We Already Know About This Topic?

- Common reasons cited in the literature for why distance education has become so popular are flexibility, convenience and increased access to the offered courses.
- E-learning presents itself as an opportunity for the employer to improve professional training while keeping workers at their jobs.
- Factors such as personal motivation, infrastructure, and technology must be considered in the planning for the use of distance education in the work environment

How Does Your Research Contribute to the Field?

- The research highlights present the importance of providing not only effective educational strategies for CE, but also appropriate conditions to allow pharmacists both to attend CE courses and to implement the innovations in their services.
- It emphasizes the importance of planning and management in the process of training professionals as well as their impact on health services.
- It reveals the role that workers' personal responsibility plays in CE and how the e-learning modality exacerbates the current situation of overworked health professionals.

What Are Your Research's implications Toward Theory, Practice, or Policy?

- For CE policy, this research suggests the need to ensure that pharmacists (and other professionals) have dedicated work hours and technical conditions to attend e-learning CE courses.
- For research theories and methods, it indicates that CE development is influenced by technical, environmental, social, and personal characteristics; so research should consider the entire setting in which CE activities are offered.
- For the practice of CE projects, it shows that proposed educational activities should seek to commit managers and teams to incorporate new knowledge and practices into the reality of the health service.

Introduction

The health and education sectors have experienced rapid technological development. Not only the amount of new information but mainly the easy access to it, suggest that the role of universities, education providers, and students needs to be rethought and redesigned. Due to fragmented curricula and distance from social reality and the world of work, professional education has faced difficulties in following this developing state.¹ In this scenario, e-learning has gained popularity. This increase in the demand for e-learning courses started even before the COVID-19 pandemic—which made said demand skyrocket. Thousands of online courses are being offered and distance education has become a promising alternative to the traditional classroom. There are several reasons cited in the literature for why distance education has become so popular. Flexibility, convenience and increased access to the courses offered are considered the most important motivators.²⁻⁶ Employers and professionals see e-learning as a way to not disrupt work activities and still develop professional training or a way to get CE, while living far from academic centers.^{5,7,8}

Even though e-learning is increasingly incorporated into the educational environment and that the performance of the participants is equal to or higher than those in traditional models, a review about the use of distance education in pharmacy education suggests that some students still prefer face-to-face teaching. The authors argue that, although most of the available studies address the students' perception of the use of the modality for their learning, the analyses are still fragmented and lacking an in-depth discussion about the conditions of the use of e-learning and its personal and social impacts—as well as how it impacts students' workload, especially in continuing education (CE).⁹

The currently available studies in the use of distance learning in CE address, for example, student satisfaction, user acceptance, knowledge and behavior change, the operationalization of courses/organizational aspects, training of teachers and tutors, cost, and infrastructure.¹⁰⁻¹⁴

Considering that students are professionals in service is a fundamental issue to the success of CE learning proposals. Caudill and Reeves (2014)¹⁵ have already warned that e-learning presents itself as an opportunity for the employer to improve professional qualification, but that this educational approach is not effective if its planning and execution are not part of a strategic plan, linked to the goals and the organizational objectives of the company/employer. Thus, it is clear how important it is to consider the limits and possibilities of distance education in CE. It is also essential that multiple factors that might constitute obstacles to this approach be taken into consideration so that they can be overcome. Silva et al¹⁶ suggest that such factors are the individual and cultural aspects that permeate the social and professional environment, as well as the technological and technical-scientific aspects involved in the educational process. Thus, adopting socio-cultural perspectives on learning and

contemplating the relationships between the person and the technical infrastructure and technology, are factors to be considered in the planning for implementing the use of distance education in the work environment.¹⁷

The need to understand the complex relationships between the introduction of new technology and the social and human contexts of a given society led us to consider the contributions of the socio-technical system approach. The term “socio-technical system” originated in the mid-1950s from the Tavistock Institute to explain the decrease in productivity among workers after the insertion of mechanical equipment in the work routine. The study suggested that the work process (initially developed from the perspective of an industrial system) is influenced by technical, human, and social aspects, and that the outcome depends more on the interconnections between these aspects than on any of them alone.^{18,19} This theoretical framework has been used in several fields of knowledge, such as education and health, to broaden the vision on the use of new technologies.²⁰⁻²² This approach considers that better results from technological system projects are obtained when taking into account the social aspects of their users.²³

Hence, the objective of this study is to develop a comprehensive approach to understand the experience and complex setting of the use of e-learning in the CE of health professionals, based on the experience of pharmacists who completed a specialization course in a public health system CE program.

Method

Study Context

Brazil is the largest country in South America and presents huge regional and social inequities. The Unified Health System (SUS- acronym in Portuguese) provides access to health services for everyone in Brazil, fully financed by public resources. The majority of the population relies on it. The country has 5570 municipalities and each one is responsible for the management of its primary healthcare services, including the dispensing of medicines. In about 90% of municipalities' health departments, pharmacists manage the selection, planning, and purchase of medicines.²⁴⁻²⁶

Recognizing the need for specialization of the pharmacists working in the public health service, the Ministry of Health (MoH) offered the Pharmaceutical Service and Access to Medicine Management (the PSAMM course). The purpose of the course was to develop competencies in the scope of health services and the management of pharmaceutical services, encompassing technical, political, and social aspects of public health management. The course was coordinated by a public funded university between 2010 and 2016. The PSAMM course was offered using e-learning as its main approach. It was free of charge and was aimed at pharmacists working in the SUS, from all geographic regions of the country.^{27,28}

PSAMM was a hybrid e-learning and face-to-face course. According to the Brazilian legislation, until 2017, e-learning

courses should include face-to-face assessments and a face-to-face dissertation defense or a Course Completion Work presentation.²⁹ At the first face-to-face meeting, students received the study material in a flash drive (printable text books and videos) to facilitate their access to the content because of possible problems with the quality of the internet connection in different parts of the country. The PSAMM Course total workload was of 375 hours carried out over 15 months (64 weeks).

The pharmacists who were the students attending PSAMM Course were divided into 31 regional university centers, located in 17 Brazilian states, where the evaluations and four face-to-face meetings were held. The tutors, who were experienced pharmacists, came from all regions of the country and linked to the regional course centers. The PSAMM Course had 132 peer tutors. Each tutor guided 25 students per virtual class. The tutors were previously trained by the course's faculty and staff through workshops and online activities. Asynchronous activities such as texts, cartoons, video documentaries, forums, and questionnaire reports were evaluated by the tutors, based on criteria previously established by the faculty. Synchronous activities such as chats took place to facilitate interaction between students and tutors.^{27,28}

Characterization of Pharmacists Who Completed the Course

A total of 2500 pharmacists completed the PSAMM Course. These students worked in the SUS in 1068 municipalities, covering all 27 states of Brazil. [Figure 1](#) shows the density of students who attended the course in each state.

The PSAMM course had a total number of 4244 initial applications. By the end of the course 2500 students completed the course. These students worked in the SUS in 1068 municipalities, covering all 27 states of Brazil. From initial applications, 303 gave up and 1441 students failed the course. It is important to highlight that the results presented here include only students that completed the course. 77% of them were female, 68% aging between 25 and 39. All of them were government employees (at municipal, state or federal levels).

[Figure 1](#) shows the density of students who attended the course in each state.

Data Collection and Analyses

Data collection happened through individual interviews, focus groups, and researchers' records observations about the characteristics of the interviewees' municipalities and workplaces. It happened between the months of August and October of 2018 (on average, 3 years after the pharmacists had finished the course) in 10 states across the country. The criterion for the selection of states for data collection was the highest density of students from PSAMM Course. These states represent all the 5 geographic regions, including the

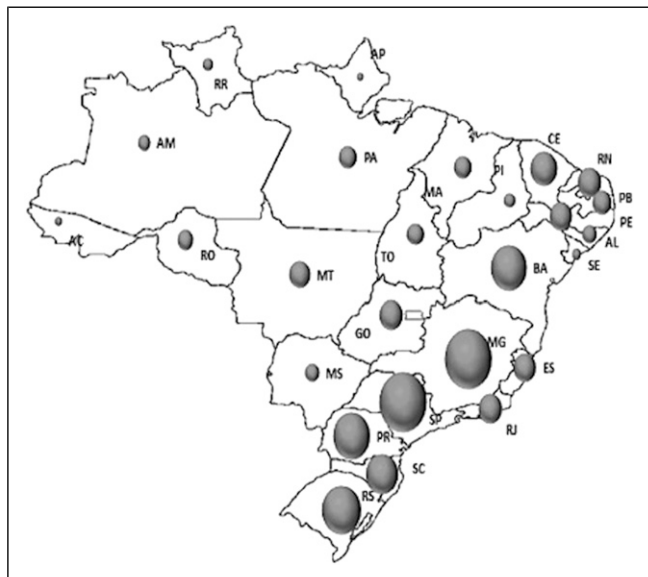


Figure 1. Students' density, by state.

Amazon region, which is the region with the lowest population density in the country. The interviews took place in the state capitals and, whenever possible, in 1 smaller municipality in each state.

In each of these ten states, 10 students were selected for the focus groups and 3 to individual interviews. The students were randomly selected from the list of students from each state. They were assigned to the interviews or to the focus groups according to their availability to participate in the given activity. The students were contacted by phone and email. Whenever necessary, new students were randomly selected and contacted until the desired sample was achieved.

The focus groups helped identify the regional specificities, which were important in informing the interviews and the visits to the workplaces. There were 10 focus groups in the capital cities that lasted for around 1 hour and 30 minutes each. Each focus group had an average attendance of six participants. The focus groups were led by the researchers. If during the focus group the need for it became evident, participants were invited to be interviewed individually to deepen some themes.

The in-depth interviews took place in the pharmacists' workplaces after written informed consent had been given. A semi-structured interview guided the interview in a way that the interviewee was able to share her/his experiences remaining on topic, while also allowing free and spontaneous answers.

Focus groups and individual interviews were carried out using a pre-defined script (Table 1). In all, a total of 58 participants participated in focus groups and 31 individuals were interviewed.

The study was approved by the Research Ethics Committee (UFSC CAAE: 46912815.0.0000.0121). All participants signed an informed consent form prior to the interview.

All activities were recorded in audio and transcribed in full. To guarantee the quality of the data, all the transcribed material was validated by the authors, comparing parts of the recorded audio with the transcription (one check every 10 minutes of audio).

To safeguard participants' identities, they were identified in the individual interviews by the letter E—for "interview", in Portuguese—followed by the acronym for their geographical region (EN—interview conducted in the North region, ENE—Northeast, ECO—Center-West, ES—South, ESE—Southeast). Focus groups were identified as GF—for "focus group," in Portuguese—followed by a number to differentiate the ten groups, for example, GF1.

NVIVO 10 was used to manage our data during the coding process and help organize themes. The excerpts highlighted by category were indexed and, considering their contexts and peculiarities, were selected to exemplify each of the categories.

Theoretical-Methodological Definition Path for Data Analysis

The context and the theme determined the choice of the qualitative method as a research approach for this study, with the premise that more in-depth reflections could be developed on the theme.

From the collection and treatment of data and the observation of the particularities of each place where the focus groups and individual interviews took place, it was observed that the data obtained went beyond the theoretical framework used up to that moment (related to distance education and e-learning per se). Subjective issues to the pharmacists and their social context seemed to directly impact the technology incorporated in their CE.

The team of researchers realized the need to find a theoretical-methodological framework for data analysis that would understand the explicit and latent messages brought by the research subjects and allow the analysis in its real context. This is justified, as pointed out by Graneheim et al (2017),³⁰ by the fact that the qualitative content analysis comprises descriptions of the manifest content (close to the text and/or explicit), as well as interpretations of the latent content.

Data Analysis

Thematic analysis was applied to verbal texts based on the proposal by Pope et al³¹ (2000). Passages in the text were identified and systematically coded line-by-line. After completing this initial coding, codes were combined into broader organizing themes. These themes were determined by their general area of inquiry, such areas were pre-determined by the theoretical framework. Both deductive and inductive approaches oriented the content and thematic

Table 1. Script for data collection.

Questions used during data collection	
Focus group	a) How was it for you to take a specialization course using e-learning? b) What are the advantages and barriers encountered during the course using e-learning?
Individual interview	a) How was the overall experience using e-learning? b) How was your digital fluency at the time of the course? c) How was family and service support in this process using e-learning? d) Which were the facilitating factors and hindrances regarding the technology and tools used? e) What was the reason for choosing an e-learning course?

analyses. The final analysis process involved a high level of abstraction and a high degree of interpretation.³⁰

Thematic categories were defined based on the conceptualization of socio-technical systems. The framework developed by Davis et al (2014)³² was adopted as a reference and adapted to this theme.

However, this categorization was constantly questioned to identify alternative interpretations and other possible components of the socio-technical system for the situation under study.

The framework described by Davis et al (2014)³² was used with adaptations and it includes the Objectives for the use of e-learning, People, Processes, Culture of the use of e-learning, Technology, Infrastructure, and Scenario. Table 2 describes the characteristics of each component defined for this study.

In addition to the deductive analysis based on the model of socio-technical systems adapted from³² and the deepening of the analysis for the latent content,³⁰ considering the context of the Brazilian health system and the context of these pharmacists (particularities related to social, economic, and life conditions), a new category, now inductive, has emerged. This non-exclusive category brings a look at the effect of using e-learning for CE in the context of the Brazilian health system and its CE program.

Results

There is a total of 2215 minutes of audio recordings. Thirty-one interviews and 10 focus groups were conducted. Six participants gave individual interviews and participated in focus groups. The participants' profiles are presented in Table 3.

In the profile of the studied sample, the predominant age group was between 40 and 59 years old (62%) similar to the average of all course participants; 78% of the sample was female. Both in the sample of individual respondents and in the focus group's sample, most had an employment relationship with SUS at the municipal level, and most of the sampled students had remained at the same workplace since the time of the course. Table 4 illustrates the main results found in this study, according to the component of the socio-technical system to which they are related.

FO: Fields Observation

Work Overload: Understanding Latent Content. PSAMM was one of the activities developed by the Brazilian Unified Health System Open University—UNA-SUS, an initiative of the Ministry of Health in partnership with Brazilian universities, to meet the training and education needs of the system. It is an action of the Brazilian Policy for health professionals permanent education in the SUS,²⁹ which defines that educational interventions for health professionals must be understood and developed as a health system's investment: being so, educational activities must be part of the health worker's work, once they will benefit the health system as a whole. However, from the analysis of the categories described above, a last category emerged from the set of results, pointing to a different reality from the proposal.

The evidence presented in the structure of the socio-technical system involved in the use of distance education, as a whole, strongly highlights aspects related to work overload and, consequently, precarious working conditions for pharmacists who wish to attend CE.

The same evidence brought by students as advantages presented by the online modality, such as ease of choice in times and places to take the course, as can be seen in "*Wherever I had a little time, I would open the computer and work right there, (ECO5)*," also show that the training process was not incorporated by the services as a work process, seen in "*When we were invited to take the course, the proposal was for us to do it during office hours, but that did not happen. It was at night, at home, at the weekend that you piled up everything you had to do during the week, (GF2)*." Thus, it was observed the lack of support from several workplaces that were supposed to provide the technical and material conditions for the pharmacist to develop the course. These conditions were physical (such as access to computers and unrestricted internet), but also involved the organization of the work process with moments for the development of activities during work hours.

The characteristics of the course, for instance, the distance learning technology, reinforced this work overload, since, like most courses in this modality, it presents a dense structure, with a lot of content and that demanded time and

Table 2. Description of the components of the socio-technical system in general, according to the literature,³² and its adaptation for application in this research.

Components	Literature description	Adaptation to the study
Objectives	It describes the objectives of the system, of its operation, or of those who generated the demand for its construction.	It addresses the objectives of using e-learning modality in the PSAMM course and the motivations for joining a distance course.
People	It describes the skills and attitudes of people who can influence the use of technology.	It brings out the individual characteristics of participants which can influence the use of technology.
Processes	It describes the main activities that are part of the system, planning processes and user actions, or even the use of technology itself.	It discusses “how to do” the course, detailing facilities, difficulties, and the work process during the course.
Culture	It describes the cultural assumptions that involve the system or technology, influencing its use and understanding.	It addresses issues related to the acculturation of the use of e-learning in CE, in addition to habits and preferences socially constructed related to the process of training and the use of educational technologies.
Technology	It describes the wide range of components, tools, and technological devices, such as software, hardware, and system or technology mold.	It covers characteristics related to the technology itself, in this case, the PSAMM course.
Infrastructure	It describes the equipment or physical structure that the technology requires to be used.	It deals with questions of technical and organizational infrastructure of students to take the distance course, involving places and time allocated to the course, computers, internet access and bandwidth.
Scenario	It considers the financial/and economic circumstances as well as the political/and regulatory scenario.	It focuses on the scenario and context of the health system in which the study is inserted (considering incentive policies and service organization).

Table 3. Demographics of pharmacists working in Brazil's public health system who completed the PSAMM Course.

Variable	Profile n (%)
Gender	
Female	65 (78.3)
Male	18 (21.7)
Age range	
30–39	25 (30.1)
40–49	32 (38.6)
50–59	22 (26.5)
60 and above	4 (4.8)
Governmental sphere (work)	
Municipal	48 (57.8)
State	24 (28.9)
Other	11 (13.3)
Labor relationship	
Government employee (with job stability)	66 (79.6)
Outsourced	8 (9.6)
Other	9 (10.8)
Continuance in the workplace after finishing the course	
Yes	69 (83.1)
No	14 (16.9)

reflection. This characteristic is evidenced in “*I was desperate when I came home and had a lot of articles to read, there were many things, I thought: “people I will not be able to handle, , (EN4).”*”

Considering the characteristics of people, often with more than one job, or belonging to a family nucleus with their own needs (“*After the family went to sleep, I started the course, but then I missed some discussions in the chat rooms, (EN4)*”), difficulties were observed due to the demands arising from the course, which had a strong impact on the individual’s professional and personal life, in addition to working hours (“*I loved the holidays and put it (the course) on my calendar. Husband asked me out and I said I couldn’t because I had to study (GF9)*”).

Discussion

The structure for the study of socio-technical systems adapted and applied in this study allowed the analysis of the use of e-learning in a broader way, considering the application of technology in the social reality in which it will operate. Thus, the collected data could be analyzed to assist in the understanding of the real experience of using e-learning in CE; considering not only the technology or the student’s satisfaction, but also the entire context. Such understanding of the context made it possible to visualize its particularities, relationships between system components, and how it impacts students personally, socially, and professionally. The conformation of the socio-technical system obtained by the relationships established in the course, using e-learning in the continuing education of health professionals can be structured based on the results found.

The structure of this socio-technical system shows different relationships between the studied categories. The

Table 4. Main Findings: Components of the Framework.

Components	Description	Example findings
People	Students from different backgrounds participated in online courses; some are very accustomed to the modality, while others have difficulties, but still, they are convinced of its usefulness. They realize that discipline and autonomy are key issues for students online.	<p>It was quite easy for me, it depends only on you. (GF1)</p> <p>I think e-learning courses require incredible self-discipline. This was the first big exercise. (GF2)</p> <p>When you reach a certain age, in your personal development, you look for it regardless of whether someone is giving it to you, so you will study by yourself. If you want to learn, you don't keep waiting. (GF9)</p> <p>[...] nowadays it's all on the internet... I can't do it, so I printed everything out so I could study. (GF5)</p> <p>I'm older, I prefer the face-to-face modality, I can concentrate better and pay attention longer. (ESE2)</p> <p>[...] and then I discovered e-learning. I like to study a lot, but I hate going to the face-to-face class [...] I prefer e-learning. (GF4)</p> <p><i>FO: Pessoa com deficiência física</i></p>
Objectives	Students recognize e-learning as the main way to get CE— for professional or personal reasons, and this is the main objective of registering for the course. They believed, however, that it would be easier and more flexible than it ended up being.	<p>Wherever I had a little time, I would open the computer and work right there. (ECO5)</p> <p>But currently, you either do e-learning or you don't have the opportunity to get CE. (GF2)</p> <p>It was impossible for me to be present, to have a physical presence. (ENE9)</p> <p><i>FO: He simultaneously works two jobs.</i></p> <p>I think the possibility of organizing our schedule is very important. (GF3)</p> <p>It made it easier because I had the opportunity to study at the time that was most convenient for me; made it possible to be very productive. It was whenever I was available. (ESE5)</p> <p>Imagine if you have family, work, sometimes more than one job, you have to organize your schedules. E-learning helps a lot; being able to organize your schedule. (GF3)</p> <p>[...] you can find the best time to do it, you don't have that commitment to give up "oh, my son got sick, I can't go to the face-to-face class". (EN3)</p>
Processes	Students recognize that e-learning requires more dedication and discipline from students; students may feel that they are alone and not involved. Almost all students reported spending weekends and evenings to study and prepare coursework. Workplaces are not prepared or do not allow CE activities.	<p>It may become a little lonely [...] and like it or not, when you are in a classroom, you interact with the teacher, with the colleague [...] (GF6)</p> <p>I think that in face-to-face (classes) I get more involved. (ESE2)</p> <p>The first thing that was remarkable for me was the demystification of the idea that distance education is easier. (GF6)</p> <p>Contrary to what it seems, you have to study a lot more. (GF3)</p> <p>I had never taken a long e-learning course. The dynamics for me at first were difficult, due to the discipline that you have to impose (to yourself). Because it's you, there's no teacher demanding from you, you don't have to go to class. (GF3)</p> <p>I took the course in a variety of ways, I didn't have a fixed schedule, it was according to the organization of the week, but I usually did the activities at night and on weekends. (GF6)</p> <p>It was good, because sometimes I couldn't do it here (at work), but I had the weekend available, sometimes I spent the whole Sunday on it. My day at work is busy and I couldn't do activities there. (ES5)</p> <p>After the family went to sleep I started the course, but then I missed some discussions in the chat rooms. (EN4)<i>FO: Mother of two; two different Jobs.</i></p> <p>I would be desperate when I got home and I had a lot of articles to read, there were a lot of things, I thought: "I will not be able to handle" (EN4)</p> <p><i>FO: Married woman with child and two different jobs.</i></p>

(continued)

Table 4. (continued)

Components	Description	Example findings
Culture	<p>None of the students demonstrated some degree of reflection about the use of e-learning in CE, simply adopted it.</p> <p>Students are used to use the Internet, platforms, and information systems, having adopted e-learning as a “natural” way of studying. Among students, there are no issues about e-learning as the main approach for CE. Still, some of the students report that, if possible, they would prefer face-to-face courses.</p> <p>Participants also naturalize the fact that they do not have time and incentives to attend the CE program offered by the health system. They have incorporated the CE in the personal and family routine.</p>	<p>I did not miss a teacher or classroom. (ESE5)</p> <p>I had no problems regarding the absence of face-to-face contact. (ECO3)</p> <p>I consider (the e-learning course) a challenge. A personal challenge. (EN3)</p> <p>I prefer the e-learning mode. (ESE1)</p> <p>e-learning is a modality that will no longer disappear (ENE9)</p> <p>I always had an easy time with the use of systems and I couldn't see any difficulty in using the tools (EN5)</p> <p>[...] as I had a very difficult pregnancy, I was already with a baby, and studying at home was very advantageous. (GF4)</p> <p>I loved the holidays and put it (the course) on my calendar. Sometimes my husband asked me out and I said I couldn't because I had to study. (GF9)</p> <p><i>FO: She is a mother</i></p>
PSAMM course	<p>Students recognize that specific features of the course platform and instructional design significantly affect the experience of taking an online course.</p> <p>Different activities, motivation strategies for the study, support, and interactivity were essential.</p>	<p>I liked the platform, literally the concern to do e-learning is the platform. If it's going to be fast, if it's cool, if it's really intuitive... (GF4)</p> <p>[...] in the other (course previously held) there was no such dynamic platform. (ESE1)</p> <p>I had everything I needed available on the platform, so it met my needs. (ES4)</p> <p>At first, I thought I wouldn't be able to do it, but it was very well explained, I watched the tutorials and could understand everything. I can't complain about anything, there was no way to be in doubt about anything. (ESE2 and ES4)</p> <p>About the platform, I thought it was very easy, especially because I had the tutorial, I could read there to clarify doubts, besides, we had very good support [...] that chat part was very cool because there I was able to talk to people who were in other states. (EN5)</p> <p>You can't just have a lot of material to read, you have to have something attractive. This I found very interesting about the PSAMM course. (GF3)</p> <p>You need a diversity of styles, like video lessons, reading, so you don't get bored. (GF3)</p> <p>There has to be motivation. Just reading on the computer screen is awful. Whoever designs these courses has to think about it. (GF3)</p> <p>My concern when I started was in relation to texts, I imagined that because it is e-learning, classes could be monotonous, with only texts to read. I have already taken courses like this, and I was very positively surprised by the layout of (moodle), it made me want to continue studying. (PL6)</p> <p>The course had many activities. I remember that I used the whole weekend to do the activities. (ES5)</p> <p>The course material was better (than other experiences), it was more interesting, better elaborated. The others (courses), despite being e-learning, had that face-to-face course format, without didactic instruments. (ENE2)</p> <p>The PSAMM course had this concern with the people of the smaller cities, which in a way helped us. (GF4)</p> <p>So, the tutoring part was very important, it directed us a lot and consolidated the thoughts and actions. (ENE7)</p>

(continued)

Table 4. (continued)

Components	Description	Example findings
Infrastructure	The services' organization impacts how the modality is used. The reports reveal barriers related to infrastructure, particularly in small and remote cities. However, strategies used to overcome the barriers connected to the physical and organizational infrastructure were well described.	<p>When we were invited to take the course, the proposal was for us to do it during office hours, but that did not happen. It was at night, at home, at the weekend that you piled up everything you had to do during the week. (GF2)</p> <p>At the hospital I didn't even have a computer that I could use. (GF7)</p> <p>Even though there's no formal obstacle to our participation, the routines themselves do not stop and we have no chance to attend online activities in work hours. (ESE5)</p> <p>Through the internet of the municipal government, the sites are blocked, so I could only access the course at home. (GF2)</p> <p>FO: Even though the course was part of the MoH CE program, in some public institutions there was no access to it due to the fact that the computers were only allowed to access pre-approved websites, directly related to the health service.</p> <p>At work, I couldn't study. Sometimes I would print and read on the way to work. (ESE6)</p> <p>To send (the activities), sometimes I had to go to the internet café. (EN1)</p> <p>FO: <i>City in the northern region of the country, where there were several reports of students with difficulty accessing quality internet.</i></p> <p>In this city, the internet was horrible. In my work I didn't have the internet, I didn't have access. To have access to the course, it was necessary to ask the manager for authorization, because I had no freedom. (EN1)</p> <p>[...] in the countryside town where I worked, the internet was terrible. (EN3)</p> <p>FO: <i>City in the northern region of the country, where there were several reports of students with difficulty accessing quality internet</i></p> <p>We have run out of electricity for 48 hours. The supply of energy is made by a diesel generator—the diesel arrives by ferry—and sometimes the ferry fails to arrive. (EN2)</p> <p>FO: <i>Small isolated city in the northern region of the country.</i></p> <p>The internet made it very difficult [...] as I supervise areas without access (to the internet), at those times I did not participate [...] and I had to justify my absence. (GF4)</p> <p>FO: <i>City in the northern region of the country</i></p> <p>There were times when we didn't have internet [in the whole city], so I called my son, dictated everything I had written down, he wrote and then typed to send (EN2)</p> <p>Here, I had everything available (electronic devices). Even today, if my computer is a little slow, I request it and they exchange it for a better one. (ES5)</p> <p>FO: <i>Small city in the South region of the country, with a good public health infrastructure.</i></p>

(continued)

Table 4. (continued)

Components	Description	Example findings
Scenario	<p>The socioeconomic and cultural context of society and the health system organization has an influence on the way the course is developed and on the responsibilities of students.</p> <p>There are few offers of CE by local institutions. Health institutions have no planning for CE. The search for CE is an individual choice for the majority of health workers.</p>	<p>Sometimes we even want to take a course, but we don't know where it is available. If I have to take a private lesson, I will pay dearly [...] With the wage of pharmacist, how can I take a course? (GF3)</p> <p>I think the municipal government does not offer (courses) due to lack of resources, lack of specialized people to promote CE. (ESE3)</p> <p>I have been here since 2004, if we do not individually look for something new to bring here, the municipality would not have the conditions or initiative. (ENE7)</p> <p>For the pharmacist there are not many continuing education activities supported by the health system, I see a lot for nurses, doctors, health agents, nursing technicians, but not for pharmacists. (ECO3)</p> <p>It seems to me that today, as management has changed, it is a little more difficult to obtain clearance for courses. (ESE2)</p> <p>I saw the news on the health portal, there was an add there, then when I saw it was available, it was practically the last minute. (ECO4)</p> <p>We learn that there are opportunities and (if) it is interesting, we go on our own. State management does not plan "we need to train the pharmacist." (ES2)</p>

understanding of *Processes* or activities related to the use of e-learning by pharmacists materializes the convergence resulting from the other components of the system. In addition to the characteristics of the PSAMM course (*Technology*), the *Culture*, *Infrastructure*, and *Scenario* components were responsible for the greatest influence on the *Processes* that characterize the use of e-learning in the daily routine of CE for these pharmacists. Even so, the other categories, even if indirectly, presented influential relations that were decisive in the functioning of this socio-technical system.

Hall et al (2010)³³ indicate that most students agreed that the use of technology-based teaching challenged them intellectually, overturning the idea that distance education courses are easier. Still, due to the domestication of communication and information technologies, the results suggest that the subjects commonly use technological tools, often without questioning and without reflecting on their use and application, and the same attitude is found with the use of distance education tools. The use of information and communication technologies is inseparable from people's daily lives and their incorporation for CE is not questioned, revealing the cultural component of the system under study.

In addition to the broader cultural construction, each student was inserted in a particular and specific context, that is, in an environment. The scenario of the public health system, the social conditions of pharmacists, and the culture related to the use of e-learning played a decisive role in the willingness to attend CE. The lack of organization and planning for the development of CE by the health services and the economic difficulties to bear the costs of CE have made e-learning a viable training option. In

this scenario, the health professional is responsible for looking for a spot in the course and for deciding whether to take the course or not, that is, he or she is responsible for the workforce training process. This responsibility demands personal choices and sacrifices. There is pressure to meet the constant need for training in which health professionals are culturally inserted. This trend reinforces the e-learning as a viable option, as described in the literature.^{2-5,34,35}

The literature presents flexibility as one of the most relevant characteristics of the e-learning modality for students.^{3,4,36-44} In this study, the results corroborate the literature, placing flexibility as a keyword linked to the choice for the e-learning modality; especially when the learner is a professional already in service.

The *Objectives* of using e-learning in such *Scenario* may bring biases for the participant pharmacists. The conception that this type of education is easier, more flexible, more autonomous and independent of specific infrastructure tends to lead professionals and managers or those responsible for local health services to interpret that e-learning CE does not require planning for the training of the workforce in the context of everyday health services. In this way, the *Goal*, *Culture*, *Organizational Structure*, and *Scenario* tend to attribute to the professional the responsibility for their own training, with the use of personal time to do so. Thus, even though the course was offered for pharmacists employed in the diverse institutions of the SUS with purpose of developing practical activities in the service and to foster the transformation of health practices, the health services organizations are exempt from such responsibility.

Corroborating these findings, the literature suggests the lack of management and planning as a barrier to the professional training process. Ruggeri et al (2013)⁴⁵ points out that the institutional organization's support of professionals in the training process is a determining factor for success. This includes, among other actions, allotting proper time for the learning activities. The results found in this study reveal that many workspaces are not prepared to support the e-learning processes in the way the professionals need it.

Considering the case studied was a strategy of the Brazilian Policy for health professionals permanent education in the SUS, funded by the Ministry of Health as an investment in health system's improvement, the absence of local (mostly municipal) health managers engagement in the workforce training is particularly significant. The referred policy defines the workforce training in service as part of health professionals' work and a strategic action of the health services.^{29,46}

Observing the quotes highlighted in Table 4, about the study *Process* of the course, the results point to the inversion of this conception. The real experience reveals that, for pharmacists, the training using the e-learning modality results in an enormous workload. Despite allowing flexibility in schedules and management of the study, e-learning does not save time. It increases students' responsibility and demands very taxing time-management from them. Virtually every student was forced to use mostly their own time away from work (an enormous amount of time) to attend the course.

The proposal of the PSAMM course established that the e-learning activities would take place in the learners' work environment. However, the development of the study process revealed that very few students were able to do so. Baldwin-Evans (2004)⁴⁷ points out that many students develop their training activities using distance education at home since they do not have adequate space (time and place) in the service environment. It can be understood that there is still difficulty in integrating CE activities into the work process. It is evident, then, that there is still a need to understand e-learning as a teaching modality not based solely on the responsibility of the professional in training, but that needs to be contemplated in an institutional training plan. Strategic planning must consider training, e-learning included, as a tool for transforming health practices. It must be seen as an inseparable part of the work process and institutional organization.

Nonetheless, the concept of CE is usually seen in the literature as an individual investment. Even within the public health systems, it is not usual to find an explicit policy of investments in CE. A recent study in Kuwait reveals that the main barrier to CE from the perspectives of pharmacists was lack of personal time, as reported by 66.5% of pharmacists. The authors referred other studies to show pharmacists worldwide have reported work and family constraints and uninteresting topics as barriers to participate in CE activities.⁴⁸ The responsibility of the companies and governments (in public systems) in providing better conditions for pharmacists to develop their skills in favor of the quality

improvement of the services offered to the patients is not well discussed. It is interesting to observe FIP's report: pharmacists in developed countries showed higher participation rates in CE than those in developing countries.⁴⁹ It is important to consider if this is a result of how much support do pharmacists receive in different countries to be motivated and engaged in CE.

The perception of pharmacists about the difficulties, as noted, was related to infrastructure, both organizational and technical. As shown in Table 4, at various times students reported difficulties in accessing computers, low-quality internet, and lack of space for the development of the activities proposed in the course. Ruggeri et al (2013)⁴⁵ describes that the institutional organization, as a provider of technical infrastructure, can directly impact the success of professional education. Otherwise, this category, when associated with the aspects of the *Scenario*, becomes responsible for legitimizing the *Culture* of e-learning as the individual responsibility of the student with no onus to the organizations.

Regarding the technology used in education, the available literature points to similar results, where aspects of the studied technology (such as hardware problems, software, connection speed, planning and development of activities) are factors of great impact in the training process.^{37,39,40} Consequently, there is a need to develop and improve the implementation of technological tools that are efficient in order to guarantee the quality and consistency of the teaching and learning process with the expected flexibility and autonomy.⁵⁰⁻⁵²

As seen before, there are several obstacles that professionals encounter when becoming students. In this STS, it was observed that the PSAMM course presented an important responsibility for the pharmacists to carry out the course activities. The importance of prior planning for the provision of CE activities in e-learning is evident, especially in large scale proposals such as the one studied here. The planning must be based on a deep knowledge of the target audience of CE and the particularities that each student may have (including those of technical, organizational, and social infrastructure) in order to help the student (*People*) to find ways to overcome adversities.

As shown in Figure 1, the course was taken by professionals across the country, from large centers to more isolated regions. The results shown in Table 4 about the PSAMM course, show that notwithstanding the difficulties (whether related to infrastructure or social context and scenario, for example), the students' characteristics (also related to the culture of individual responsibility) combined with the characteristics of the course (including all its instructional design and tools to overcome structural obstacles) were able to provide the students with the means to overcome hardships and make the course feasible.

This look at the studied socio-technical system, provided the visualization of the duality imposed by the e-learning modality, mainly when considering the context of this analysis, that is, the Brazilian health system and the particularities of each student, from their individual context.

It is interesting to note how the results present explicit data on how students perceive the benefits provided by e-learning, such as flexibility and convenience, but how pharmacists do not reflect on its negative and stressful impact on their private life. Unlike a CE scenario with face-to-face teaching, in which the professional is authorized to leave the service to carry out his activities, in the distance mode, autonomy places the responsibility on the professional to develop her or his training without being absent from work, once that she or he can develop the course “anywhere and anytime”.

Graneheim et al (2017)³⁰ justifies that the analysis of qualitative results can present different degrees of abstraction and, consequently, different levels of interpretation. Thus, based on this premise and reading in the context of the quotes presented, the course proposal and the PNEPS, the characteristics of the modality, as well as the other factors presented in this study, it is possible to infer that the statements brought by pharmacists, even in its subjectivities, corroborates the duality of distance education as a tool, on the one hand, for expanding access to CE, on the other hand, for amplifying precarious working conditions.

Strengths and Limitations

The addressing of a real and relevant experience by the study of pharmacists who have experienced the use of e-learning as part of their training while working in the health system is a strength that should be highlighted. In addition, this study (including *in loco* data collection) reached pharmacists from various scenarios, professionals of different ages and backgrounds, from those residing in remote areas of the country, with major structural difficulties, to those working in large urban centers.

However, the study of the socio-technical system was carried out based on the reports of pharmacists only, without the viewpoint of the other stakeholders involved with the course, which is a limitation. The perspective of managers, teachers, and other health professionals in the work team could bring more elements to understand the complexity of the system.

Finally, as a limitation in this manuscript, the learning evaluation was not addressed, however, this analysis has already been described by Manzini et al⁵³ (2021).

Conclusion

What can we learn from this course about e-learning in CE?

The results suggest that, although some components—such as technology, infrastructure, and scenario - offer great obstacles to students, the course structure, the socio-cultural characteristics of the studied context favor the surpassing of such impediments. In this sense, the data reinforce the use of the chosen framework, that is, the use of the socio-technical approach as a way to understand the complex relationships between different components, how they speak to

each other, and their importance in the functioning of a system and the consequent success in using technology.

The e-learning modality proved to be useful to enable and expand access to education. It allows that pharmacists already in health services, even in remote regions of the country, develop CE activities. On the other hand, e-learning in the context in which it has been applied, contributes to the naturalization of precarious working conditions, specifically in the professional training of the worker. By placing on the workers the personal responsibility for the development of their training process, the current situation overloads them.

E-learning supports and allows the reality experienced by learners, that is, a model of personal goals. This model, however, supports a management organization logic that alienates the education process from the service management process. The health manager needs to include the continuing education process and its demands in the planning of its management program, with a technical and organizational infrastructure capable of integrating the service formation process into the professional practice.

The planning of offered CE activities needs, in turn, to go far beyond the technical components internal to the course/digital platform. Such planning needs to be based on a profound knowledge of the professionals and their expectations, the necessary infrastructure and their availability to these professionals, and the professional education/practice relationships in place. The CE offer must foresee the main obstacles that professionals may encounter in the course of activities and provide the means for participants to overcome them more easily. In addition, recognizing the complex socio-technical system in which the CE is inserted, the proposed activities should seek to commit managers and teams to incorporate new knowledge and practices into the reality of the health service.

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