



Process of educating ergonomic demands related to accessibility in the context of emergency evacuation in a museum

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Summary

This work aims, in the light of the Ergonomic Work Analysis-AET method, to describe the process of instructing the ergonomic demand underway in a museum located in the city of Natal/RN, Brazil, and characterize its overall structure and functioning, considering accessibility of the museum and the possible need to evacuate occupants in an emergency situation. To this end, initially, a bibliographical survey was carried out to identify existing problems in museums, related to disaster risks, accessibility, informational and physical barriers and evacuation of occupants in an emergency situation. The survey of these problems, as part of the ergonomic demand instruction process, and the study of the structure and global functioning of the aforementioned museum resulted in the formulation and presentation to the museum director of an ergonomic demand hypothesis (provoked demand) that is being discussed and analyzed with him, in order to establish the negotiated ergonomic demand. The social construction developed proved to be an efficient device for AET in the demand instruction process in the aforementioned museum.

Keywords: Museum; Emergency; Ergonomics; Social Construction; Demand Instruction.

1. Introduction

Human populations, of the most diverse ages, characteristics, cultures, languages, abilities, limitations, etc., are attracted daily to visit museums of all types throughout the world, but many of them lack prevention and mitigation systems. accidents or disasters

and preparing the occupant population (employees and visitors) for the safe evacuation of these facilities in emergency situations.

This article aims, in the context of museum accessibility for the safe evacuation of users in an emergency situation caused by an accident or disaster, to describe, in light of the Ergonomic Work Analysis-AET method, the process of instructing ergonomic demand in course in a museum located in the city of Natal/RN, Brazil, and characterize its structure and global functioning, aiming to define the negotiated ergonomic demand.

Museums are “permanent, non-profit establishments in the service of society and its development, open to the public, which collect, conserve, research, communicate and exhibit, for study, education and entertainment, the material evidence of man and their environment” (ICOM, 2022).

Museums are extremely important in representing a society, as they are spaces that contribute to the cultural formation of the country. Its materials are the results of the action and thought of different social groups and, thus, serve as a bridge between cultures, distinct and distant peoples (ONO; MOREIRA, 2011).

In Natal/RN, where the research that led to this article is being carried out, the Department of Culture (SECULT) is responsible for planning, suggesting and implementing municipal policies to support and encourage culture (SECULT, 2023). Law No. 7,515, of May 16, 2023, provides for the Municipal Culture System of the municipality of Natal, which is integrated into the Municipal Museum System (SMM) of the city of Natal/RN.

In the state of Rio Grande do Norte (RN), Decree No. 4,793, of April 4, 1967, established the State Council of Culture – CEC/RN, linking it to the State Department of Education and Culture. Among other commissions, the CEC/RN is advised by the Historical Heritage Commission. In 2022, Law No. 11,227 was created, which established the State Policy for Living Culture in the state of Rio Grande do Norte, with the purpose of

“promote the production and dissemination of culture and access to cultural rights for different groups and collectives, constituting a community-based policy, with the objective of expanding the access of the population of Rio Grande do Norte to the conditions for exercising cultural rights” (RIO GRANDE DO NORTE, 2022).

In Brazil, in 2003, the National Museum Policy – PNM was launched (BRASIL, 2003). Afterwards, the Brazilian System of Museums (2004), the Statute of Museums (Law nº 11,904/2009) and the Brazilian Institute of Museums (IBRAM, 2009) were created.

The International Council of Museums-ICOM (in Portuguese, International Council of Museums) was created in 1946. It is an international, non-profit, non-governmental organization dedicated to developing international policies for museums and supporting the creation and the development of museums of all types and themes around the world. ICOM maintains formal relations with UNESCO and is a member of the Economic and Social Council of the United Nations (UN) (ICOM, 2023).

According to Valente (2008, p. 32), “the museum is dynamic and permeable because it allows the inclusion of countless contents organized in different ways and the promotion of the most different integrations with knowledge, institutions and individuals”.

Museums also play an important role in inclusion and accessibility. Chacon (2011) states that the museum must be open to the community, without contempt or imposition of ideas, considering social, political, psychological, anthropological and economic aspects. This means that communities must be heard, understood in their complexity and diversity and welcomed in their differences.

An accessible museum space must eliminate barriers, whether physical, informational or others, in order to promote accessibility both in the facilities and in the content and service (COHEN; BRASILEIRO, 2012).

Museums are subject to different types of accidents, requiring, in addition to protecting the collection and objects on display, attention to the protection of human life, especially in a context of rapid abandonment of the site. It is necessary to develop previously prepared and effective emergency plans (ONO; MOREIRA, 2011).

Natural disasters, such as floods, storms or earthquakes, as well as human-induced events, such as terrorism, vandalism or armed conflicts, lead to the loss of countless heritage assets and cause significant damage to many people (ROMAO; BERTOLIN, 2021).

The Sendai Framework for Disaster Risk Reduction (DRR) 2015-2030 states that “it is urgent and critical to predict, plan for and reduce the risk of disasters in order to more effectively protect people, communities and countries, their livelihoods and life, health, cultural heritage, socioeconomic heritage and ecosystems, thus strengthening their resilience” (UNISDR, 2015, p. 4).

According to one of the guiding principles of the Sendai Framework for DRR, “disaster risk management aims to protect people and their assets, health, livelihoods and productive assets, as well as their cultural and environmental heritage, as well as promoting and protect all human rights, including the right to development” (UNISDR, 2015, p. 13).

Barriers create direct implications during the context of an emergency evacuation of the space by the population, since the location needs to meet the security conditions for a safe evacuation of the population.

Another important factor concerns people's perception regarding the risks of accidents/disasters in the museum space, as well as the emergency response systems in the museums in which they are located. This perception can be developed or sharpened by carrying out simulated evacuation exercises in museums for the occupying population, but it is noted that few Brazilian museums adopt this type of practice with any regularity.

It is expected that, in a further stage of the research to which this article is linked, one or more simulated exercises will be developed and applied for analysis in the museum in question, considering the scenario of the museum's accessibility for the emergency evacuation of people occupants safely.

2. Development

2.1. Method

a) Demand Instruction

The AET process begins with the emergence of demand. According to Guérin et al. (2001), the demand may arise from different transmitters and it is necessary for the ergonomics professional to analyze and reformulate the situation to characterize a fundamental perspective in driving the route. According to the authors, the instruction of

the demand consists of defining “the problems raised in relation to the prescribed/actual distance and the modalities of its management” (GUÉRIN et al., 2001, p. 41).

For Vidal (2003, p. 87), the instruction of the demand “... consists of the transition from the managerial perception of the problem (managerial demand) to the proposal for ergonomic action (ergonomic demand), from which an ergonomic intervention contract can be celebrated.”

Carvalho and Saldanha (2001) state that demand can be conceived from the company interested in solving problems, through an organization manager, for example, who formulates one or more demands associated with such problem(s) identified and communicates it to consultants/researchers contacted to answer it, with the aim of carrying out an AET. In this case, it is called “managerial demand”. There is also the situation, called provoked or induced demand (CARVALHO; SALDANHA, 2001) in which researchers interested in a certain Ergonomics research topic in a certain field or sector of society, identify potential problem(s) existing therein, formulates demand hypothesis(es) associated with it(s) and states it to some potential demander or interested party of an organization (director, for example), in order to understand and solve possible existing problems, within the scope of Ergonomics, in an organization, following an AET, through its stages.

To formulate the demand provoked, initially, a bibliographical survey was carried out on the topic in question - physical and informational accessibility in the context of emergency and evacuation in museums, through which problems in museums were identified, in general, associating disaster and accessibility/informational and physical barrier, disaster and evacuation of people in emergency situations and evacuation and accessibility/informational and physical barrier. Based on these problems, potential ergonomic demands were formulated (demand hypotheses), which have been presented and discussed with the museum manager, in order to establish the negotiated ergonomic demand(s) that will follow up with the AET at the aforementioned museum.

The databases explored in this research were Scopus and Science Direct, from the CAPES Periodical Portal (CAPES, 2023), following the criteria of peer-reviewed articles to guarantee the quality of publications.

In the selected journals, the search was carried out using Boolean operators “or”, so that the search result contained at least one of the keywords related to this operator,

obtaining publications with one or another related keyword, and “and”, so that the search result contained all groups of keywords related to this operator, obtaining publications with all keywords related to the “and” operator. Using the “all” operator intended to obtain all publications in this search. In Table 1, below, the organization of the keywords that were used is presented.

Table 1 – Keywords used in databases

Terms and Synonyms				
<i>Accessibility</i>	<i>Museum</i>	<i>Evacuation</i>	<i>Disaster Risk</i>	<i>Ergonomics</i>
<i>Museum accessible</i>	<i>Museum safety</i>	<i>Safe evacuation</i>	<i>Risk</i>	<i>Cognitive</i>
		<i>Emergency evacuation</i>	<i>Disaster</i>	
		<i>Safe evacuation for all</i>	<i>Risk perception</i>	
		<i>Museum emergency evacuation</i>		

Source: Authors (2023)

The terms “ergonomics” and “cognitive” were excluded as they did not return results. Therefore, the search was carried out as follows: ALL ((“museum” OR “museum safety”) AND (“safe evacuation” OR “emergency evacuation” OR “museum evacuation” OR “safe evacuation for all” OR “museum emergency evacuation ”) AND (“risk perception” OR “disaster risk” OR “risk” OR “disaster”)).

As a result of the search for these terms in the databases, 108 documents, including scientific articles, theses, dissertations and books, were found in Scopus and 461 in Science Direct. Duplicate articles, documents that were not scientific articles published in journals and articles that were very different from the study area proposed here were excluded. The summaries and, later, the full texts of the documents found were read, according to the screening. The search period was not limited, obtaining a final result of 11 scientific articles between 2017 and 2022.

The problems listed in Table 2, below, were obtained from the literature search described, from UNDRR documents (2009, 2012, 2013, 2015, 2019, 2023) and from

articles and reports in the media. Based on these problems, an ergonomic demand was formulated (provoked demand), in order to present it to the director of the museum in question, triggering the beginning of a discussion and analysis, which has not yet been completed, in order to negotiate an ergonomic demand, the be answered through an AET.

Table 2 – Problems and ergonomic demands presented to the director of the museum in question

Problems related to accessibility, risk of accident/disaster and emergency evacuation in museums (Pi)		Caused or induced ergonomic demand (demand hypothesis or potential demand)
P1	Emergency system failure (emergency equipment not installed, lack of team training for emergency situations)	Analyze the risks of accidents/disasters, the physical and informational accessibility conditions of the Museum and the risk perception of the occupant population, with the aim of preparing them for evacuation in a possible emergency situation.
P2	Technological disasters (environmental control system failure, power outage, fire, chemical spill, structural collapse, waste collection collapse)	
P3	Accidents (medical emergency involving a visitor or employee, physical damage to the building or collection)	
P4	Low perception of risk of accidents in the museum (by the fixed and floating user population)	
P5	Failures by museum teams, such as inadequate handling and transportation of the collection, improper operation and maintenance of air conditioning equipment, use of environmental cleaning products with the potential to harm the works	
P6	Failure in the physical and informational accessibility system (absence of assistive technologies, elevator without information in Braille, inadequate ramps, absence of a defined escape route, absence of emergency exit, etc.)	

Source: Authors (2023)

The interactions (conversations) carried out so far, with the management of the case study museum, dealing with potentially existing problems (because they were obtained from bibliographical, documentary and media research), and field observation have favored the identification of real problems /located in the museum, which are identical and distinct from those already identified. This ongoing process, which should be expanded with interactions with employees who deal directly with certain problems and with visitors, will possibly enable, in a timely manner, the formulation and definition of the negotiated ergonomic demand(s)(s).

b) Global Analysis

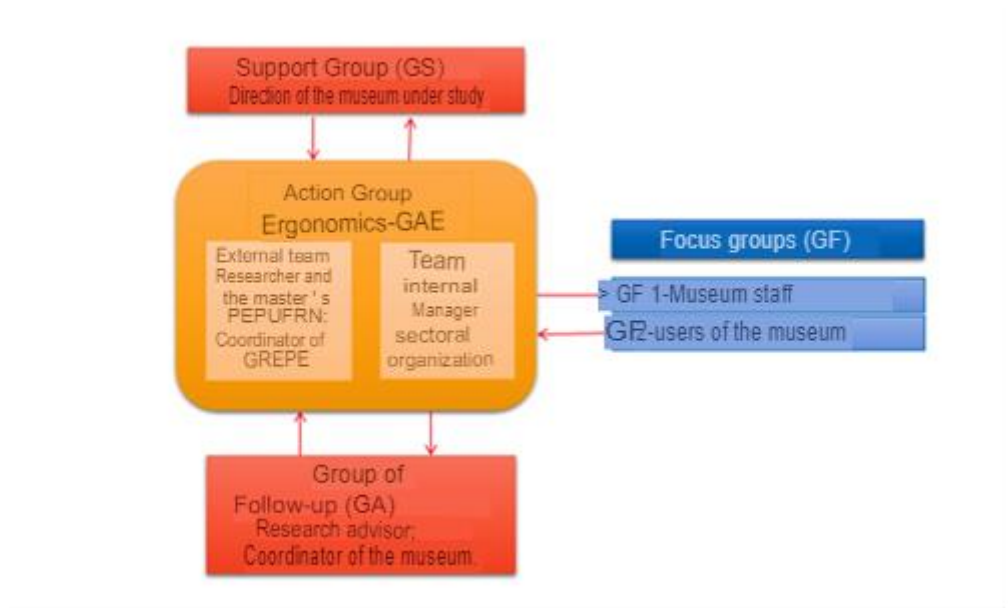
The global analysis consists of knowing the structure, global functioning, population and technical, economic, productive and market problems of the place/organization where the AET will be carried out. Thus, the global analysis is appropriate to expand the initial objective, adjust the focuses and improve ergonomic demand (VIDAL, 2008).

The global analysis was developed through documentary research, on the website and official documents relating to the museum, and interactions (conversations), for data collection, with the director and employees of the museum.

c) Social Construction

Social construction is a methodological device used in AET, which has a dynamic and participatory character, and adjusts progressively throughout AET (VIDAL, 2008). The social construction developed, up to the current moment of the research, took place through interactions with the director of the Museum located in the city of Natal/RN. Figure 1, below, presents the groups planned to compose the social construction process in all phases of the AET, which is being carried out in the aforementioned museum.

Figure 1 – Scheme of Social Construction carried out in the museum in question



Source: Autores (2023), adapted from Vidal (2008)

3. Results and discussions

3.1. Characterization of Museums in Brazil, in the state of Rio Grande do Norte and in the city of Natal/RN

Currently, according to the Museus BR platform (2023), the official website of Museum registrations by the Ministry of Culture, Brazil has 3887 registered museums, 85 in Rio Grande do Norte and 30 in Natal/RN (PAINEL ANALÍTICO, 2023).

The Museums' attendance count, which indicates the exhibitions with the highest attendance, the need to adapt the services offered, the need to expand the educational action, takes place, in Brazil, through the Annual Visitation Form (FVA). The last form released, in 2020, shows a total of 7,010,196 people visiting museums in Brazil. A total of 1118 museums provided responses considered valid, 91% of which were museums that counted visitors and 09% did not count visitors (FVA, 2020).

In Rio Grande do Norte, 11 museums completed the FVA in 2020, and it is not possible to identify whether museums in Natal are included in this published quantity. It

is believed that the low participation in Rio Grande do Norte is related to the pandemic period.

The Department of Diffusion, Promotion and Economy of Museums – DDFEM is responsible for “subsidising, stimulating, supporting and developing lines of action and studies on the economy of museums and their interfaces with the cultural industry” in Brazil (DDFEM/IBRAM/MINISTÉRIO DO TURISMO , 2023).

Currently, financing for projects in the museum sector is supported by the Special Secretariat for Culture and the Brazilian Institute of Museums with resources from the General Budget of the Union (OGU). In 2020, the budget available for Culture was R\$1.94 billion — a decrease of 41.8% compared to 2011 (IBRAM, 2020).

The State Culture Incentive Program, called Câmara Cascudo Law - Law No. 7,799, was created on December 30, 1999, with the aim of encouraging cultural development in RN using the tax waiver from the Tax on Circulation of Goods and Provision of Services (ICMS) (RIO GRANDE DO NORTE, 1999).

During its existence, the program has already made more than R\$72 million in resources available, and more than 444 projects have already benefited, 90% of them in the State capital (RIO GRANDE DO NORTE, 1999).

In Natal/RN, Law No. 4,838, of July 9, 1997, establishes the Djalma Maranhão Project of tax incentives for carrying out cultural projects in the municipality and among the cultural facilities covered by the law, the collections and historical heritage stand out - cultural and Museums, cultural centers and libraries (NATAL, 1997).

Just as the State Culture Foundation – FEC allocates resources to the state's cultural production, in Natal, the President of the Capitania das Artes Cultural Foundation – FUNCARTE, using his legal powers, made public, in 2018, the CULTURE INCENTIVE FUND notice – FIC for the purpose of selecting and allocating resources to cultural projects (SECULT/FUNCARTE, 2023).

In 2018, the FIC, in support of material and intangible heritage, allocated, to the projects covered, the amount of R\$ 100,000.00 (one hundred thousand reais) in

programming for museums managed by the Municipality, programming and activities in parks and places of memory (various themes and Christmas during the Second World War), actions for traditional groups and restoration of monuments (SECULT/FUNCARTE, 2023).

3.2. Characterization of the Museum under study

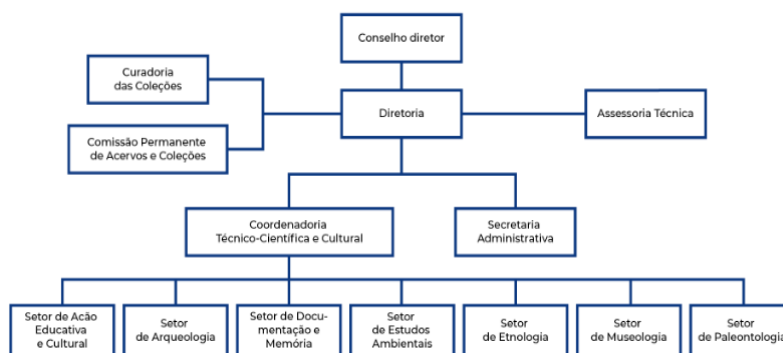
The museum object of this study began its history in Natal/RN in 1960 as a space for the production of scientific knowledge in the state and, in 1973, established its current name as a form of homage to the first director (UFRN/MCC, 2023).

The museum was built in two stages, in 1969 a large 1,668 m² pavilion was inaugurated and, in 1971, other pavilions were inaugurated behind the first, to house technical reserves, laboratories, classrooms, administrative spaces and accommodation for researchers (UFRN/MCC, 2023).

At the beginning of 2010, due to a major renovation of the Exhibition Pavilion, the main entrance was moved to the side of the building, completely modifying the appearance of the original facade, as well as changes to the internal spaces (UFRN/MCC, 2023).

Currently, the museum has the following organizational chart (Figure 2):

Figure 2 – Organizational chart of the museum object of the study



Source: UFRN/MCC (2023)

The museum's accessibility system for users is under development. The museum does not have assistive technologies or information in Braille or a Libras interpreter, but it does have access ramps, an elevator for wheelchair users, 2 accessible bathrooms and 1 wheelchair for its users.

The emergency system is being improved, an emergency and evacuation plan is being drawn up and safety items (such as fire hydrants) are being installed in the museum space, which has working fire extinguishers, exit emergency and some signs that can still be improved.

The Exhibition Pavilion is open every month of the year, for public visits, from Tuesday to Saturday. The current opening hours are from 8:30 am to 12:00 pm and from 1:00 pm to 4:00 pm. Entry is free (UFRN/MCC, 2023).

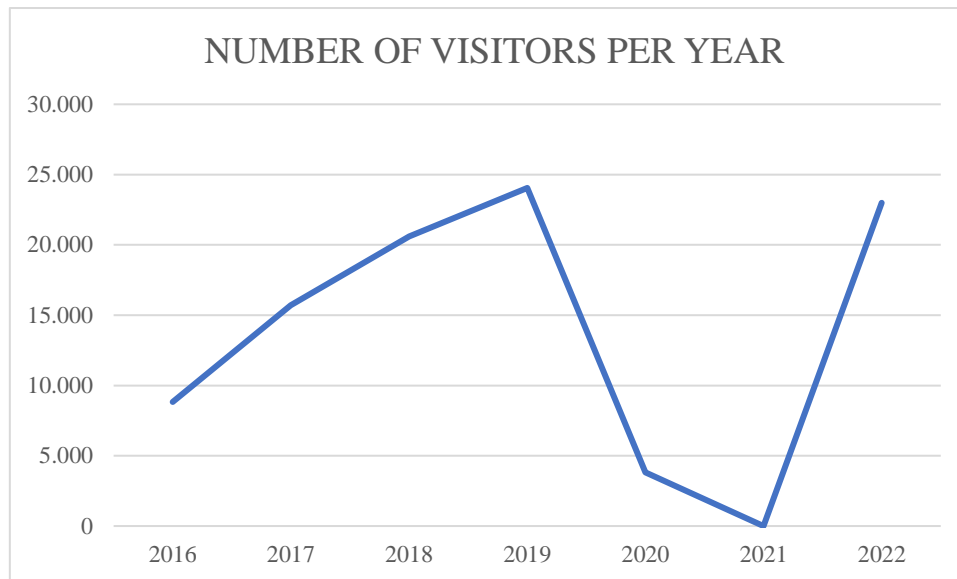
For individual visits, no appointment is necessary, but visits in school groups must be scheduled with the Education Sector. Groups must have a minimum of 10 and a maximum of 40 people per time. Mediated visits last up to 1h30min, from Tuesday to Friday, and take place at 8:30am, 10:30am, 1:00pm and 3:00pm. The museum does not have a sign language interpreter for people with hearing impairments and does not have an audio description service for people with visual impairments (UFRN/MCC, 2023).

The last record of the number of visitors was released in 2022 on the museum's official website (UFRN/MCC, 2023) with a total of 22,989 people in the 12 months of 2022, considered a significant number given that the museum remained closed throughout the period of pandemic. In 2019, before the pandemic, the museum welcomed 24,050 people over the 12 months of the year (UFRN/MCC, 2023).

In 2022, records for daily visits were broken in the two biggest annual events held by the museum: Museum Week (823 visitors on May 21st) and Museum Spring (1046 visitors on September 24th) (UFRN/MCC, 2023).

Figure 3, below, shows the number of people who visited the museum, per year, between 2016 and 2022.

Figure 3 – Number of visitors per year to the museum object of the study, from 2016 to 2022



Source: UFRN/MCC (2023)

It is possible to observe a significant increase in the number of annual visits from 2017 onwards. In 2020, in the first 03 months before the closure of activities due to the COVID-19 pandemic, there were 2,316 visitors in January, 987 in February and 523 until mid-March, according to the annual management report available on the museum's official website (UFRN/MCC, 2023). Generally, the months with the most visits are January and February due to school holidays and the presence of tourists in the city.

The Museum has 27 workers, 12 of whom are permanent employees of the Museum and 15 outsourced. Of this workforce, 03 are teachers, 05 are outsourced employees and 19 are administrative technicians, 15 are female and 12 are male. The working day is 40 hours per week for administrative and teaching technicians and 44 hours per week for outsourced workers (UFRN/MCC, 2023).

4. Conclusion

This article aimed to describe the ongoing ergonomic demand instruction process in a museum located in the city of Natal/RN, Brazil, and characterize its overall structure and functioning, considering the accessibility of the museum and the possible need for evacuation of occupants in emergency situation.

The applied social construction process, which is a device used to promote the

participation of interested parties in an AET, proved to be efficient during the current stage of the museum's global analysis and demand instruction stages carried out.

The presentation, to the museum director and employees, of potential problems related to the triad of accessibility – emergency situation – evacuation of occupants in museums, the demand caused and the global analysis related to the case study museum – fruits of bibliographical, documentary and in the media –, it led to a discussion around potential demands (hypotheses of demands), which is evolving towards the formulation and definition of the corresponding negotiated ergonomic demand.

It is expected that, after negotiating the ergonomic demand, with the museum's stakeholders, situated analyzes of visitations will begin (provided by on-site observations, interactions with the user population and application of a simulated exercise for analysis). The aim is to establish an ergonomic diagnosis of the analyzed situations and indications for improving the respective situations, aiming at preventing and mitigating accidents/disasters in museums and preparing the user or occupant population for possible emergency evacuations from museums. safely, thus minimizing the potential number of victims with or without deaths.

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