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ANALYSIS OF THE JOB OF TEACHERS OF CLOTHING MODELING SUBJECTS WITH A FOCUS ON POSTURAL ASSESSMENT AND IDENTIFICATION OF THE PREVALENCE OF MUSCULOSKELETAL DYSFUNCTIONS

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Abstract

Work activity of teachers, especially in practical disciplines, involves a considerable physical burden which, therefore, can result in discomfort and dysfunction that poses a high risk to the professional's occupational health. Since pattern making is considered one of the main practical disciplines in the educational context of fashion and apparel, this study aims to analyze the ergonomics of teaching work in clothing pattern making disciplines, with an emphasis on postural assessment, to recommend ergonomic improvements that, possibly , please didactic teaching-learning strategies and prevent the prevalence of musculoskeletal disorders. As an applied and exploratory research criterion, an approach with a descriptive, analytical, and correlational design was stipulated, with qualitative and quantitative data collection, based on the methodological procedures proposed by the Ergonomic Work Analysis (EWA) — that has its structure based on three main analysis stages: demand, task, and activities. The results obtained show the existence of ergonomic inadequacies involving this professional activity, which harm the health and satisfaction of teachers, with a significant prevalence of musculoskeletal discomfort, mainly in the body regions of the neck/cervical, back/spine, leg/knee and foot/heel which, in combination with the laboratory and didactic-methodological inadequacies found, can negatively influence the teaching practice, resulting in losses to the educational and pedagogical system. In conclusion, the need for reflection and investigation into the teaching practice is evident, and factual implementation of improvements that can benefit this professional's work activity has to be considered.

Keywords: Ergonomics; teaching activity; clothing pattern making; postural assessment.

1. INTRODUCTION

Teaching work involves a considerable physical, cognitive and psychological burden and is often carried out under unfavorable circumstances (Cardoso et al., 2009; Dias & Cunha, 2017). Several factors directly affect teaching and are associated not only with the social and emotional context, but also with the environmental context of the profession. These factors,

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mainly related, affect the perception of satisfaction, motivation and work effort of this professional and, if unbalanced, can contribute to a degenerative cycle of teaching effectiveness (Blase, 1982 apud Esteve, 1999).

The most prevalent health problems among teachers are musculoskeletal disorders (MSD), vocal problems and psychological disorders (Cardoso et al., 2009). In this sense, the literary apparatus that deals with the investigation of teacher health is divided, initially, between studies that explore teaching work from the perspective of its responsibilities, demands, requirements and conditions with an analytical focus on cognitive and mentality of the professional. In this case, many discussions focus on verifying the stresses caused by the precariousness of the educational sector resulting from new policies and by the organizational conflicts generated by the lack of resources, work overload and the devaluation of the profession (Neves & Silva, 2006; Cardoso et al. , 2009).

On the other hand, there is significant research that aims to analyze teaching work, also focusing on the teacher's physical health and in this sense, when consulting the literature, the number of studies that investigate the prevalence of MSDs in teaching practice is considerable. MSDs denote health problems related to the locomotor system and constitute disorders involving the muscular, bone, nervous, tendon, cartilage or ligament systems (Luttmann et al., 2003) that can occur from an isolated or cumulative trauma (Erick & Smith, 2011). Such dysfunctions are usually characterized as persistent physical pain or discomfort, as well as limitations in mobility, dexterity or bodily functional capacity (WHO, 2019).

MSDs associated with work practice — specifically, in this study, teaching activity — result in one of the most common problems faced by occupational health, having a considerable impact on the worker's quality of life and organizational productivity (Erick & Smith, 2011). Musculoskeletal discomforts are risk factors for functional impairment in the teaching profession, being one of the main causes reported for medical leave, abandonment of the profession and early retirement in the teaching profession (Kebede et al., 2019; Alharbi et al., 2023). Even psychosocial factors, related to mental health, can significantly affect the prevalence and intensification of MSD in teachers (Ng et al., 2019; Teles et al., 2023).

Furthermore, the results of the systematic bibliographic review developed by Erick & Smith (2011) showed that teachers of disciplines and areas of a more technical/practical nature, such as music or nursing — areas identified by them in the studies found — have a higher risk for the manifestation of DME when compared with theoretical disciplines. Considering that the teaching practice in clothing modeling disciplines is configured as a transfer of technical and

practical content, it therefore has a possibly higher risk for the manifestation of DME. However, when consulting the literature, it was found that there was no bibliographical study involving the specific analysis of this teaching activity — clothing modeling —, as well as studies that investigated the prevalence of DME in teaching activities in the areas of fashion and clothing.

In addition to this reality, it is clear, based on informal observations in competitions and selection processes in the fashion/clothing area, that clothing modeling disciplines, precisely because they deal with technical and more practical content, are rejected by the majority of teachers. , that is, the lack of predilection for this subject may indicate in some way that there are ergonomic problems related to teaching in this subject, whether related to the work space/environment or postural issues, including the possible prevalence of MSD.

Therefore, this study proposes to ergonomically analyze the activity of teaching work in clothing modeling disciplines, with an emphasis on postural assessment, in order to recommend ergonomic improvements that favor didactic teaching-learning strategies and prevent the prevalence of MSD. To investigate the teaching practices adopted in the teaching-learning of clothing modeling disciplines, an Ergonomic Work Analysis (AET) was carried out with teachers of these disciplines with a focus on postural assessment and the identification of prevalence of EMD.

Based on this gap found in knowledge related to the ergonomic analysis of teaching work in clothing modeling disciplines, this work demonstrates academic and professional relevance as it aims to improve working conditions with a focus on teachers' health and improvement of teaching action, aiming to improve the pedagogical organizational functioning and maximize the overall performance of the educational system.

2. THEORETICAL REFERENCE

Ergonomics is considered a systemic discipline that studies aspects of human activity through a holistic approach to man in which man is thought of simultaneously in his various dimensions (Iida & Buarque, 2016; Falzon, 2007). Ergonomics therefore corresponds to the search for information and data related to the skills, limitations and characteristics of human beings with the aim of inserting them into interfaces and interactive systems, thus contributing to the planning and improvement of products, tasks, jobs, organizations and environments in order to make them compatible with the physical, mental and personal needs, abilities and limitations of human beings (IEA, 2019; Moraes & Mont'Alvão, 2003; Tilley, 2005).

Among the different modalities and approaches to studying ergonomics, this study sought precisely the approach obtained by AET. AET can be conceptualized as the observation, diagnosis and correction of a real work situation based on the application of concepts, procedures and techniques derived from ergonomics. With initial studies coming from the French academy, AET is known as correction ergonomics (Guérin et al., 2001).

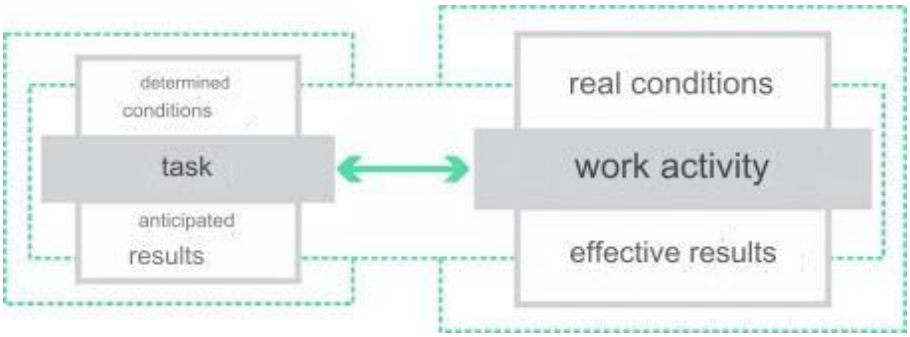
AET's ergonomic action is intrinsically articulated with the objectives proposed by the discipline itself, as it provides for a work project aimed at maximizing and valuing workers' individual and collective skills and abilities — without affecting health or safety —, at the same time in which it is possible to achieve the economic and organizational objectives of business institutions and corporations, due to the investments made (Guérin et al., 2001; Wisner, 1987).

In AET, the human being should not be understood only as a means for work, but rather as a means for work activity. And, in this case, the ergonomic analysis must have an awareness of the interface — in conjunction with the triad proposed by Bonsiepe (1997) in his ontological diagram established between user, task and activity.

In this sense, the transformation of work consists of a bias centered on the social scope — related to the individual — and another centered on the productive scope — related to the organization. For an ergonomic action to be truly effective, it is necessary to compare, in a panoramic way, these two points of view: that of health (comfort and safety of the worker) and that of efficiency (flexibility and productivity of the organization), always articulating the social bases and the economic bases (Guérin et al., 2001).

AET is the analysis of the work interface, considering that work is always connected to the nature of its conditions, its results and its activities. The concept of work distances itself from the concept of task in ergonomic analysis, since the task consists of determined conditions and anticipated results while work consists of real conditions and actual results (cf. Figure 1). In other words, the conceptual difference between work and task lies in the factual distance between what is prescribed and what is real (Guérin et al., 2001).

Figure 1. Relationship between actual work and prescribed work.



Source: Prepared by the authors (2019), adapted from Guérin et al. (2001, p. 15).

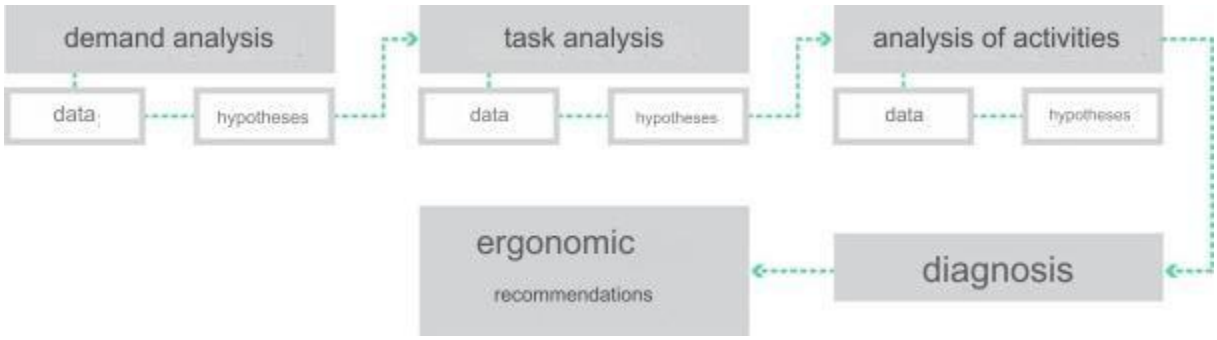
The distance between real work and prescribed work is established through the comparison of the different variables that influence work activity, which can come from both the personal dimension (of the worker), as well as the history and personal characteristics, professional experiences acquired and the transitory meanings and socializations; as well as the organizational dimension (of the company), such as the objectives, tools and social policies used, the resource management used, the environment and the control of productivity and quality arranged (Guérin et al., 2001). Guérin et al. (2001, p. 15) point out that AET "[...] is an analysis of the activity that is confronted with the analysis of other elements of the work", that is, "[...] it is the analysis of the strategies used by the operator to manage this distance [...]" between the actual work and the prescribed work.

This study, therefore, aims to analyze the distance between prescribed work and real work — following the conceptual approach of AET raised here — of teachers of clothing modeling disciplines.

3. METHODOLOGICAL PROCEDURES

To conduct this research — characterized as descriptive, analytical and correlational — the AET conceptual approach proposed by Guérin et al. (2001) and systematized by Santos & Fialho (1997). In order to identify the gap between real and prescribed work, the following methodological approach subdivides AET into three distinct analysis phases (cf. Figure 2): a) demand analysis, b) task analysis and c) activity analysis.

Figure 2. AET approach scheme.



Source: Prepared by the authors (2019), adapted from Santos & Fialho (1997).

Demand analysis refers to the definition of the problem to be analyzed considering all the agents involved in the work process. Task analysis, in turn, is the gathering of information about the supposed working conditions (environmental, technical, methodologies, organizational, among others) to be carried out by the worker, that is, it is the prescribed work. Finally, the analysis of activities involves the evaluation of the effective working conditions carried out by the workers in the actual execution of the task, that is, it is the real work (Merino, 2011).

The results obtained through the panoramic diagnosis of all these elements involving work therefore guide the proposition of ergonomic recommendations aimed at improving working conditions that benefit both the personal aspect (worker) and the organizational aspect (company) (Merino, 2011).

To define the elements to be investigated in each of the AET analysis phases, as well as the data collection instruments, an adaptation of the analysis model developed specifically for teaching work, proposed by Biazus (2000) was used (cf. Figure 3).

Figure 3. AET analysis phases.

Source: Prepared by the authors (2019), based on Biazus (2000).

As evidenced by Andrade & Tonin (2023), the results of the AET of teaching jobs are contrasting considering the teaching-learning modalities in a face-to-face environment and in a remote environment, therefore, it is important to highlight that the context of this investigation is limited, exclusively , to teaching work carried out in person, since data collection and analysis were conducted in a period prior to the context of remote work imposed by the New Coronavirus (COVID-19) pandemic.

3.1. Structured questionnaire

The structured questionnaire was used as a data collection instrument for the task analysis and activity analysis stages, to investigate teaching practice in clothing modeling disciplines, with a focus on identifying the prescribed work — methodological, environmental and didactic procedures adopted in the profession — and also to verify possible prevalence of DME in this work practice. To this end, a virtual, online questionnaire was structured, made available via the *Google Forms platform* . The choice of the survey method through the questionnaire was considered the most appropriate in terms of scope for collecting data regarding the characteristics of teaching practice and action.

The questionnaire was developed based on the literature and was based on approximately 35 questions, including open and closed questions, being divided into three distinct aspects: a) sociodemographic profile; b) characteristics of teaching activity and; c) verification of DME arising from teaching practice.

The specific objective of the second questionnaire approach was to understand how teaching is carried out in clothing modeling subjects in the classroom and to collect data regarding didactic, environmental and physical factors in relation to teaching in these subjects. Furthermore, the third approach of the questionnaire, checking DME, aimed to map the main body regions in which it is possible to verify the prevalence of DME among teachers.

A subdivision of body regions — neck/cervical, shoulders, back/spine, forearm/elbow, wrist/hand, leg/knee, foot/heel — was presented to participants so that they could indicate the level, frequency and duration of physical discomforts arising from teaching in clothing modeling disciplines. This mapping was adapted from the protocol for surveying DME derived from work activities developed by Cheng et al. (2016), which in turn uses as a reference an adaptation of the painful areas diagram proposed by Corlett & Manenica (1980).

The population at this stage of the research consisted only of professors working in clothing modeling courses in the second semester of 2019, because, as it involved investigating the perception of physical discomfort, it was understood that if the professor had taught clothing modeling courses for longer or only once in their teaching career, they might not be able to remember or adequately identify the levels of discomfort involved in practicing that discipline specifically — which would harm the analysis of research data.

The questionnaire was available for completion between September and October 2019. In total, 15 valid completion protocols were obtained. The qualitative data obtained were analyzed, compared and categorized through content analysis — according to the systematization proposed by Meireles & Cendón (2010), aiming to identify similar results that converged to enrich the study discussions. Quantitative data were tabulated and organized using *Microsoft Excel software* and analyzed using *IBM SPSS statistical software* . Each question, of a closed nature, was considered a variable categorized in the form of nominal or ordinal data and analyzed descriptively through frequency distribution. Furthermore, some of the categorical variables were subjected to inferential statistical tests, through linear trend chi-square association analysis (χ^2). In all inferential statistical tests carried out, the significance level adopted was 5%.

3.2. Direct observations

To collect data from the analysis stage of teaching work activities in clothing modeling disciplines, direct observations were carried out at the place of work of two (02) professionals in their teaching practice in the discipline in question. The institution selected for the observations was the Federal Institute of Education, Science and Technology (IFSC), Campus Gaspar. The IFSC/Campus Gaspar is a federal public institution, linked to the Ministry of Education (MEC), which currently offers two courses in the clothing/fashion axis: the Concomitant Technical Course (CTC) in Clothing Modeling and the Higher Course in Technology (CST) in Fashion Design. In addition to direct observations, photographic and video records were made in order to identify the main attitudes adopted by teachers in their professional practice.

The analysis was carried out in the curricular units “Modeling I” and “Modeling II” in force in the first and second semester, respectively, of the CTC in Clothing Modeling and consisted of two four-hour class observations, totaling eight hours of evaluation. The imagery

records were made at regular intervals and frequencies and included documentation of the main categories of postures adopted by the teachers.

It is noteworthy that the research participants — both in the stage involving the structured questionnaire and in the stage involving direct observations — declared their consent to the procedures set out for data collection through a Free and Informed Consent Form (TCLE), which previously explained to the individuals, in a clear and objective way, all the explanations relevant to the study.

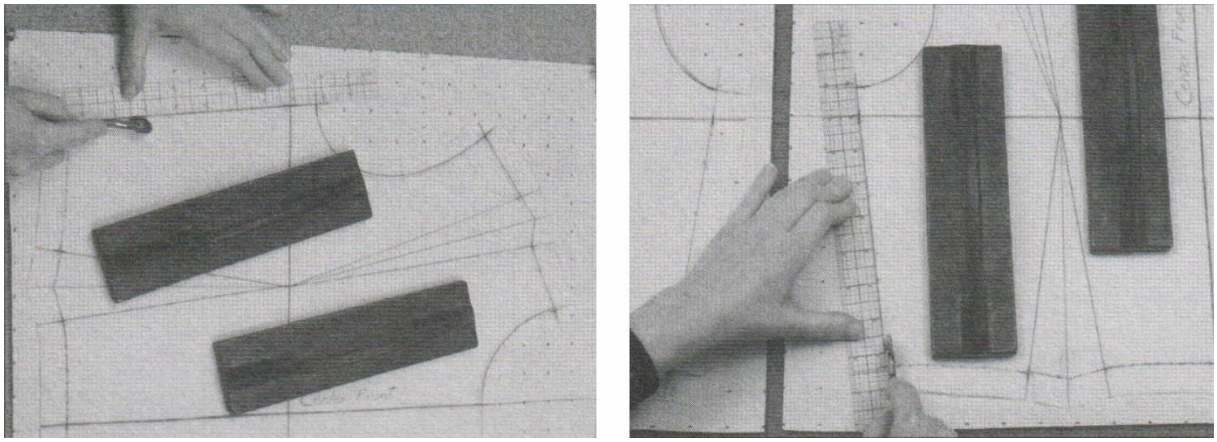
4. RESULTS AND DISCUSSION

The results of the investigation and respective discussions are presented below, divided into three distinct moments — demand analysis, task analysis and activity analysis —, in accordance with established AET methodological procedures.

4.1. Demand analysis

Clothing modeling is understood as the project development stage, responsible for the elaboration and three-dimensional structuring of the product, through specific two-dimensional techniques and methods. Based on the technical drawing of the product, diagrams are drawn based on anthropometric measurement tables, with the aim of preparing the component parts of the garment for the cutting and sewing sectors (cf. Figure 4). This flat modeling layout can be performed manually or computerized, using specific computerized systems (Berg, 2017; Sabrá, 2014; SENAC, 2017; Silveira, 2003).

Figure 4. Two-dimensional clothing modeling performed manually.



Source: Abling & Maggio (2014, p. 66).

This discipline is present in curricula in several courses in the cultural production and design (fashion/clothing) axis, such as fashion design, clothing production and costume design, and in different levels of education, such as industrial learning courses, technical courses, courses higher education and postgraduate courses. It is in the craft of teaching this discipline — specifically manual two-dimensional modeling — that this analysis is based.

To analyze the demand, we therefore considered the theoretical framework that supported the central research issue and that can be explored when reading the introduction of this study. The instruction of the demand was based mainly on the teaching experience of the central researcher of this study in clothing modeling disciplines, as well as on the scientific data found that highlight the main occupational health problems associated with teaching work practice.

Given the possibility of research on teaching in clothing modeling disciplines, some questions were raised in order to understand teaching in this discipline. Some inconsistencies found may, in principle, help justify the study. The first reflection focuses on the curricular need for the clothing modeling discipline to be carried out in a specialized teaching laboratory — which corroborates the consistency that this curricular unit involves practical content. Specifically in CST (Fashion Design and Clothing Production), according to the National Catalog of Higher Education Courses [4], and Technical Courses (Fashion Production, Clothing Modeling, Scenic Costume Design and Clothing), according to the National Course Catalog Technical [5]— both developed by the Ministry of Education (MEC) —, a "modeling laboratory" is imposed as the minimum infrastructure required in offering these courses. Now, the existence of a laboratory to practice this discipline is legally prescribed (at least in the public courses described), however, there is no technical and legal apparatus that structures and ergonomically standardizes the spatial elements, resources, equipment, furniture or standards of security — at least specific — for the pedagogical adaptation of these laboratories.

Even public or private higher education courses, despite not being subject to the very specific requirements of the National Catalogs established by the MEC, in their pedagogical projects and curricular structures, institutionalize the existence and use of specialized teaching laboratories to teach modeling disciplines. of clothing.

[4]Available at: http://portal.mec.gov.br/catalogos-nacionais-de-cursos-superiores-de-tecnologia . Accessed on: September 5th. 2023.
[5]Available at: http://portal.mec.gov.br/catalogos-nacionais-de-cursos-tecnicos . Accessed on: September 5th. 2023.

Consulting in an unsystematic manner the pedagogical projects of some of the main courses, technical and higher education, in the State of Santa Catarina, which have a clothing modeling discipline in their curricula, it is clear that modeling laboratories are normally characterized by the presence of the following specific equipment and furniture: large modeling benches and tables, stools, modeling mannequins and busts, sewing machines with specific functions, pattern scanning software, plotters for printing patterns, whiteboards, clothes racks, etc.

The second reflection — originating from the inconsistencies in teaching in the clothing modeling disciplines — concerns the lack of methods and procedures in the teaching profession for teaching-learning in this discipline. In the literature it is possible to find a study carried out by Beduschi (2013), in which the author proposes guidelines for teaching clothing modeling, however, this proposition is made only at a pedagogical level and not exactly methodological action. The author presents partial teaching material that brings together the guidelines she proposed, including: interdisciplinarity and mastery of knowledge from the areas of ergonomics, anthropometry and geometry; the approach of theoretical content together with practical content; the transfer of practical content — elaboration of base models and interpretations — based on descriptions in an execution order format — step by step — with indication of points and trace lines; and the use of visual and/or tangible references for an adequate visualization of the clothing elements. However, these guidelines do not include didactic guidance in the face-to-face classroom, or the practical teaching procedures to be adopted and the teaching resources to be used in the transfer of content, mainly practical.

Menezes & Spaine (2010) also developed guidelines for teaching clothing modeling, but like Beduschi (2013), they only explore the pedagogical process based on the division of the main factors and aspects necessary for the teaching-learning of this discipline, such as , ergonomics, anthropometry, the user and geometry. As in the previous case, the authors do not propose methodological procedures or didactic models oriented to teaching action.

4.2. Task analysis

It is complex to establish teaching at methodological levels, as there is no regulation that specifies this practice. It is evident that each teacher establishes a different action according to their theoretical framework and the habits incorporated by their academic and professional training. It is quite likely that a clothing modeling teacher will base his practice on observation and experience as an academic in these same disciplines.

In this way, the structured questionnaire was an essential data collection instrument for identifying the prescribed work based on a survey of the methodological, environmental, didactic and behavioral procedures adopted by teachers in clothing modeling disciplines.

The sociodemographic profile of the sample (n=15) indicates a unanimous number of female participants (100%), among them, 53.3% are aged between 31 and 40, 26.7% are between 21 and 30 years and 20% are over 51 years old. All participants have at least higher education, as they work as teachers, with the majority of the sample having a postgraduate degree (specialization, master's or doctorate) — approximately 93%. In relation to the main variables identified in the theoretical framework that may influence the prevalence, or not, of MSD in teachers, it was identified that approximately half of the sample (53.3%) declared themselves married or with a stable union agreement, a third of participants (33.3%) have children and a little less than half (46.7%) practice some physical activity on a recurring basis.

Considering the length of teaching experience, 60% of participants have six years or more (in full years) of career experience. In relation to the educational institutions in which the participants teach, IFSC (n=7), SENAI (n=5), UDESC (n=1), UNIDAVI (n=1) and UNIASSELVI (n=1) are listed. A third (n=5) of the sample teaches subjects that relate other content beyond the area of modeling and clothing manufacturing, such as product design subjects, fashion history and fashion production.

The qualitative research data extracted from the structured questionnaire converge to the need to teach clothing modeling courses in a specialized teaching laboratory. The entire participant sample stated that in the educational institution(s) where they teach, clothing modeling disciplines are taught in a specialized teaching laboratory and what characterizes this laboratory is the presence of specific equipment and furniture. , such as large modeling benches and tables, stools, modeling mannequins and busts, rulers and specific materials, whiteboards, etc. — practically the same elements already described in the demand analysis.

In relation to the teaching-learning methodology adopted by the participants, in their teaching practice in clothing modeling disciplines, it was noticed that the answers converged to the description of classes that are expository and dialogued, with the carrying out of practical exercises oriented in a collective and individual by the teacher. The theoretical contents are briefly presented in a discursive and dialogued manner, with the possible use of illustrated or tangible exemplifications — prototypes. The practical contents are presented by the teacher, who draws up diagrams and base templates and interprets full-size models, normally with the help of the board. During this stage, the anatomical aspects and the sequence and order of

execution of the models are explained in detail, in which students develop their diagrams and molds concomitantly. At the end of the explanations, the teacher monitors student activities through individual assistance to students.

Approximately half of the participants (46.7%) disagreed (strongly disagree, disagree) or remained neutral (neither agree/nor disagree) in relation to the following statement: “I prefer to teach clothing modeling subjects compared to other subjects in the area of fashion/clothing”. It can also be seen that the incidence of disagreement responses occurs more significantly among teachers who teach subjects with other content in addition to the area of modeling and clothing manufacturing. This data corroborates informal observations made which indicate that, as they deal with technical and more practical content, clothing modeling subjects are not preferred among teachers in comparison to other subjects in the fashion/clothing area.

Regarding the perception of physical discomfort being greater in clothing modeling disciplines compared to other disciplines in the fashion/clothing area, the observed predisposition is a positive agreement between participants (agree and completely agree) (64.3%) . Likewise, the sample was unanimous (100%) in positive agreement (agree and completely agree) regarding the following statement: “subjects with practical content, such as clothing modeling, require more physical disposition compared to other disciplines with more theoretical content in the fashion/clothing area”. This result may indicate that one of the reasons for not preferring to teach these subjects may be, precisely, the practical/technical nature involved in the contents, as well as the fact that teaching these contents involves a greater physical disposition of the teachers.

4.3. Analysis of activities

The analysis of the activity involved direct observations of teaching practice in clothing modeling disciplines as presented in the methodological procedures. The observations were made at the IFSC/Campus Gaspar, which currently has two specialized teaching laboratories for clothing modeling. The laboratory, in which the analysis was carried out (cf. Figure 5) is approximately 70 m² and is equipped with: eight high modeling benches, and 19 adjustable swivel chairs, some of which are upholstered and others without upholstery. It has three cabinets, a drawer and a rack to store teaching materials used in the classroom, such as: modeling rulers, reels, scissors, prototypes, brown paper, among others. The laboratory also has an industrial iron and modeling dummies arranged at the ends along the walls. In front of the laboratory there is a whiteboard and an “L” shaped table with a microcomputer exclusively for

teaching use. The laboratory also has an air conditioning unit and adequate lighting with side windows with curtains. The space can accommodate a maximum of 25 people following institutional criteria.

Figure 5. Specialized teaching laboratory for clothing modeling at IFSC/Campus Gaspar.

Source: Prepared by the authors (2019).

The first observation was carried out with the participating teacher identified in this study as DP1, female, 26 years old. His background is in Fashion Design and he has a postgraduate degree in Design. She has one year of teaching experience and is currently a substitute teacher at IFSC/Campus Gaspar and teaches the subject “Modeling I” for the CTC in Clothing Modeling. Your workload is 40 hours per week, four hours of which are dedicated exclusively to teaching the subject in question, not including preparation or teaching organization hours.

The second observation was carried out with the participating teacher identified in this study as DP2, female, 32 years old. His background is in Fashion Design and Technology and he has a postgraduate degree in Design. She has 10 years of teaching experience and is currently an effective professor at IFSC/Campus Gaspar and teaches the subject “Modeling II” for the CTC in Clothing Modeling. Your workload is 40 hours per week, with exclusive dedication, with eight hours dedicated exclusively to teaching the subject in question, not including preparation hours or teaching organization.

It can be observed that teaching practice in clothing modeling disciplines corresponds to the same methodological procedures obtained through the structured questionnaire and, therefore, consists of creating a two-dimensional diagram of a given model or base of the human body following an order of execution — step by step — pre-established. The main teaching difficulty encountered was that, while students use the large modeling benches (sized for this

activity) as support, in a horizontal movement plane, the teacher uses the whiteboard as support, in a vertical movement plane.

The physical load involved in the explanations made in the table — in the vertical plane — highlights inadequate postures, with constant twisting of the trunk usually associated with the elevation of both arms (cf. Figure 6 and Figure 7). Furthermore, when modeling clothing, as it deals with traces of body diagrams in natural size, the dimensional extension of these diagrams suggests to the teacher in a vertical work plane, at times, variations of extreme postures, such as DP1, which in a In a given situation explaining the industrial basis of women's trousers, the woman performed a complete flexion of her legs in a squatting posture and then adopted a posture of total flexion of the trunk with arms extended and supporting herself on the tips of her feet (cf. Figure 6f and Figure 6g).

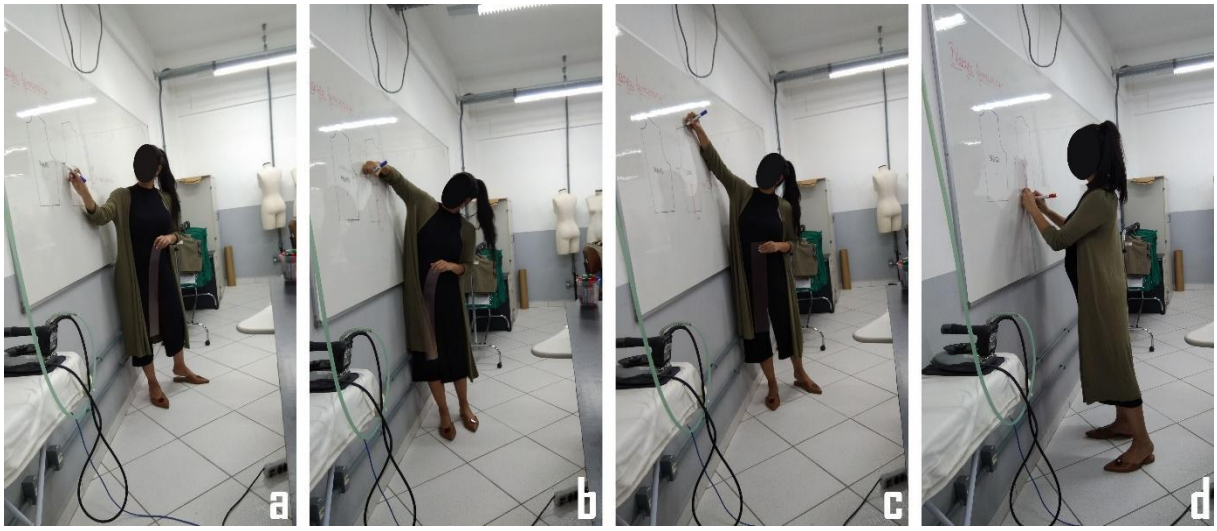
DP2 draws up the diagrams of models and body bases directly on the whiteboard with the help of specific markers, however, a relevant difficulty was noticed in this procedure, because, as the layout involves the constant positioning of rulers and specific curves, manipulation These tools ended up removing previous information or traces. It was found that, to minimize this difficulty, DP2 uses its own technique based on an ineffective positioning of the ruler (cf. Figure 7d).

On the other hand, DP1 draws up the model diagrams and body bases using brown paper posted on the whiteboard. This way, the positioning of the rulers does not harm the previous lines, therefore there is no unintentional removal. However, it is clear that the support in the color of brown paper makes it difficult for both teachers and students to visualize the elements, when compared to the support in white color (on the whiteboard).

Figure 6. Postural variations observed in DP1.

Source: Prepared by the authors (2019).

Figure 7. Postural variations observed in DP2.



Source: Prepared by the authors (2019).

As manual and flat clothing modeling involves the manipulation of large and bulky acrylic rulers, the physical condition of teachers is intensified during the development of

activities. Furthermore, certain activities inherent to clothing modeling, such as, for example, the act of detaching the pattern with the aid of the reel, become unfeasible in the vertical movement plane due to the characteristics of the support, whiteboard, which, unlike the rubber applied to the benches, made of wood, do not allow the transfer of the design. In this case, to explain the content, the teachers either provided individual assistance to each student or asked everyone to follow the explanation at one of the benches. In this case, the teacher performs the procedure on the bench — in the horizontal plane — and all the students around observe. In this way, the difficulty in visualizing the activity for students becomes evident.

There was also difficulty in handling the materials necessary to carry out the clothing modeling, mainly related to access to rulers and curves and checking the teaching material, such as the course booklet or textbooks used. The teacher's table, positioned just in front of the whiteboard, is low in comparison to the modeling benches, which demands a postural variation that is harmful to the cervical/neck and back/spine, as the teachers needed to flex considerably these body regions to reach materials and access information. Furthermore, the reach, especially to the rulers, is constant, which physically requires the teacher to move and twist their body continuously towards the support table.

Specifically in relation to individual assistance to students, it was noticed that there is excessive physical movement on the part of teachers, with several movements with both legs — walking — throughout the laboratory space. Practically, with each new explanation in the operational sequence of tracing the body diagram, the teacher went to each modeling bench, where the students were, to guide them individually, observing whether the step was executed correctly or resolved possible doubts. It was found that the spacing between the benches is insufficient for comfortable movement, and at various times the teacher needs to ask students for passage and overcome obstacles to move between spaces.

When remaining at the students' benches, clarifying possible doubts or correcting any stage of the diagram and molds execution, it was noticed that the postural demand is great, as, again, there are several twists of the trunk, lateral inclinations and inclinations of the cervical/neck, there are , also, excessive extensions of the arms, even on the horizontal plane (cf. Figure 8).

Figure 8. Postural variations observed when assisting students.

Source: Prepared by the authors (2019).

As the benches do not have height adjustment, and even if they did they would be adjusted to the student's height, the physical demand is much greater for the teacher who needs to bend over frequently to help with students' doubts and corrections. At times, it was possible to identify a difficulty related to lighting, which, depending on the specific location in the classroom and the materials used by students (quality of brown paper and markers, pens or pencils), hindered teaching visualization. This was mainly observed in the practice of DP2, which sought other body postures in order to accommodate itself at a certain angle that allowed adequate visualization of the elements outlined in the student activity.

In relation to the analysis of the structured questionnaire applied to teachers of the clothing modeling discipline, which mainly involved checking the level, frequency and duration of musculoskeletal discomforts observed in teaching practice in each of the main body regions, the results obtained can be seen in Table 1 — with the highest frequencies found in each region highlighted.

It is noticed that the body regions with the highest frequency in relation to the level of musculoskeletal discomfort, identified by the sample, are the back/spine (46.7%) and the foot/heel (53.3%), both with moderate discomfort and the neck/cervical (46.7%) and the leg/knee (46.7%), both with mild discomfort. In relation to the frequency of musculoskeletal discomfort, there is a significant high frequency (sometimes, frequently and always) of some

body regions, such as the foot/heel (53.4%), the back/spine (53, 3%), the leg/knee (46.7%) and the neck/cervical (33.4%).

Table 1. Frequencies of level, frequency and duration of musculoskeletal discomfort (MSD) in each body region.

DME LEVEL	No discomfort		Mild discomfort		Moderate discomfort		Severe discomfort		Unbearable discomfort	
	(n)	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**
Neck/Cervical	4	26.7	**7**	**46.7**	4	26.7	0	0.0	0	0.0
Shoulders	**6**	**40.0**	5	33.3	4	26.7	0	0.0	0	0.0
Back/Spine	3	20.0	5	33.3	**7**	**46.7**	0	0.0	0	0.0
Forearm/Elbow	**11**	**73.3**	3	26.7	0	0.0	1	6.7	0	0.0
Wrist/Hand	**10**	**66.7**	5	33.3	0	0.0	0	0	0	0.0
Leg/Knee	3	20.0	**7**	**46.7**	4	26.7	1	6.7	0	0.0
Foot/Heel	two	13.3	5	33.3	**8**	**53.3**	0	0.0	0	0.0

DME FREQUENCY	Never		Rarely		Sometimes		Often		Ever	
	(n)	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**
Neck/Cervical	1	6.7	**9**	**60**	4	26.7	1	6.7	0	0.0
Shoulders	3	20.0	**8**	**53.3**	3	20.0.0	1	6.7	0	0.0
Back/Spine	1	6.7	**6**	**40.0**	**6**	**40**	two	13.3	0	0.0
Forearm/Elbow	**10**	**66.7**	3	20.0	two	13.3	0	0	0	0.0
Wrist/Hand	**7**	**46.7**	**7**	**46.7**	1	6.7	0	0	0	0.0
Leg/Knee	two	13.3	**6**	**40.0**	4	26.7	two	13.3	1	6.7
Foot/Heel	two	13.3	**5**	**33.3**	3	20.0	4	26.7	1	6.7

DME DURATION	Not applicable		Momentarily (hours)		Temporarily (days)		Often (weeks)		Constantly (months)	
	(n)	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**	**(n)**	**(%)**
Neck/Cervical	3	20.0	**8**	**53.3**	3	20.0	1	6.7	0	0.0
Shoulders	**6**	**40.0**	**6**	**40.0**	3	20.0	0	0.0	0	0.0
Back/Spine	4	26.7	**7**	**46.7**	3	20.0	1	6.7	0	0.0
Forearm/Elbow	**13**	**86.7**	two	13.3	0	0.0	0	0.0	0	0.0
Wrist/Hand	**11**	**73.3**	4	26.7	0	0.0	0	0.0	0	0.0
Leg/Knee	5	33.3	**7**	**46.7**	3	20.0	0	0.0	0	0.0
Foot/Heel	4	26.7	**9**	**60.0**	two	13.3	0	0.0	0	0.0

Source: Prepared by the authors (2019).

Regarding duration, it is clear that most musculoskeletal discomforts are momentary, lasting approximately hours, in almost all body regions — with the exception of the forearm/elbow and wrist/hand —, but relevant frequencies of temporary duration (days) and frequent (weeks) were identified in the following body regions: neck/cervical (26.7%), back/spine (26.7%), shoulders (20%) and legs/knees (20%).

These results corroborate the data obtained through direct observations, as the body regions with the highest level, frequency and duration of musculoskeletal discomfort — identified by the structured questionnaire sample — are precisely the regions affected due to the postural characteristics adopted in practice. teacher. Postural variations, extreme positions, inappropriate and constant twisting, excessive movement and continuous standing in an orthostatic position may therefore indicate the prevalence of DME in teachers of clothing modeling disciplines, especially in the neck/cervical area, back /spine, on the leg/knees and on the foot/heel.

From the data found, through the frequency distributions of the questionnaire approaches, hypotheses of dependence and correlation between some study variables were tested. As previously stated, the inferential statistical test of the chi-square with linear trend (χ^2) and the probability of significance used considering $p \leq 0.05$. As the research sample was small (n=15), aiming for relevant results in statistical tests, some of the variables submitted had their categories grouped.

Associations were made between categories of level of musculoskeletal discomfort in each of the mapped body regions and sociodemographic variables, such as age group, marital status, whether you have children and whether you practice physical activity recurrently. Furthermore, these categories were associated with variables related to teaching practice, such as teaching time (≤6 years and >6 years), the educational institution in which they teach (public or private), the working hours spent only in clothing modeling subjects (≤6 hours and >6 hours), whether they teach other subjects in the fashion/clothing area (yes and no), satisfaction in teaching the subject (neutral and agree), preference in teaching the subject (disagree, neutral and agree) and perception of greater physical discomfort in the teaching practice of clothing modeling subjects (disagree, neutral and agree).

In none of the associations made between the variables agreed for the analysis — mentioned above — were significant results found, however, according to statistical inference, some relative frequencies were identified — which, possibly, with the application of the research considering a larger sample could generate trends for associations. Some of these relative frequencies can be observed in relation to married individuals or those with a stable union agreement to experience greater musculoskeletal discomfort in the mapped body regions compared to single individuals. This is probably due to the double or triple working hours attributed to females, which, together with domestic activities, in addition to work activities, may have a higher prevalence of MSD than single individuals or male individuals — a trend

that converges with observations by Erick & Smith (2011) of a positive association with the prevalence of DME in females.

Furthermore, it appears that individuals who do not recurrently practice physical activity tend to feel musculoskeletal discomfort, especially in the legs/knees and foot/heel region, more frequently when compared to individuals who practice physical activity. Likewise, individuals with a longer teaching career (>6 years) tend to feel musculoskeletal discomfort more frequently and for a longer period of time than teachers with a professional experience of six years or less, especially in the body regions of the neck, shoulders, back/spine. These data highlight the possible worsening of DME during the teaching career, as well as indicating that the practice of physical activities on a continuous basis can alleviate perceptions of musculoskeletal discomfort.

Furthermore, individuals who teach only clothing modeling subjects have a relative frequency of experiencing musculoskeletal discomfort with greater regularity and duration than teachers who teach other subjects in the fashion/clothing area combined, particularly in the neck/cervical and foot/ to heel. This supposedly demonstrates the physical effort necessary for the teaching practice of this discipline, mainly derived from postural variations identified in direct observations of neck/cervical positions and twists and constant movements.

Although the research issue touches on the assumption that the lack of predilection for teaching clothing modeling subjects may be associated with the prevalence of MSD in teaching practice, it is clear that the research data are not sufficient to corroborate this assumption. It was observed that individuals who disagree or remain neutral in the face of the statement of preference in teaching clothing modeling subjects tend to feel musculoskeletal discomfort more frequently, especially in the body regions of the back/spine, leg/knee, foot/heel, in comparison to individuals who agree with such a statement. However, considering an analysis between cause and effect, the fact of having a predilection or not in teaching these subjects is not directly associated with the prevalence of DME in the studied sample, after all, the teacher may prefer to teach clothing modeling subjects at the same time as feel musculoskeletal discomfort when administering it and vice versa.

Finally, no trends were identified related to teaching workload in clothing modeling classes with the frequency and duration of musculoskeletal discomfort, nor were any trends related to satisfaction in teaching clothing modeling classes identified with the frequency of musculoskeletal discomfort. .

4.4. Diagnosis and ergonomic recommendations

Based on the results of the AET carried out, it was possible to prepare a diagnosis listing the main ergonomic inadequacies found in teaching practice in clothing modeling disciplines. It is clear that in this work activity there are difficulties related to the spatial environment of the specialized didactic laboratory, the postural configurations and the didactic-methodological procedures adopted in the profession. Thus, considering these three dimensions of action (cf. Figure 9), ergonomic recommendations are suggested that can favor didactic teaching-learning strategies and prevent the prevalence of MSD. It should be noted that some suggestions were adapted from proposals perceived and indicated by some participants in the structured questionnaire.

Figure 9. Action dimensions for ergonomic recommendations.

Source: Prepared by the authors (2019).

In relation to the laboratory dimension, the dimensioned design of the environment/space is proposed as an ergonomic recommendation, allowing free circulation and movement of the teacher for individualized student care; the design of ergonomic furniture, considering the planning of benches, swivel chairs and teaching tables suitable for activities inherent to professional practice; the lighting design appropriate to the space; the design of the modeling benches considering the adequate surface design and with rounded ends; the design of a board — vertical support for explaining the content — suitable for creating clothing modeling, considering the surface and material consistent with the activities of the craft, the possibility of inserting grids and the feasibility of creating style " drawing board with parallel ruler" with coupled ruler mechanism or with magnetic mechanism (to avoid physical support of the rulers).

Regarding the postural dimension, it is suggested that there be greater awareness of teaching in clothing modeling disciplines, in order to avoid certain harmful postural combinations, especially in the long term. Furthermore, it is recommended to take breaks at stipulated periods and intervals to rest from postural variations, prevent the adoption of

inappropriate postures by modifying the procedures for demonstrating the outlines of model diagrams and bases of the human body, possibility and elevation of the teaching surface using a platform or platform — or even an architectural design of the laboratory in the format of an "arena" or "theater".

Finally, regarding the didactic-pedagogical dimension, the proposed suggestions concern, mainly, the reduction in the number of students per class — reducing the amount of individualized assistance, eventually, there would be less movement and teaching displacement in the laboratory —, the reduction of the workload weekly time allocated to the discipline and modifications to the procedures for demonstrating the outlines of clothing modeling activities, possibly using a virtual interface or digital whiteboard, in which the teacher prepares the activities also in the horizontal movement plane and that these are simultaneously projected onto the vertical plane for student viewing.

5. CONCLUSION

The primary objective of this study was the ergonomic analysis of teaching work in clothing modeling disciplines, with an emphasis on postural assessment, in order to recommend ergonomic improvements that would favor didactic teaching-learning strategies and prevent the prevalence of MSD. Based on methodological procedures originating from AET, it was possible to understand teaching work in this specific discipline, identifying ergonomic inadequacies, through direct observations carried out on site, and verifying the level, frequency and duration of musculoskeletal discomforts perceived by teachers in their activity. employment, through the structured questionnaire applied. In this sense, it is understood that the objectives initially outlined for this study were fully and satisfactorily achieved, considering the limits and resources available.

From the research stages established for this study, the importance of articulating knowledge arising from ergonomics, through AET, and design was realized in order to carry out analyzes and implement improvements in activities related to teaching work, considering not only teacher satisfaction and health, but also the global optimization of the educational system. The application of specific analysis in clothing modeling disciplines allowed us to verify that the teaching-learning process of this discipline is fragile and difficult for teachers, largely due to the problems identified in relation to the laboratory space, the postures adopted and the didactic-methodological procedures. employees. In this way, from the implementation

of the ergonomic recommendations proposed by this work, it is expected that the work activity of these teachers will be improved.

New investigations, discussions and reflections on teaching activity are suggested for future work, mainly in the context of ergonomic analysis, in clothing modeling disciplines or in the fashion/clothing axis, in order to explore new areas of activity for this professional, aiming to the proposition and implementation of improvements to teaching work. Continuities of the study carried out here are motivated, preferably considering the application of data collection instruments with statistically more significant samples — which intend to analyze more in-depth correlations between teaching activity in clothing modeling disciplines and the prevalence of DME, especially in relation to the impacts of occurrences of musculoskeletal discomfort on variables of predilection and teaching satisfaction in these disciplines. Likewise, it is recommended to apply postural assessment protocols — such as, more traditionally, OWAS, RULA, REBA, among others — to complement the preambular analysis of this study.

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