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EXTENDED SUMMARY

MATHEMATICAL LANGUAGE IN THE MODELING LEARNING PROCESS IN THE TECHNOLOGIC COURSE IN FASHION DESIGN: A CASE STUDY AT A PRIVATE COLLAGE IN RECIFE-PE

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1. INTRODUCTION

Fashion is a social and cultural phenomenon, of a more or less coercive character, which consists of the periodic change of style, and whose vitality comes from the need to conquer or maintain a certain social position (JOFFILY, 1999 apud TREPTOW, 2013). Social, economic and cultural aspects are essential in the constitution and representation of identities expressed by fashion in the most diverse periods of civilizations, as the clothing serves, over time, as a sign of differentiation between social classes. Fashion is an effective means of analyzing identities, used to express embodiment, the externalization of fragmented, mutable, fluctuating subjectivities that fluctuate the experience of the contemporary world. In the construction and understanding of symbols and signs, modeling has a fundamental role, due to its ergonomic function.

The modeling of clothing emerged from the moment that man discovered the technique of tanning the skins and the bone needle, Paleolithic period. The skins of the animals on the primitive man's shoulder prevented movements, so adaptations were made to release them. The different forms of clothing evolved from human physical needs (FEGHALI, 2006) and people changed their way of dressing due to social influences. "The clothing, which at first was determined only by the available resources and technology, starts to vary in styles according to the vogue of the time" (TREPTOW, 2013, p. 25-26). Thus, modeling starts to be seen as an integral part of the fashion project, being an important instrument that allows fashion products to be derived from the materialization made possible by this development process. Therefore, it constitutes an important teaching tool for the material elaboration of concepts, expressions and trends, as well as for the search for pedagogical solutions by techniques, planning and methods applicable in the teaching of the Higher Technology Course (CST) in Design of Fashion.

Souza (2006), researched the efficiency of three-dimensional modeling, moulage, as an instrument to optimize the fashion / clothing product development process, focusing on the creation and materialization stages in which the technique was inserted and found the dichotomy between the areas of creation and modeling. Still, it addressed the technical, constructive, ergonomic and aesthetic qualities involved in the product modeling project, emphasizing comfort, trim and formal innovation.

The modeling of a garment is based on mathematical calculations that are performed from a table of standardized measurements or measurements of body or clothing. Many professionals involved in the process of creating and adapting clothing, as well as students of Fashion Design, do not have the practice with tools that help in the execution of patterns, reproducing the content presented in the classroom without any understanding of the process and without reasoning, compromising the productive quality and the profile of the graduate. Thus, knowledge of basic mathematics, geometric designs, among others, are indispensable for CST students in Fashion Design. Seeking to meet the demands of training a fashion designer, Higher Education Institutions (HEIs) formatted their Fashion Design courses and included disciplines that offered the graduate a wide range of knowledge to develop the necessary skills.

However, they did not contemplate disciplines or actions that developed mathematical knowledge. Thus, it is possible to perceive resistance and difficulties of the students regarding the disciplines that involve modeling, one of the fundamental axes of CST in Fashion Design. Given the above, it is possible to perceive the constant presence and the need to have basic mathematical knowledge to develop models of clothing appropriate to the needs of society.

The interest in the theme arose from the researcher's experiences as a teacher, observing the low performance of undergraduate students at CST in Fashion Design. Thus, it was noticed the difficulty of students and professionals regarding the development and execution of modeling activities in classes and in the studio, due to the lack of basic mathematical and geometric knowledge, as well as the lack of direct and objective interrelationship between the disciplines. of the course. Therefore, the question this research sought to answer was: How can interdisciplinarity contribute to the teaching-learning process of flat and three-dimensional modeling of clothes in relation to mathematics at CST in Fashion Design? We start from the hypothesis that interdisciplinarity is an adequate approach to relate modeling to mathematics, by enabling the integration of knowledge in a contextualized way, contributing to the good performance in the learning process.

Therefore, this work had the general objective: to analyze the relationship between Mathematics and the teaching-learning process of Flat and three-dimensional modeling in the CSGT in Fashion Design. The specific objectives of the study were: to highlight the importance of interdisciplinarity and mathematical knowledge in the teaching-learning process of flat and three-dimensional modeling; Investigate the mathematical knowledge of Fashion Design students who are taking modeling disciplines; analyze the difficulties faced by students in the modeling teaching-learning process; Relate the learners' mathematical knowledge to an adequate execution of flat or two-dimensional and three-dimensional modeling.

In this sense, the relevance of a teaching-learning process based on interdisciplinarity was discussed, that is, on the recognition of integration between disciplines, focused on critical reflection on the process and on professional performance. It is expected that the research will contribute to the improvement of teaching and learning in Flat and Three-dimensional Modeling.

2 INTERDISCIPLINARITY IN MODELING TEACHING IN FASHION DESIGN

The fashion industry is interdisciplinary, as it comprises a network of designers, manufacturers, traders and media professionals who dictate changes and the official image that fashion will have over time. It emerged in the 1670s, in Paris, revolutionizing behaviors and reducing social distances. Until the 1980s, in Brazil, fashion was not considered an area for study in regular courses or in higher education, so there were no formal courses before that period (FRAGA, 2013; PIRES, 2002).

Fashion education was based on the transmission of knowledge from generation to generation, that is, people learned from mothers or grandmothers who sewed or were self-taught, that is, they learned by taking out patterns from magazines, buying

clothes to copy the pieces and making the patterns from them. The functions and positions that created fashion products were occupied by lay people and self-taught people, who, as already said, learned the trade with the exercise of the profession. The understanding at the time was that the work could be performed by people with artistic talent, some fashion information and "good taste". As for fashion, there was no real concern for studying the subject. The interest in the area arose from the increase in textile and clothing companies in the country (PIRES, 2002). With the increase in the economy and companies in the sector, there was a need to create specialized courses in fashion to train qualified professionals and supply the market demand.

According to Fraga (2013), in Brazil, the teaching of fashion is recent, therefore, in its emergence, there were no professionals prepared for the role of teacher. The classes were taught by laypeople or self-taught who were teachers in the classroom. With the opening of undergraduate courses in Technology in Fashion Design, the need arose for the training of qualified, pedagogically prepared teachers, and the interest in the training of these professionals arose through postgraduate courses in the area, or the like, as training for teaching is limited to a discipline of Methodology in Higher Education, in graduate school, which has an average workload of 60 hours. This discipline establishes, in most cases, the references and guidelines for the university teacher to teach in the classroom (PIMENTA; ANASTASIOU, 2002).

According to data from 2017, Brazil is the country that has the largest number of courses focused on the Fashion area. In 2017, 142 courses in the Fashion area are registered on the e-MEC website, in person or at distance, aimed at the formation of Bachelor's, Licentiate, Technological (CST) or Sequential, in activity. The state of Pernambuco has 7 Fashion Design courses registered on that platform (LIMA and ITALIANO, 2016). Because Fashion is more strongly associated with issues related to clothing, its formal study becomes comprehensive around the production of clothing and, in part, on appearance and requires the understanding of several related areas, given its complexity. Hence the importance of interdisciplinarity in the teaching-learning approach in that area. In this way, most higher education courses try to cover teaching based on different methodologies for the development of clothing, the study of textiles and the development of design in their curriculum, which may also cover the productive and creative processes, modeling, Business, marketing, and others related to the culture of Fashion such as History, Aesthetics or Communication.

> The profile of the student entering university courses that require creation, as in the case of fashion design, is generally of high creative potential. Although, in the vast majority, these people had the same type of castrating education of creativity and individuality, which focuses on promoting the largest number of students for university education, it is possible to say that they found other paths in their life that led them to develop that potential. Many aspiring fashion professionals tend to be frustrated when, in the creative disciplines, they are faced with the need to translate their ideas through drawing, a technique that demands years of practice and that few students master (LIMA and ITALIANO, 2016, p. 479).

Although the Fashion Design has multidisciplinary characteristics, enabling undergraduate courses to approach product creation and production unified, favoring the understanding of the integration of design to execution and that both are part

of the same process, the teaching of modeling disciplines has not contemplated interdisciplinary teaching-learning. It is usually worked with disciplines and their respective fragmented content, which makes it difficult to integrate them. According to Morin (2001), fragmented knowledge often prevents the linking of the parts with the whole. Still according to the author, knowledge capable of "apprehending objects in their context, their complexity, their set" must be valued (MORIN, 2001, p.14).

Fontoura (2011) agrees with this perspective when stating that teaching should be open to plurality, to the innovative spirit, to creation, strengthened by integrated knowledge bases, with interdisciplinarity being an alternative to this possibility. According to the author, design has "an interdisciplinary vocation implicit, as it is an area conducive to working together with other areas of knowledge" (FONTOURA, 2011, p. 88). It is understood that interdisciplinarity in fashion courses assists in improving the quality of academic-professional training of apprentices, as it contemplates content integration; the interrelational concept of knowledge; the association between teaching and research, considering study and research, based on the contribution of different sciences; ¬ teaching-learning process that values knowledge built by experience throughout life (INSTITUTO PAULO FREIRE, 2011).

To teach it is necessary to have the mastery of content and knowledge that go beyond the limits of the curriculum and teachers need to seek knowledge and the development of teaching skills that enable the performance of the profession with competence. Pimenta and Anastasiou (2002) emphasize that, in the process of teacher training, it is necessary to master the knowledge in the areas of knowledge, pedagogics, didactics and teaching experience. In addition to the lack of pedagogical training in undergraduate courses, or poor training, many fashion teachers did not have an interdisciplinary teaching-learning approach and are not prepared for higher education in this perspective.

Therefore, in order to work in higher education, the teacher is committed to knowing the content to be taught, being a researcher, promoting awareness, forming critical people, capable of analyzing the context that surrounds them and intervening in society. For this, interdisciplinarity can contribute to the perspective of academic education that will positively impact on comprehensive and quality student education. Thus, there is a change in the educational, teaching, student and institutional profile in order to build an interdisciplinary learning of modeling, because for Morin (2002, 2003, 2005), the importance of a comprehensive and multidisciplinary thinking is marked out for the quality of reflection and the notion of the whole provided, enabling a reflective knowledge that contemplates the parts as forming elements of the integrality of the whole. Thus, the interdisciplinary approach must be considered in the teaching-learning process of Fashion Design, such as the relationship between modeling and mathematics in the development of molds and the production of fashion pieces.

3 THE RELATIONSHIP BETWEEN MODELING TEACHING AND MATHEMATICS

According to Araújo (1996), the clothing making process involves research, cre-

ation, modeling, cutting, assembly and finishing (ARAÚJO, 1996), as it defines what will be produced as a two-dimensional artifact for a three-dimensional artifact. Modeling is understood as the technique responsible for the construction of garments, through the observation and interpretation of models. This procedure implies the production of forms of clothing, study of the silhouette, fabrics and other elements of fashion, trends and cultures (ARAÙJO, 1996). Thus, modeling is considered the process of materializing the idea, creation, design and interpretation of the fashion designer, referring to the model on base.

The flat models are elaborated from standardized clothing measurements. However, for its construction it is necessary to follow a scheme of geometric techniques and measures that go beyond the simple standardization of subjective measures to real measures, that is, measures of each individual. The elaboration of a flat model requires knowledge of measurement tables, strokes, points, lines, lines and curves that originate the mold, variations in measures that can help or hinder standardization, among others. Thus, it is revealed the difficulty of students and professionals in the area in using equipment such as rulers, curves and square for the execution of their work. According to Grave (2009, p. 12), "multidisciplinary modeling should make 'human machine' available, within its main principle, thinking, feeling, action and motricity, making clothing interactive, responding to the interior and exterior of the individual".

Considering this thought, modeling brings together several areas of knowledge to have a satisfactory result in the modeling technique, in view of anthropometry, one of the most important disciplines in its multidisciplinarity. Araújo (1996), in turn, states that modeling consists of "the art of making molds from a pre-established model". It is an important step in the manufacture of clothing and arose from the need to build clothes with standardized measures to the precise cut, in which the process of tracing on paper is evidenced, using a table of measurements and geometric calculations.

In turn, for Sabrá (2009, p. 129) "modeling comprises the development of a geometric mold that interprets a creative design, a photo or a finished product". In the construction of the modeling, it is necessary to follow a scheme of techniques and measures from the anatomical study of the human body, using the principles of geometry for the drawing of diagrams that will result in shapes in the body. Therefore, quality modeling also considers human anatomy, its functions and needs, with mathematics having an important role in the process.

Grave (2004, apud MARTINS, 2006, p. 57) analyzes that "poorly modeled clothing exposes the body to physical changes, even diseases. Therefore, a pertinent study is required for each garment ". Thus, the industrial modeling process determines through its characteristics the shapes, volumes, trim, comfort that are configured around the body and must, therefore, analyze in detail the body's morphology and its movements. Modeling is an art of proportional measures that requires knowledge of body measurements, human anatomy, such as symmetry, shape and posture and notions of ergonomics to adapt to consumer needs, since the study of body movements guides possible changes in modeling, increasing product quality (RADICETTI, 1999).

According to Souza (2006), the visualization of the product's three-dimensionality allows the immediate evaluation of the wearability issues. Therefore, it is possible

to work on the techniques of creation and materialization at the same time. Modeling is one of the most important parts of the result of a garment and it is the technique by which a design, sketch, costume or image is interpreted that reflects in the garment image, created with ease in fashion design, being able to be a stylist, fashion design, costume designer.

3.1 Two-dimensional or flat modeling

Flat clothing modeling is a technique that consists of drawing straight and curved lines on rectangular, square, semicircle and circle planes, using a pattern created based on fundamental and complementary measurement tables. Also known as two-dimensional, this modeling is characterized by the use of geometry for the construction of molds. In this type of modeling, the professional uses knowledge of the geometry and anatomy of the human body, with which he builds diagrams made on paper, that is, the mold. These lines, drawn on paper, are composed of horizontal or vertical lines or lines, based on body measurements.

The knowledge of the proportions of the body is essential for modeling, like the industrial model that uses geometry to plan the body, considering the model and standardized measures. Such knowledge is fundamental for flat modeling and the technique for measuring body parts is divided into six stages: tracing the bases; interpretation of models; finishing the molds; prototype cutting and assembly; graduation and technical drawing of the pieces. The measurement table represents the measurements of the human body, and an indication of works. Such measures were elaborated by the Brazilian Technical Standards Association (ABNT) to NBR 13377 - Referential Normative Measures, regulating the clothing size ranges from PP to GG, that is, from size 34 to 55, elaborated in October 1995. It represents the circumferences of the bust or thorax, waist and hips, measured with the tape measure close to the body, the modeling emerged with industrialization. Starting from the measurement table, points, lines, lines and curves that originate the mold are drawn. Hence, the difficulty of many professionals to use rulers, curves and squares, instruments used in the execution of the molds.

In 2002, ABNT made NBR12071 available for the manufacture of a clothing product, identifying the measurement position and considering four pieces of clothing as basic: a shirt, a dress, a skirt and pants. In 2004, NBR15127 (ABNT, 2004) was made available with information on how individuals' body measurements should be made. 54 parameters were defined for the manufacture of clothing. Subsequently, ABNT developed two other standards in search of further deepening in the clothing genres: in 2009 the children's measurement table (NBR15800) and in 2012, the male (NBR16060), divided into three segments: normal, athletic and special.

Thus, in the construction of molds, flat modeling reveals the importance of mathematical knowledge to the fashion professional who produces for the clothing industry in clothing, ateliers and sewing salons. Research on mathematical modeling in teaching indicates advantages for student training and points to significant changes in the knowledge, action and attitude of CST teachers and students in Fashion De-

sign, specifically in modeling.

3.2 Three-dimensional modeling [draping (English) or moulage (French)]

Modeling, draping, from English or moulage, from French. Three-dimensional modeling is a technique performed by manipulating the fabric on the mannequin, allowing the visualization of the three dimensions of the piece: height, width and depth of the model, from the front, back and side. This technique consists of placing on the rectangular shape or body of fabrics marked with fundamental lines of the body, bust line, waist, hip, both vertically and horizontally, corresponding to the thread, warp and weft of the fabric. The fabric is modeled on the anatomy of the body, according to the model desired by the designer. However, due to the great demand and the need of the industry, the technologization by machines and computers is essential to attend the modeling market.

3.3 Computer modeling

The computerized modeling process is derived from the modernization of the industry, given the market's competitiveness, meeting society's demands for new technologies and aligning with innovations in the modeling process. Computer modeling consists of a system composed of several sets of interconnected programs to perform various tasks. This method generates savings in the industry and enables several steps, at once, generating savings and speed. Technological evolution adds the innovative concept to revolutionize clothing making in the computer-aided design (CAD) process, that is, computer-aided design and computer-aided manufacturing (CAM), which means computer-aided manufacturing.

Therefore, the modeling of clothing is only a cog in the process of production technology, through the product design, important and necessary in the execution of the garment. According to Treptow (2013), flat modeling can also be developed through a CAD / CAM system that can operate with the construction of molds by changing bases filed in the system or by typing molds produced outside the system. This modeling will give perfect shape, volume and fit, when well executed. The knowledge in this art brings solutions in the interpretation of the models produced.

In summary, the modeling process consists of one of the most important stages in the development cycle of a product in the Garment Industry. We currently have Computer Assisted Design (CAD) (Computer Aided Design) and Computer Assisted Manufacturing (CAM) software (Computer-Aided Manufacturing) which can facilitate the work of garment modeling to some extent. However, knowing the manual processes, terminologies and concepts are fundamental for obtaining good results in the development of parts and even greater resourcefulness when using CAD / CAM systems.

It is observed the presence of mathematical knowledge and its relevance with regard to the teaching-learning process of modeling for the development of well-

-executed pieces of quality, beauty and usability, that is, mastering the mathematical language can facilitate the learning of modeling.

4 RESEARCH METHOD

The present research was a case study, having as locus a private institution of higher education, located in the city of Recife-PE. It is an exploratory, comparative and quali-quantitative investigation, based on empirical data collected in tests and questionnaires applied to students, from CST modeling disciplines in Fashion Design. The study considers the need to improve the quality of the teaching-learning process at CST in Fashion Design. Initially, a survey was made with students from the first and second periods of the course about their knowledge of basic mathematical operations and geometry, content necessary to make modeling. Then, the data were analyzed, discussed and presented in graphs.

The research field was a private college, located in Recife-PE, which offers the Higher Technology Course in Fashion Design, which is considered one of the best in the country and the best in the state of Pernambuco, having a concept 4 in the Ministry's evaluation of Education (MEC). The sample consisted of 44 students, 20 of whom were students of the first module (period) of CST in Fashion Design, who are in three-dimensional modeling, here called Class A; and 24 students, from the second module, studying flat modeling, called Turma B. We sought to divide the collections by period of the course, with a view to comparing the results of incoming students with those of those who had already studied the first modeling discipline.

The data collection were carried out from August to September 2017, in night and day classes of Fashion Design. As instruments of data collection, a questionnaire and a test of basic mathematical knowledge such as fractions and geometric figures were used. The student questionnaire contained 4 questions about the student's profile and 6 open questions about students' understanding of the relationship between mathematics and modeling.

5 DATA ANALYSIS AND INTERPRETATION AND DISCUSSION OF RESULTS

5.1 Profile of the students of the first and second modules surveyed

From the data collected through a questionnaire in class A, that is, from the first module (period), it was possible to identify the following results. As for the profile of those surveyed, 9 studied elementary education in private schools; 2 in municipal ones; 8 state; and 1 in state / private. High school was attended by 7 of them in private schools; by 11 in state schools; and 2 in state / private. For 17 students, the training took place in an urban / capital environment and the Metropolitan Region of Recife; 2 inland, that is, in a rural environment; and 1 left the question blank.

In turn, the sample of students in the second module was composed of 24 respondents. As for elementary school, 8 claimed to have attended it in state schools; 1

in municipal; and 15 in private schools. Regarding high school, 14 said they had studied in private schools; 9 in state schools; and 1 in a federal institution. When asked about the training location, 19 reported that it was in the urban space; 4 inland, that is, in the countryside; and 1 did not respond. From these data, it was possible to perceive the heterogeneity of the CST student profile in Fashion Design at the college that served as the field for the research. It was observed that in the class of the first module, training at the fundamental level had close numbers between state and private schools.

In high school, more than half of the students attended state schools. Regarding the second period class, most attended both elementary and high school in private schools. We emphasize that training in urban areas obtained a much higher rate than in rural areas, both in module I and in module II. The profile results indicate that the majority of students had access to education in private schools in the urban area, which, theoretically, offer a better quality of education.

When asked to self-assess their mathematical knowledge, of the students in the first module, 5 considered that they had a good level; 2 responded badly; 9 consider it regular; and 4 left the item blank. Of the students in the second period, 3 declared themselves to be terrible; 4 said they were bad; 8 are considered regular; and 9 said they were good. The data indicate that the majority of students in both modules consider themselves "good" or "regular", although the second module has more students who consider themselves "good" in relation to the first. The number of "regular" students is balanced in both groups.

It is possible to infer that this greater security in relation to basic mathematical knowledge may be due to the fact that the majority of students in the second module have studied in private and urban schools and, therefore, have a more solid base in relation to the contents of that discipline. . It is worth mentioning the high rate of students in the first group who did not respond and in the second group who classified their knowledge as terrible. In addition to mathematical knowledge, we sought the reason why students chose to study fashion. In question "a", we asked about the reason for choosing CST in Fashion Design, of the 20 respondents in Class A, 15 stated that it was a dream, a passion and / or personal taste; 4 said they already work in the area or want to start their own business; and 1 stated that "it was lost", a fact that we consider serious in the context of higher education.

As for the students of the second period, or Class B, of the 24 participants, 2 said it was because they want to practice the profession and create clothes and accessories with personality; 3 because they already work in the area and 19 said it was out of passion, dream or interest in the area. The analysis revealed that the majority chose the CST in Fashion Design, based on love, passion and the dream of working in the area since childhood. Then, the reason for the choice was the already acting in the area and the search for qualification and new knowledge.

Then, in question "b", when asked about what knowledge they considered necessary for the student to have a degree in Fashion Design, in Class A, 7 mentioned that they should have notions of sewing, trend, design, modeling, world of fashion, art, aesthetics and clothing; 6 stated that knowledge of Portuguese, mathematics, history is necessary; 4 gave generic responses such as "general knowledge" and

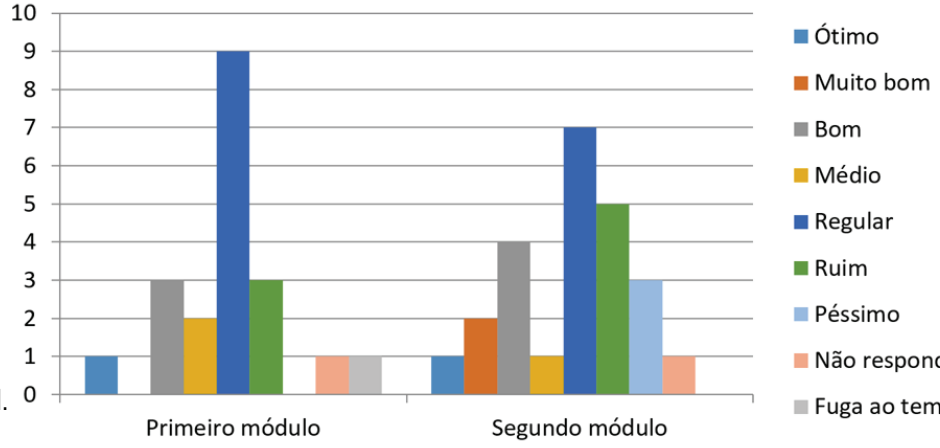
"everything"); 1 gave a vague answer, saying that the curriculum of that course already meets their needs; the researchers deduced that he may not have understood the question. In addition, 1 respondent left the question blank; and 1 stated that "no knowledge" was needed. Thus, it was possible to observe a balance between the answers that involved specific elements about fashion, Mathematics, and general knowledge. This result is consistent with Fraga (2013), for those who study fashion is a complex process that involves, in addition to clothing aspects, comprehensive knowledge about related areas.

In the second module, or Class B, 10 students answered that it was necessary to know the history of fashion, modeling and sewing; 6 cited mathematics, in addition to modeling and sewing; 1 escaped the topic in the answer; 6 were generic in stating that basic knowledge and high school education were necessary; and 1 did not respond. Considering the results presented, we observed that most students cite aspects directly associated with fashion, revealed by a specific lexical use, that is, terms and expressions such as: "cut and sew", "trends", "aesthetics", " clothing "," fashion world "and" modeling ". This result confirms what Pires (2002) states that, at its inception, fashion was seen as a job that could be performed by people with artistic talent, fashion information and good taste.

However, although many students have mentioned the word "modeling", they do not signal the understanding that it, for example, is related to mathematics, through geometry and measurements, among others (SABRÁ, 2009). Despite this, a considerable number of students cited mathematics as the necessary knowledge to study Fashion Design at a higher level. The students in the first module pointed out this need more than those in the second period. This can be explained by the fact that they obtained better results in the survey test, which may indicate that they have a more solid base in mathematics, acquired in elementary and high school, while those said to have more deficiencies in the contents of the discipline.

After investigating what knowledge they thought was necessary to be a CST student in Fashion Design, they were asked how they evaluated their knowledge in Mathematics. When asked, in question "c", 1 student indicated that he was excellent; 3 said it was good; 3 consider it bad; 9 claim to be regular; 2 consider it medium, we highlight that one of them added that it was "almost nothing, in fact"; 1 left the question blank; and 1 said it was everyday, making calculations, which may indicate that he did not understand the question. Of the students in the second module, 3 responded excellent or very good; 4 good; 7 regular; 1 median; 5 bad; 3 terrible; and 1 did not respond. Let's see graph 1, below.

Graph 1: Self-assessment of the level of knowledge in mathematics.

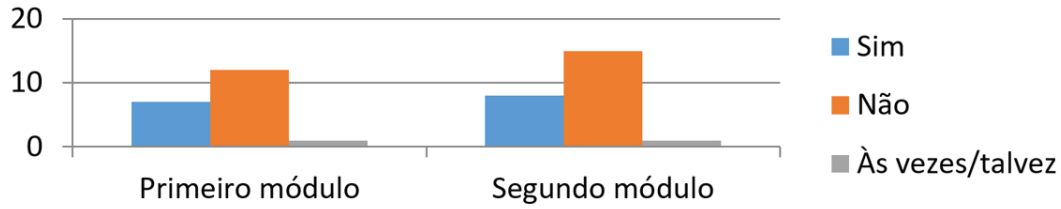


Source: Research author (2019)

In this regard, the majority of students in both modules claimed to have "regular" knowledge and there was an increase in the number of those who considered their level "bad". We highlight that there was an inversion of the results of this item in relation to the question on the topic in the profile questionnaire, at the beginning of the research. In the first result, the students in the second module were more confident in relation to mathematical knowledge, but in this one, the number of students who considered themselves "bad", surpassed those in the first module. Class B also changed in relation to the initial question, but, in general, the average remained the same. To understand this result, it was necessary to investigate the relationship of these students with mathematics. For this reason, they asked in "d" if they liked mathematics and were asked to explain why. Of the 20 respondents, 7 answered yes, but in the explanation, 1 left it blank, 2 stated that it was because it is "exact", "obvious", "simple" and "detailed"; 1 spoke about the contribution to life and the profession; and 2 stated that it was for affinity and for having good grades in school. 1 student said that he likes "sometimes, but most of them do".

In turn, in Class B, 12 students said no and in the explanation, 2 left it blank; 2 said they did not identify with the discipline; 1 stated that the reason he doesn't like it is because he doesn't have a chance to put the content into practice; 1 replied that it was a lack of interest; 1 said he is not good at it; 1 justified that he never did well at school; 1 stated that he did not have good experience with the discipline; 1 had no chance to actually learn; 2 do not like these, one stated that he never liked, because it is complicated and another replied that he knows the importance, but does not like it. In that same question, most students in the second module, 15 students, answered that they do not like it; 8 said they liked it; and 1 said "maybe", as we can see in graph 2, below.

Graph 2: Taste for mathematics



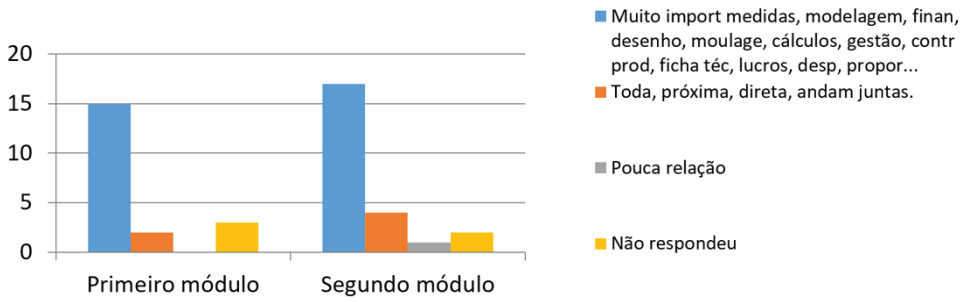
Source: Research author (2019)

In both classes, most responded that they don't like math. This can be caused by the lack of adequate knowledge of its contents, because to like something you need to understand its rules and functions. The lack of basic knowledge about mathematics, as well as the absence of practice in modeling, contextualized and interrelating with other knowledge, can generate the distance of the trained professional in relation to the exercise of the profession or even make him give up or work in other areas.

Regarding the question "e", on what is the relationship between fashion and mathematics, in Class A, 15 students from the first module recognized this relationship as important / very important; in relation to financial issues, measurements, mode-

ling, geometric designs, moulage and proportions; 2 gave generic responses such as "all", "close relationship" and 3 left it blank. In turn, still in "e", on the relationship between fashion and mathematics, in Class B, 17 students responded that both are related to the following topics: fashion, modeling, calculations, production quantity, drawing, cutting and sewing, management, technical sheet, measurements, fabric savings, finance, expenses, profits, buying and selling. Other students, 4 specifically, wrote generic expressions such as "everything", "has to go together", "direct", and "knowledge of basic operations and spatial notion is necessary to easily perform and understand the situations in which they are present". Next, graph 3 is shown.

Graph 3: Relationship between Fashion Design and Mathematics



Source: Research author (2019)

We emphasize that 2 students did not answer and 1 thinks that it has little relation when he affirms: "I believe that little, but we need mathematics for some subjects". Although he thinks he has little relationship, he recognizes that it is necessary to have mathematical knowledge to perform well in subjects that are part of the curriculum.

Most students, in both periods, are aware of the relationship between mathematics and CST in Fashion Design, and indicate examples of daily use by professionals in this area. This result corroborates Fontoura (2011, p. 88) when stating that design is interdisciplinary in nature, as it enables "joint work with other areas of knowledge". It is very important to highlight that one student stated that the two areas, objects of this research , that is, mathematics and modeling, have little relation. This question is relevant to reinforce, since this student is already studying the second period, that is, he has studied a modeling discipline, and is studying another modeling discipline, but he still cannot visualize When students fail to perceive the strong relationship between both, it is inferred that in their practice "problems are treated mechanically, without the student often understanding what they are doing" (CARRAHER, 1994, p. 14).

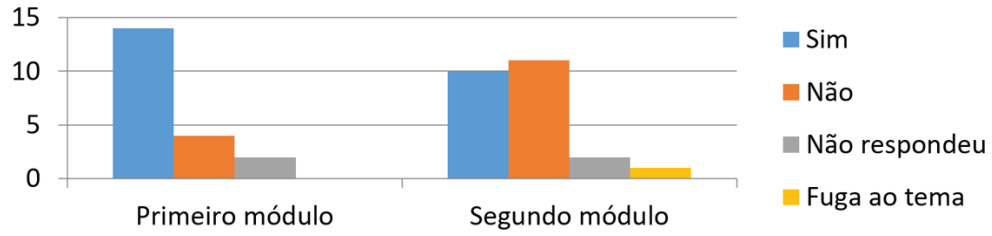
In order to enable the student to perceive the interrelationship between knowledge, Fontoura (2011) suggests interdisciplinarity as a resource to develop the teaching of Fashion Design in a plural perspective and based on integrated knowledge. It is understood, therefore, that it is necessary to promote integrated, interdisciplinary knowledge in fashion courses based on the integration between disciplines, since the interaction between them can contribute to an improvement in the academic and professional practices of apprentices.

Finally, in question "f", about the importance of the basic mathematics discipline being offered in the Higher Technology Course in Fashion Design, in Class A, 14 respondents answered "yes". Of those, for 1 it can be good; for 3, math is in everything;

3 relate it to use in fashion; 5 because they don't know the basics of mathematics; 2 commented that they have mathematics on a daily basis and the knowledge about it adds in other areas. However, 4 replied that they did not (2 said that it can be seen in Financial Management; 1 stated that basic mathematical knowledge could be inserted, but not the inclusion of the discipline in the course grid); 2 did not respond.

In the second period, 11 students were categorical in stating that they were not; 10 said yes; 2 people did not respond; and 1 escaped the theme, as shown in Graph 4.

Graph 4: Importance of inserting a basic mathematics subject in the Fashion Design curriculum



Source: Research author (2019)

In the first module, it was almost unanimous the need to have a specific mathematics subject in the CST curriculum in Fashion Design. This is due to the fact that they declared to have a "bad" level of knowledge in mathematics. The students in the second module who answered "no" justified that basic knowledge about mathematics must be learned on the basis of education, that is, in elementary school. Still, they added that it is enough to know the four operations for a good performance in fashion. One respondent stated that the apprentice himself can study basic mathematics on his own, while another said that the mathematics knowledge of fashion students should be assessed in the college selection process. Although a student considered that he did not need a specific subject in basic mathematics, he added that it could be offered if the course took place in three years.

It is possible to perceive that, of the students who answered "no", some are aware that an interdisciplinary approach can be used as a way to solve the problem of lack or low knowledge about basic mathematics, inserting it in other CST disciplines in Design of College fashion that served as a research field. This stance corroborates Morin's (2002, 2003, 2005) idea about the importance of comprehensive and multidisciplinary thinking for reflective learning that considers the process in context and in its entirety. On the other hand, of the students who answered "yes", some said that they did not have the basic knowledge solidified, others stated that they needed to reinforce what was learned in school to level the class, to facilitate calculations and better prepare the student for the market of work.

The results above demonstrate that it is almost unanimous the importance of offering a specific discipline of basic mathematics in the curriculum of the Superior Course in Technology in Fashion Design for students of the first period. In contrast, the students of the second module are divided, although most respondents said that it is not necessary, they justified their answer, stating that there could be the inclusion of basic knowledge throughout the other disciplines already existing in the course. Grave (2009), reinforces interdisciplinarity between different areas of knowledge to

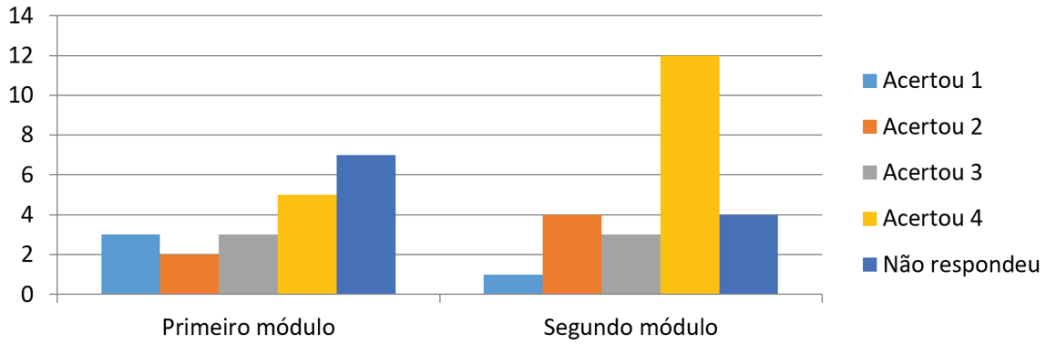
obtain good results in modeling.

5.2 Survey test of the first and second periods of Fashion Design

In order to investigate the level of knowledge about basic mathematics, a probing test was carried out with 2 questions, one on fractions and basic mathematical operations (write out the fractions and operations in full and solve them, using, for example, the division); and one about geometric shapes. In question 1, students were asked to write in full and solve the exercises with the indicated fractions. Of the 20 respondents in Class A, 14 left all questions blank; 4 wrote in full (correctly), of those 4, 2 solved correctly and 2 incorrectly. 2 students did not write in full, but solved the exercises (1 complete, but incorrect and 1 correct, but incomplete).

In the next question, 4 geometric figures were presented and the students were asked to write their names, being circle, parallel lines, right triangle and vertex. Of the 20 respondents in module I, 7 did not answer the second question; 3 answered only one letter, correctly, of the four requests, reaching 25% of correct answers; 2 answered only 2 letters correctly, being 50% correct; and 3 answered 3 letters correctly, which means 75% of use; and 5 answered all four correctly, that is, 100% correct answers. Of the 24 students in module II, 4 got 2 options right, 1 got 1 correct, 3 got 3 correct, 12 got 4 correct and 4 did not answer, comparatively illustrated in graph 5, below.

Graph 5: Index of correct answers for question 1 in the poll test



Source: Research author (2019)

The results indicate that the module I class performed less positively compared to the results of the second module class. Most of the students did not answer this option, and only 5 got the four options right. Meanwhile, 12 people from Module 2 got the four options right. This fact can be attributed to the profile of students in the second period who, according to previous results, claimed to have a good knowledge of mathematics, as well as the context of basic education of the majority having taken place in private schools.

Another important factor may be the fact that the students in Class B have already experienced the first modeling discipline and have felt the need to seek more appropriation of the mathematical content to develop learning and improve the performance of activities. It was also observed that the results of the self-assessment on

the knowledge in mathematics are not in line with the results obtained in the survey test performed. Mathematical knowledge can facilitate the execution of work and improve the quality of the final product, but it is not enough to learn procedures, but to transform them into thinking tools (NUNES & BRYANT, 2007). It is necessary to know the representation systems and the tools as in mathematics, and these systems need to have a relationship with the situations in which they will be used, because "people better understand the things that they discover themselves" (CARRAHER, 1994, p. 20). The lack of interrelationship between the contents of the fashion courses can be changed by developing interdisciplinary projects, basic extension courses on mathematics that demonstrate the direct relationship between mathematics and fashion, specifically mathematics as an instrument for improving techniques, to awaken in students and workers in salons and sewing studios, understanding and the good development of all processes, from creation to the final product, that is, the garment.

The research demonstrated the need for teaching that encompasses interdisciplinarity in the fashion area, combining flat and three-dimensional modeling with ergonomics and geometry, based on modeling teaching integrated with other knowledge, associating theory with practice. These suggestions are focused on teaching the modeling syllabus, but tend to demonstrate greater functionality if addressed during the courses in order to complement the aspects worked in research and creation disciplines, with the insertion of flat and three-dimensional modeling techniques, providing creative thinking in the making of modeling.

6 CONCLUSION

This research sought to show the relationship between mathematics and modeling in the academic life of CST in Fashion Design from a student perspective. Based on the data analyzed, it was observed that many CST students in Fashion Design at the researched college have a great deficiency in relation to mathematics. It is necessary to understand, by fashion professionals, the intrinsic relationship between mathematics and the modeling process. This can be achieved from the beginning of their academic training, that is, in the space of formal, creative and critical-reflexive learning with the support of teachers.

It is believed, therefore, that the introduction of teaching based on interdisciplinarity and complex thinking is able to assist in the process of development and creation of clothing. It is necessary to make students aware that the mathematical content is completely involved with the construction of a garment. Therefore, the inclusion of mathematics in the teaching-learning of modeling disciplines is extremely relevant. It should be added that the teacher is also essential in this process, due to his social role as an educator and theoretically-methodologically-based opinion maker, expanding the possibilities of learning and meeting the needs of students, improving pedagogical practice and, consequently, learning .

The results are expected to contribute to the awareness of the need for changes in the teaching-learning approaches to modeling in higher education courses in Fashion Design; that teachers can dynamically insert mathematics into the classroom, showing the precise applications of their operations in the daily life of the

fashion professional. Still, that awaken students to the interest in mathematics at CST in Fashion Design and in its various areas of professional practice.

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