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TECHNOLOGY TRANSFER WITH OPERATIONAL FOCUS ON ERGONOMIC DEMAND: TRAINING THE CREW OF THE RIACHUELO CLASS OF THE BRAZILIAN NAVY

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Abstract: This article deals with technology transfer with a focus on knowledge retention of the Crew of the Riachuelo Class Submarines (SCR⁴) of the Brazilian Navy (MB). The process falls within the scope of the Brazil - France military agreement (2008). The study deals with the evolution of knowledge necessary for the crew's operational training process. Training is modeled based on Ergonomics, more precisely from the perspective of Anthropotechnology (WISNER, 1985). Its methodology was made possible with the contributions of Grounded Theory, enabling evaluation to instrument the training of submariners, within the concept of simulators such as Computer Based Training (CBT). To this end, the generation of categories and concepts, based on the observed elements, takes place throughout the development of an explicit theory, which contributes to determining the demands applied and necessary for the aforementioned training.

Keywords: Ergonomics; training; technology transfer; simulation; Grounded Theory, underwater work.

1. Introduction

The origin of the word technology goes back to the Greek language, as it combines the radicals tecknikós (art, craft) with logos (treaty, study). In common sense, the concept involves: capacity for creation, development of knowledge and application in the production and operation of material goods. From a commercial perspective, its meaning has relevant decision-making consequences for the economic development of a country.

In Brazil, the search for external independence, combined with the desire to strengthen national defense, justifies the fact that the Brazilian Navy (MB) invests in technology transfer plans that aim to promote the trinomial security, defense and development (BRASIL, 2018) . Maritime space is Brazil's heritage, as 80% of the commercial volume of exports and imports passes through it, and is also a source of natural and mineral wealth, scientific, fishing and

tourist activities. MB's role in providing protection for this natural heritage called the Blue Amazon is closely related to the power of the oceans in international relations and the resulting constitutional mission.

In this sense, according to Fonseca Júnior (2015), investments in defense with the development of technologies for patrolling and monitoring must be a reality, as such investments will return as a benefit to society, contributing to innovation in science and technology in the Naval Force. At this juncture, the Submarine Development Program (PROSUB) was launched by MB in 2009, the largest Brazilian industrial and technological training program in the national defense and scientific-technological infrastructure sector. In this vision, MB adopts sustainable actions to develop defense technologies, such as: partnerships with universities and research centers; encouraging the participation of companies in nationalization; training and maintenance of professionals; and technology transfer.

It is also noteworthy that the main technologies involved in PROSUB have repercussions in other areas of the industry, such as the modernization of infrastructure and shipbuilding techniques (BRASIL, 2018). In this context, the problem to be investigated is the provision of adequate conditions for the good retention of operational knowledge by crews, during technology transfer in PROSUB. The justification for this study is due to the need to bring out relevant benefits for the operational training of SCR crews, taken as a characteristic situation. Thus, the general objective of this article is to present a framework that models the ability to identify elements that impact SCR crew performance, based on the perception of focus groups pertinent to such an effort.

In parallel, the following are specific objectives:

a) Inventory available technical resources in the defined context;

b) Explain knowledge gaps throughout the initial training phase; It is

c) Deepen learning regarding innovation in the specific phase.

It is expected to establish, within the content of this study, the consolidation of an ergonomic modeling that serves as a basis for the diagnostic and consolidated construction, according to the methodical, ordered and systematic itinerary recommended by Vidal (2003). To achieve these objectives, ergonomic science will be used, focusing on the Anthropotechnology tool.

2. METHODOLOGY

The methodology applied during the work was Grounded Theory – Theory Based on Data (TFD) with instrumentation from an anthropotechnological assessment. GT has three main methodological perspectives: Classical, Straussian and Constructivist. Despite having common characteristics, such as theoretical sampling, comparative data analysis and the preparation of memos, there are differences regarding the data analysis system. In view of this, it is worth saying that here we adopt the Straussian approach, in which the theory evolves during the research process itself, and is a product of the continuous interaction between analysis and data collection (GLASER AND STRAUSS, 1967).

Therefore, the main premise of Straussian GT in this research is that the theory must be developed inductively based on the interactive and constant analysis of the data collected to develop an in-depth understanding of the phenomenon studied, moving through several levels to build the theory, going through description, abstraction to conceptual categorization, in order to investigate the underlying conditions, consequences and actions (GLASER and STRAUSS, 1967).

Regarding the type of theory, they can be classified as: explicit theory, implicit theory, syntagmatic or process-oriented theory, paradigmatic theory (GOULDING, 2002). In this study, the explicit theory approach was used, which is defined as a set of concepts that describe a hierarchy or a network of propositions, such as an innovation scenario (GOULDING, 2002). In short, GT corresponds to a set of distinct procedures or steps, presented and described in sequence, with the ultimate aim of achieving explicit theorization.

A) Application of Grounded Theory: The systematically collected and analyzed data supported the application of Straussian GT. To apply this methodology, interviews were carried out with the purpose of immersing the interlocutor in the interviewee's perspective.

B) Participant Selection or Sampling: according to Wegbrayt (2020), regarding the GT approach, the selection of participants in a research is according to the phenomenon to be studied. Aiming to attend to the process of absorbing knowledge of technology transfer, it was decided to interview military submariners from the Átilla Monteiro Ache Instruction Center (CIAMA - Escola de Submarinos) and the Humaitá Submarine. To compose the target audience, CIAMA instructors and military personnel from the submarine's Operations department were selected. The following steps were applied in sampling selection:

B.1 Definition of eligibility criteria**:** for Duarte (2002), the eligibility criteria of individuals are essential, as they provide the data that will serve as support and object of study for the investigation, therefore, their quality is decisive for the result. Taking into account the importance of correctly identifying the sample to be studied, the following eligibility criteria were adopted:

- Be an Officer or Private with the Alpha phase (theoretical and simulation phase) of the SCR course completed;
- Be an Officer or Private with the Alpha and Bravo phase (onboard phase) of the SCR completed; It is
- Be an Officer or Private instructor.

The purpose of the criteria adopted was to ensure that participants had technical knowledge of the submarine both in port and at sea, therefore having an understanding of the scenarios that preceded the training, as well as the framework established at the end of it, thus enabling them to respond appropriately. the questions of technology transfer. And to ensure multiple managerial views of the tasks assigned and performed by the military, coverage was provided at different levels of hierarchy.

B.2 Negotiation and Authorization: To carry out the interviews, contact was established via electronic channels with the CIAMA Submarine School. Subsequently, through a face-to-face meeting, the process prepared for their execution was presented, leaving scheduling at my discretion and responsibility.

B.3 Invitation approach: initial contact was made via formal email to qualified military personnel, with a brief description of the objective of the work, and, at the end, they were invited to semi-structured interviews via videoconference, with meetings scheduled according to free availability.

C) Data collect: At this stage of the research, the relevance of the data collected is extremely important, as they need to capture the essence of the revelations collected from those researched related to the topic covered in the study, thoroughly showing information, data, ideas, technical and professional concepts (ARAÚJO JÚNIOR, 2021). The data collected needs to be of quality and credible, and for this, it is necessary to put roots in its analysis. Data collection management makes it possible to detect process variation, helping to improve it and make the analysis more comprehensive, until the data saturation point is reached. Saturation, that is, theoretical sufficiency, marks the moment when data collection no longer encourages the researcher to acquire new theoretical perspectives from the data, nor does it reveal additional properties of

the main theoretical categories (ARAÚJO JÚNIOR, 2021). Below are the data collection steps carried out:

C.1 Road map: According to Wegbrayt (2022, p.39), the constructed script aimed to: "not direct the interviewee in their answers, being made up of open questions". Therefore, the first interviews carried out were conducted through two open questions, to obtain opinions. From the sixth interviewee onwards, there was an important report related to the topic of the study, which made him return to the beginning of the interviews and ratify such relevant information. In this way, greater security was provided to maintain the question script until the last interviewee.

C.2 Interviews: As already mentioned, the method chosen to conduct the interview is semi-structured, using a script with previously defined questions and faithful to the imposed delimitations, which makes a possible scenario for an adjustable and meaningful study (WEGBRAYT, 2020). With an established guideline, without pre-determined answer options, as would occur in a multiple choice approach, a balance is provided between the structure offered by the planned questions and the flexibility for the interviewee to express their answers in a broad way. The interview period varied between 20 (twenty) and 40 (forty) minutes in length. In the end, of the 10 (ten) invited participants, 9 (nine) participated in the process.

C.3 Transcription: the transcription of the recorded audio collected occurred through recordings followed by transcriptions of the submariners' responses using the "Voice Typing" tool on Google Docs, with review and finally validation with the interviewee, that is, sending to the military for your final approval.

D) Codification: At this stage, the organization of the data already collected took place using a Google spreadsheet, updated after each interview. Coding is the process of analyzing data, and at this point the researcher can identify hundreds of codes that may have potential meaning and relevance. As a result of constant comparison the data found is reduced and grouped into meaningful categories. Codes are the building blocks of theory. By coding, in all possible ways, it will provide direction for categorization (GOULDING, 2002). This process is divided into stages: initial, focused and theoretical. The initial coding is broad and generic, as all the statements collected will serve as data, which makes it possible to navigate through several theoretical directions. Focused coding can be understood as a moment in which the researcher uses the codes already mapped in the initial stage, carrying out a rigorous evaluation to select the most significant and/or frequent initial codes, which enable a better analytical understanding to categorize data. incisively and completely. Lastly, theoretical coding helps to tell an

analytical story coherently by specifying the relationships between the data categories of the focused coding. This classification encourages comparing categories at a complex level that allows for more refined organization and analysis in search of a central or main category.

E) Theory construction: This step requires the ability to select important information for the development of the theoretical model that will represent the problem studied. For this theory to be valid, there is a need to compare the theoretical concepts studied and their relationships with the data collected (BAGGIO AND ERDMANN, 2011). It was observed that the influence of the data categories in the construction of the main category led to the emergence of "Training in the Simulator" as the central category, which came closest to the purpose of the research, and which is interrelated with the other 3 emerging categories (Figure 1), for training in approaching the results at the end of this article.

3. Technology transfer

Building a technological chain requires investment, organization and allocation of human and material resources, as well as effort, continuity and constancy for its maintenance. Studies like this are essential to create, develop, produce, approve, operate and maintain a technological system or process (FREITAS, 2022).

With the advent of telecommunications and the increase in foreign trade, according to Freitas (2014), this technological chain experienced high growth in the desire to obtain solutions more quickly in favor of development. In this context, technology transfer emerges as a very attractive commercial possibility that accelerates this process.

Freitas (2014) also highlights that, for technology to be transferred, it is essential that the foreign contractor has a great commercial interest in allowing the absorption of technology, as well as the capacity, convenience and willingness of the national contractor to absorb it.

To preserve and maintain the knowledge absorbed in technology transfer processes, there must be individual effort and consistency through technical-scientific-industrial stimulation of the teams and people involved. LONGO and MOREIRA (2012) conclude that, taking into account that, normally, defense projects have long deadlines, appropriate knowledge management would be essential to avoid discontinuity and losses caused, for example, with the retirement or departure of professionals who originally received the knowledge. And they cite brain drain as a possibility and a threat.

Regarding the transfer of technology, signed through a Strategic Political Agreement between Brazil and France to enable Brazilians to design and build submarines in the PROSUB project, the final production of four new conventional SCR submarines was made possible in

addition to the submarine armed with nuclear propulsion. Currently the first is in operation (Submarino Riachuelo), the second is undergoing final tests (Submarino Humaitá) and the other two are under construction, as well as the manufacturing of the prototype of the first Brazilian submarine armed with nuclear propulsion scheduled for 2029.

However, it should be noted that for the development of this complex nuclear propulsion project there is no exchange of knowledge, corroborating the content of Freitas (2022, p. 72): "as technology is power, it is unlikely that the holder of a new technology will allow its absorption" . All nuclear technology for PROSUB is being developed in Brazil, through the Navy Nuclear Program (PNM), at the facilities of the Navy Technological Center in São Paulo (CTMSP).

Operational training, which is the object of study in this article, and the knowledge of submariners became pillars for the beginning of the technology transfer of the agreement signed between Brazil and France, which is carried out through the SCR Crew Training Course , conducted at the Almirante Áttila Monteiro Aché Instruction and Training Center (CIAMA), located at the MB Naval Complex in Itaguaí, Rio de Janeiro. The course is divided into two phases: a theoretical phase, called Phase A, which covers basic, specific training and simulations (this being the main stage), and a practical phase known as Phase B.

With constant training of staff and self-improvement, especially in internal systems, we can achieve greater technological independence and drive innovation and technological growth. An example of this is the computer-based training tool, called Computer Based Training (CBT), in use on the SCR course.

In short, in this context, LONGO and MOREIRA (2009, p. 12) conclude that "these are stages of effective technology transfer: absorption, adaptation, improvement, innovation and diffusion".

As every technological process involves commitment, people, circumstances, organization and absorptive capacity, it is of great relevance that we address some of these topics with the help of the science of Ergonomics through the Anthropotechnology tool.

3.1. Ergonomics and Technology Transfer

Ergonomics plays a role in adapting work processes to human needs and capabilities, seeking to optimize the efficiency, safety and well-being of employees. By involving Ergonomics in the technological transfer process, it is possible to ensure that the implemented

technologies are designed taking into account the characteristics and requirements of end users (MÁSCULO and VIDAL, 2011).

Másculo and Vidal (2011) highlight Ergonomics as a fundamental factor, from the initial planning and development phases of technological transfer, to the implementation and evaluation of results. Your active and early inclusion in these steps will ensure the mitigation of potential problems and the maximization of the organization's benefits.

Based on the introductory concept of the scientific-technological binomial adopted by MB as part of strengthening the infrastructure and sustainability of the PROSUB project, Ergonomics can be recognized as a science that plays a role in multidisciplinary articulation and integration, aiming to promote positive transformations.

By adopting Ergonomics as a multidisciplinary basis in the technology transfer process, you can ensure that interactions between team members, technologies and organizational processes are optimized. Thus, a participatory device is created that allows for better objectivity and consensus within the organization, contributing to effective change management (MÁSCULO and VIDAL, 2011).

Wisner (1979) shows, through studies in Anthropotechnology, some origins of the failures, partial or total, of many technology transfer experiences, highlighting for example: geographical conditions of high temperatures that affect the quality of products and means of transport; insufficient staff training; inadequate maintenance policies; difficulty in the form of conversation and understanding. (MÁSCULO and VIDAL, 2011).

In this study, regarding the technology transfer agreement between Brazil and France to date, some original conditions similar to those pointed out by Wisner (1979) were listed, such as: difficulty in communication and understanding due to different languages; lack of teaching material, especially in the initial period of the contract; cultural differences related to professional training, while the French training is departmentalized, that of Brazilian submarine officers is widespread.

In this context, regarding the mastery of transferred technologies, the organization will be closer to success the greater the capacity for adaptation, adjustment and organizational repair, corroborating with Másculo and Vidal (2011, p. 46): “the mastery of transferred technology only It is possible when technical devices, work organization and worker training undergo a global process of reconception”.

This leaves the future suggestion to adopt Ergonomic science as a facilitating instrument for the technological transfer process, since Másculo and Vidal (2011, p.52) conclude: “The

best hiring of an external group is one that helps the company to define the paths of Ergonomics, in a planned, methodical and consistent way".

3.2. Training in Technology Transfer

Education plays a fundamental role in technology transfer, from basic education to professional training. The quality of the receiver of information and content is strongly impacted by education, as it provides the skills and knowledge necessary to receive and properly use transferred technologies (FREITAS, 2014).

Investing in education is essential to develop a qualified and capable workforce, stimulating innovation and ensuring the success of technology transfer.

In the scenario of indispensable continuity in the Technological Transfer process, Freitas (2014) highlights that the ability to absorb technology results from managerial technical capital accumulated over years and various processes, not undone by the disaggregation of teams or loss of technical memory .

Still according to Freitas (2014), the loss of capabilities in technological transfer programs in obtaining submarines in accordance with an agreement signed between Brazil and Germany in the 80s/90s, constituted a good reference of experience in the need to have a project of permanent submarine construction.

In this research, the purpose is to invest in the search for suggestions for maintaining this knowledge acquired through the technological absorption process in the SCR crew course, mainly regarding training related to practical training related to the exploration of simulators. One of the practical training already existing in the course, and throughout the submariner's career, is based on simulators called Computer Based Training (CBT), a type of E-learning that uses computers to provide instructional content, and which will deserve full attention upon completion. of this research, as CBT is an effective way to retain knowledge and provide refresher and improvement training.

The information above corroborates the content presented by Rebelo (2021, p. 14):

> *One of the most recent developments has been the growth of simulation systems based on computer software, such as those developed by numerous companies such as UNITEST, Kongsberg, MarineSoft, SSPA, among others. They provide simulation software that, with a simple computer, can provide training options at a lower cost and within the reach of a greater number of institutions.*

Based on the study by Rebelo (2021, p. 15), globalization has led to "the use of machine simulators as they become a useful and effective teaching tool, and relatively accessible".

Currently, some educational establishments in the nautical field have not yet fully

embraced the idea of machine simulation, despite recognizing the benefits that navigation simulators can offer. However, this scenario is changing and varying as producers and distributors of these systems increase their learning efforts and are able to reduce the costs of purchasing and maintaining simulators. A major influence on the increased use of machine simulators was the introduction, by the IMO (International Maritime Organization), in 2017, of course models that are based on the use of simulators in engine rooms. This change has contributed significantly to technological innovation processes (REBELO, 2021).

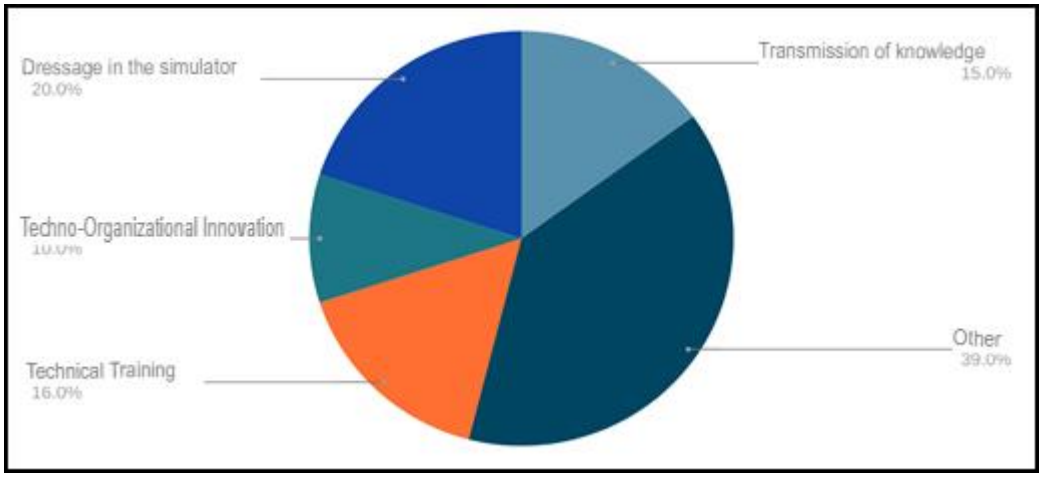
4. Results

When considering the objective of the present study, data were collected on the experiences of qualified submariners in the SCR, as well as their perceptions about technology transfer in PROSUB. By carrying out the coding process, it was possible to identify the central or main category and the existing relationships with the other emerging categories (Figure 1). After the last analysis of the coding process, twenty categories emerged, with "Training in the Simulator" considered as the central category, holding 20% of the total codes generated, and recorded in the reports of 90% of the interviewees, as observed in the fragment, the follow:

> *The infrastructure at CIAMA Itaguaí is very good, it has 2 combat system simulators, 1 immersion trainer simulator, a flooding simulator, an escape simulator and a CBT simulator (Computer Based Training - as if it were a Control Strike, in first person) in it you can operate the equipment, the valves, you can qualify 70% to 80% of the systems on a computer, you can eject waste, prepare the engine; so much so that on the qualification sheet you can qualify many of the items in the simulator, which guarantees you a level of knowledge high enough to consider the soldier qualified and later the soldier goes on board to make fine adjustments, but he will already be ready, if he does a good simulator stage. (Interviewee 01)*

This comment identifies the relevance of simulators and concludes with emphasis on the new concept of simulation in the Submarine Force, the CBT. Training in simulators circumscribes the retention of knowledge from experiences aboard the new class of submarine, which is so important for this period of change and transition. It is in this context that CBT minimizes gaps in specialized knowledge.

Figure 1 - List of Categories



Source: Developed by the Author, 2023

It is in this current scenario that Muirhead (2004) states that the introduction of new technologies is often the catalyst for innovation and evolution of techniques and methodologies, with increased productivity, greater efficiency through cost reduction, increased employee motivation and job satisfaction, as well as the development of new ideas to achieve specific goals.

Still according to the TFD analytical procedure, 3 other emerging categories related to "Training in the Simulator" were identified:

a) Transmission of Knowledge;

b) Technical Capacity; It is

c) Techno-Organizational Innovation.

Regarding the "Knowledge Transmission" category, a clear relationship with the central category can be seen through the interviewees' reports, as shown below, when asked about the biggest challenges in simulators in the technology transfer process. The new class of submarine required greater knowledge in digital technologies. To achieve this, the learning process involved instruction, communication and the didactic process taught by French. In the field of instruction related to the SCR Operations Department, greater difficulties were exposed in relation to the Machinery Department.

> *In the qualification of the Riachuelo Class submarine, if I were to summarize it in one expression, it would be the language barrier. (Interviewee 03)*

> *In the Alpha 3 phase in CBT, it was complicated because there was a Frenchman, I forgot his name now, he barely spoke Portuguese, so I learned CBT later from the ship's staff because we were maneuvering there and the version was the simpler old version, not so intuitive as for now. (Interviewee 07)*

Therefore, the degree of execution in the "Transmission of Knowledge" category is of paramount importance, corroborating Wisner (2004, p. 74): "Its insufficiency is a very frequent reason for difficulties, caused by an initial error, restrictions of the contract or miscommunication between the seller and the buyer."

Also according to Wisner (2004, p.101): "Knowledge of the language and its cultural references is, in fact, indispensable to be successful in the ergonomic analysis of the operators' cognitive activities".

The "Technical Capacity" category is connected to "Simulator Training", relating concepts that deal with the necessary qualifications for submariners, following the interviewees' arguments:

> *The simulators guarantee you a level of knowledge that is high enough to consider the person qualified. (Interviewee 01)*
>
> *Simulators are excellent for life on board, as we come on board with the great "Know How" of the system software. (Interviewee 04)*
>
> *When the student visits the simulators, starting to operate the system, it becomes possible to develop deeper knowledge. (Interviewee 04)*

In fact, "Technical Capacity" is present and illustrated in the technological transfer process, elucidating common situations of the experience on board. According to Wisner (2004, p.100) this category teaches us that, in particular: "from one country to another there is an equivalence of the cognitive capabilities of the workforce. However, technical familiarity is not the same everywhere and must be increased."

The "Techno-Organizational Innovation" category was constructed by the technological differences in the transition from the Tupi Class Submarine (SCT) to the SCR, by the advent of the CBT tool, as well as by organizational needs, such as the numerical reconstitution of teams and new functions, as per described below:

> *I thought it was a huge leap that we took in terms of technological innovation, the system is very good. (Interviewee 04)*
>
> *Nowadays, systems are practically remotely piloted. Because in the past, for example, the sergeant opened and closed the valves and wrote it down on the nameplate, that was simple. (Interviewee 01)*
>
> *Regarding the instruction in the CBT, it is very good, it is as if you were inside the submarine (as if it were a game) you enter the submarine through a screen and can open the valve, simulating that you are giving air to the ballasts. (Interviewee 08)*

> *Whoever mans the Water Officer role on the French submarine is a soldier, but we don't absorb that from them. (Interviewee 01)*
>
> *The operator that had the most changes was the weapons officer (AM), as he provided the role of PAC (Contact Plotter and Evaluator), and this has now been discontinued and thus the weapons officer removed the contact solution in the PAC. (Interviewee 04)*

The detailing of this category corroborates the content of Másculo and Vidal (2011), whose results presented by this analysis indicate that there are significant opportunities for improvements in emergency response simulation in areas such as team coordination, simulation design and dynamics, crisis management and establishing the necessary technological infrastructure for support.

Over time, work undergoes transformations resulting from organizational innovations, technical and social relations of production and work, as well as the adoption of new technologies in production processes. These transformations occurred in the context of the evolution of management models (MÁSCULO and VIDAL, 2011). Likewise, this study found the same transformations and adaptations during the technological transfer process from the SCT class to the SCR class.

5. Conclusion

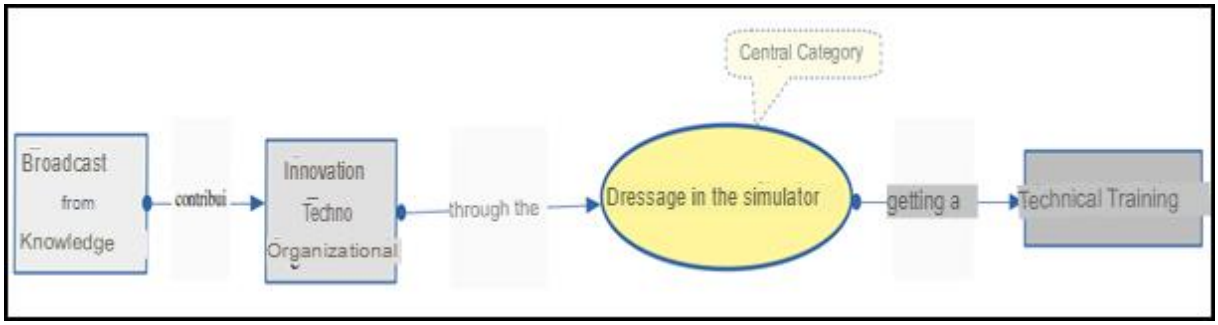
Some of the challenges encountered in the technology transfer process between Brazil and France in PROSUB could be addressed in this study, including those associated with training, technology, and organization.

Crew training, inevitably, was one of the sectors included in the fulfillment of the training program suggested by the French contractor, which adopted a theoretical teaching model, followed by a phase of simulators, and finally tests and tests on board the submarine.

The data collected in the interviews from the application of GT allowed identifying patterns of perception in submariners regarding the adaptive processes of technological transfer. These questions made it possible to understand the discursive movement, the tetralogical order-disorder-interactions-organization of information taken from the participants' reports, capturing feedback, recursiveness, self-organization, concepts, attitudes, beliefs and experiences (MORIN, 2000).

“Training in the Simulator” was the most categorized, through the line-by-line coding process, linked to its close interrelationship with the other emerging categories (Figure 2), allowing us to understand how they influence the central category, causing gaps to emerge even further. not observed.

Figure 2 - Theory elaborated based on the interviewees' perception



Source: Developed by the Author, 2023

Despite this challenge, CIAMA has in its hands a path of possibilities to lead the appropriation of knowledge and develop future actions, strengthening instruction in simulators, especially in CBT, a key element in maintaining qualified crews.

6. Bibliographic references

ARAÚJO JÚNIOR, P. C. de. **Aspectos estruturantes da percepção de professores do ensino superior quanto ao ensino remoto emergencial** : uma aplicação da teoria fundamentada nos dados. Dissertação da Graduação em Engenharia de Produção. Júlio César Bispo Neves Neves, orientador. Universidade Federal Fluminense. Niterói, 2021.

BRASIL. Marinha do Brasil. **Amazônia Azul 10 anos**. Amazônia Azul Tecnologias de Defesa S.A. PROSUB. 11/12/2018. Disponível em: https://www.amazul.mar.mil.br/Prosub-investimento-forca-naval-industria-defesa. Acessado em 18/07/2023.

DUARTE, R. **Pesquisa qualitativa: reflexões sobre o trabalho de campo**. Cad. Pesqui., n. 115, p. 139-154, São Paulo, 2002. Disponível em:<http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-15742002000100005&lng=en&nrm=iso>. Acesso em: 19/07/2023.

FONSECA JÚNIOR, P. **Programa de Desenvolvimento de Submarinos:** uma análise da política pública para capacitar o Brasil a projetar e fabricar submarinos. Dissertação do Mestrado em Estudos Estratégicos da Defesa e da Segurança. Instituto de Estudos Estratégicos. Universidade Federal Fluminense. Niterói, 2015.
FREITAS, E. de S. **A busca da grandeza:** Marinha, Tecnologia, Desenvolvimento e Defesa. Rio de Janeiro: Serviço de Documentação da Marinha, 480p. 2014.

FREITAS, E. de S. Transferência de Tecnologia. **Revista Marítima Brasileira.** Edição v. 142, n. 01/03, 2022.

GLASER, B. e STRAUSS, A. **A Descoberta de Teoria fundamentada: estratégias para Pesquisa qualitativa**. Chicago: Aldine. 1967.

GOULDING, C. ***Grounded Theory*** *- A practical Guide for management, business and market researchers.* SAGE Publicações Ltda. Londres. 2002.

LONGO, W.; MOREIRA, W.. S. Transferência de Tecnologia e Defesa. **Revista das Forças Armadas**. Rio de Janeiro, ano 7, n. 29, p. 43-48, jul.2012.

LONGO, W.; MOREIRA, W. S. O acesso a tecnologias sensíveis: obstáculos e alternativas. **Tensões Mundiais**. Fortaleza, v. 5, n. 9, p. 73-121. 2009.

MÁSCULO, F. S; VIDAL, M. C. **Ergonomia: trabalho adequado e eficiente.** Elsevier. Rio de Janeiro. 2011.

MORIN, E. **Os sete saberes necessários à educação do futuro**. Tradução: Catarina Eleonora F. Da Silva e Jeanne Sawaya. 2. ed – São Paulo: Cortez, Brasília, DF: UNESCO, 2000.

MUIRHEAD, P. M. *New Technology and Maritime Training in the 21st Century: Implications and Solutions for MET (Maritime education and training) Institutions*. WMU ***Journal of Maritime Affairs***, 139-158. 2004.

REBELO, P. M. de M. **Integração do novo Simulador de Máquinas nos cursos da Escola Naval.** Dissertação para obtenção do grau de Mestre em Ciências Militares Navais, na especialidade de Engenharia Naval – Ramo Mecânica. ASPOF EN-MEC. Portugal, Alfeite, 2021.

SPIGGLE, S. **Análise e interpretação de dados qualitativos no consumidor** 21(3): 491–503. Diário de Pesquisa de consumo. 1994.

VIDAL, M. C. **Guia para análise ergonômica do trabalho na empresa (AET): uma metodologia realista, ordenada e sistemática.** Rio de Janeiro: Editora Virtual Científica, 2003

WEGBRAYT, G.C. **Gestão visual como indutor do trabalho coletivo na metodologia *office floor management***. Dissertação da Graduação de Engenharia de Produção. Júlio César Bispo Neves, orientador. Universidade Federal Fluminense. Niterói, 2020.

WISNER, A. **Textos escolhidos, antropotecnologia**. Tradução: Adriana Nascimento, José Mario Carvão, Mario Cesar Vidal.- Rio de Janeiro: editora virtual científica, 2004.

WISNER, A. (1985) – **Organizational antropotechnological approach contingencies: an analithical** approach. In: Bradley G.E. e Hendrick H.W. (Eds.) Human Factors in Organizational Design and Management. Elesier Science, 1994, 613-617.