REVISTA Ação Ergonômica

R. Ação Ergon., 14(2), 2020.
ISSN 2965-7318. doi: 10.4322/rae.v14n2.e202013.en

THE SECRET OF THE DOUGH: THE WORK OF THE PLASTERER FROM THE PERSPECTIVE OF PARTICIPANT OBSERVATION

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Abstract

This paper presents the results of a study conducted in a small plaster manufacturing industry located in the city of Itabira/MG. Through the study of the plasterer's position in the manufacturing of frames, an Ergonomic Work Analysis (EWA) was developed, followed by the application of a Participant Observation, a tool that is based on greater interaction with the activity through its execution by the work analyst. The study was developed in order to investigate what are the most important difficulties encountered by plasterers, what are the regulations adopted in manufacturing, and how these contribute to the production process and to the safety of the system. The results show differences in the level of data collected in the EWA and in the Participant Observation. If with the EWA it was possible to identify distinct regulations used by workers during the work activity, the Participant Observation allowed a greater knowledge about the origin of these regulations and, consequently, another category of observations was created, perceptible only when performing the activity. This paper argues that the Participant Observation can serve as an important support in the fine understanding of human work.

Keywords: Ergonomics. Ergonomic analysis. Participant observation. Regulation.

1. INTRODUCTION

The technological development provided by industry 4.0 seeks to add more and more speed and fluidity to the way goods are manufactured and services, while threatening various types of professions that exist today. In the early 2000s, several studies already demonstrated this, such as that of Frey et.al (2003), suggesting that about 47% of American jobs tended to be replaced by artificial intelligence in a short period of time.

On the other hand, in certain activities, human action is irreplaceable, both for the specificity of the movements performed, and for the tacit and incorporated knowledge that individuals carry (Dreyphus and Dreyphus, 2012). A plasterer, for example, uses methods that do not lack digital technology to manufacture a set of frames that will later be installed in homes, businesses and indoor environments. In this activity, manual and manufactured tools

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are used, in order to prepare the raw material and achieve the final product, that is, plaster moldings.

The natural raw material for construction gypsum is the ore called gypso, commercially known as "natural gypsum" (Aguiar, 2004). During the hydration of the gypsum paste, characteristics of workability, setting time and dimensional variation of the pastes are generally observed (Pinheiro, 2011).

For Cincotto et al. (1988), knowing the properties of the material is essential for the design of gypsum components and for quality control. In the case of gypsum, the aspects to be analyzed are the setting time and the workability of the material.

The difficulties encountered by these workers are related to patterns that can be identified in all types of work: each function, regardless of what must be performed, has its "tricks". But how can you understand what these tricks are about? Where did they originate from and what is the difference in perception, by the analyst, between external observation and the execution of real activity? With the use of specific tools, it is possible to exercise and analyze the activity from another perspective, other than that of the observer.

The present work aims to report and characterize the experience in a company that manufactures plaster moldings, seeking to show that there is a difference, in terms of understanding the activity, between observing and performing such activity, using as the main methodological tool the "Participant Observation", in which the one who studies and analyzes also participates in the actions performed.

2. THEORETICAL FRAMEWORK

2.1. Interviews and observations in the Ergonomic Analysis of Work

Initially developed by the French school of ergonomics (Wisner, 1974; Duraffourg et al. 1977; Guérin et al. 1991), ergonomic intervention is today a method of understanding and transforming real activity, seeking the development of the health and safety of individuals, as well as the efficiency of the process (Vidal, 2001).

It is through the Ergonomic Analysis of Work (AET) that the ergonomist becomes aware of the complexity and difficulties throughout production, favoring the visualization of events that previously remained hidden, thus being able to radically modify the conditions and the way work is performed (Wisner, 1987). For this, the ergonomist, or work analyst, mainly uses interviews and open and systematic observations of the activity.

The interview can be considered as a type of directed conversation with certain pre-defined objectives (Iida, 2005). We can classify them into 3 types: structured, semi-structured and unstructured. First, in the structured interview, the content and procedures are previously defined, with questions that follow a script and ensure standardization in the answers collected. Next, the semi-structured interview makes the processing of data less explicit and less immediate, with previously defined content and procedures, but in this type the researcher is allowed to change the sequence of questions or add new ones. Finally, in the unstructured interview, only a preview of the relevant topics is made and the dialogue method is similar to that of an informal conversation (Lima, 2003).

On the other hand, the observations of the activity are initially carried out in an open manner, without well-defined hypotheses. There is then talk of "free observations", which occur mainly on the occasion of the first visits to the workplace. In addition to them, there are also observations focusing on the collection of certain categories of information with precise objectives. In this case, we speak of "systematic observations", or those with better defined hypotheses (Guérin et.al, 2001).

In free or open observation, the worker is observed so that the ergonomist/analyst has a better understanding of the activity performed, the difficulties experienced and the regulations developed, or the way that the individual, through the activity, faces and controls time pressures, environmental restrictions, discomforts or difficulties at work (Rocha, 2017).

Open observations allow the analyst to begin to establish relationships between the constraints of the work situation, the activity carried out by the operators and the consequences of this activity for the health of workers and the safety of the systems (Lima et al., 2015).

After the first open observations, it is possible to establish a pre-diagnosis of the observed situations. Therefore, based on this pre-diagnosis, "a systematic observation plan is defined, with the objective of verifying the hypotheses raised and proceeding with the treatment and validation of the data obtained" (Abrahão, 2009, p.231).

According to Abrahão (2009), the characteristics of systematic observation involve the choice of the category of variables, the choice of the nature of the data, the definition of the situations to be observed, the minimum intervention on the situations, in addition to the replicability of these situations.

2.2. Participant observation as a way to deepen the analysis

Participant observation refers to a research situation where observer and observed are in a relationship of direct interaction through the activity, in which the data collection process takes place in the work environment of the observed, who are no longer seen as objects of research, but as subjects who interact in a given study project (Serva and Junior, 1995).

In general, the researcher who uses this tool tries to learn what the life of an individual inside the system is like, even if he inevitably remains an outsider (Mack et al., 2005). This occurs when the perspective of those who observe an action in progress in order to study it and the perspective of those who perform the action merge, that is, the researcher is the same one who performs the action and who experiences the result of his action (Silva, 2013).

Participant observation, then, studies people in their natural environment, gaining a depth of vision of behavior that comes not only from observation, but also from the researcher's own experience in the group to be studied (Silva, 2013).

It is possible that different levels of involvement between the analyst, the situations and the individuals will be established and that different results will be obtained from these interactions. These interactions can range from a low level of participation to higher ones, in which participation becomes moderate, followed by active or complete participation (Spradley, 1980).

Through this method of investigation, analysts are led to share habits and roles of those who make up the observed group, thus positioning themselves in favorable conditions to observe behaviors, situations and facts that would either be altered in the presence of strangers or that would not occur (Brandão, 1984; Marshall & Rossman, 1995).

Participant observation is thus constituted as an investigation technique, which is usually complemented by semi-structured or free interviews in ethnographic research (Correia et. al., 1999).

3. METHODOLOGY

Initially based on an ETS developed in a plaster factory, located in the city of Itabira, Minas Gerais, in which the plasterer's position (the one who manufactures plaster frames) was analyzed, this study discusses the tools applied, seeking to understand the activity and, later, bringing to light elements not seen before with the help of Participant Observation.

These tools have the function of facilitating the identification and discrimination of regulations as they have been identified in the process.

The company is composed of eight people, namely: the owner, an assistant, a secretary, two masons and three plasterers. The analysis revolved around the activity of plasterers who operated in the company's manufacturing environment.

The three plasterers were monitored, one of them being the main manufacturer, acting whenever there was demand (plasterer 1); the second analyzed lived in the company and only manufactured frames when he worked overtime (plasterer 2), being the most experienced in the field, working only when the demand was very high; I usually worked in the field with facilities. The third plasterer worked for about a month as a manufacturer (plasterer 3), covering the main plasterer's vacation.

All employees analyzed were registered with the company and received a fixed remuneration based on working hours. The number of frames produced did not influence the payment of these.

The observation and construction work of the AET was carried out between March 2019 and October of the same year, on a weekly basis or according to the availability of plasterers, since manufacturing depended on demand. In total, 18 visits of about two hours were made per period. In these visits, the activity of making the frames was observed directly, through filming and through interviews at specific times.

In addition to the observations, interviews were also conducted with the individuals, seeking to understand the determinants and consequences of the observed activities.

To carry out participant observation, the researcher received a one-day training. From this, about 20 manufactures were carried out and at each process, new observations were made. Participant observation lasted a total of three months. Each molding process lasts 45 minutes and on average, at each manufacture two cycles of this same process were repeated, totaling an hour and a half per manufacture. This process was repeated once or twice a week.

The most diverse difficulties that appeared during the process and, together with the execution of the activity, generated questions, caused some perceptions of the analyst to emerge. These perceptions were recorded, aiming to demonstrate the difference between observing and developing real activity.

4. RESULTS AND DISCUSSIONS

4.1. Contextualization of the field

The place intended for the manufacture of plaster frames houses a stock of shapes spread over the walls and ceiling. On the other side of this same environment, a large shelf is intended for the storage of frames already manufactured available for immediate delivery or left over from production. In the center, a 4.5 by 1.2 meter slate table is used throughout the process.

The formats to be manufactured can vary in origin, whether they are from the internet, from the company's showroom, by pieces removed from facilities or by the analysis of the handmade notebook that was available to possible interested parties. Each model occupies a price range ranging from R$3.00 to R$7.00 per unit alone and from R$10.00 to R$14.00 per meter of the installed product.

The fact that the frames do not have identification makes it difficult for the plasterer to find the specific shape and often ask others who work in the same space to help him in the search and thus reduce the time spent.

They have developed their own language in which they call square regions as "teeth" and round regions as "bellies". Figure 1 shows the main tool used in manufacturing: the rail. The triangular shape of this is characteristic of the company, and was designed by the manager.

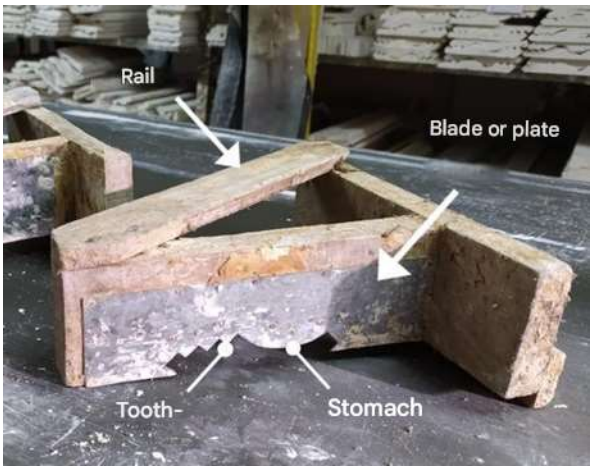

Figure 1: Rail.

With the appropriate rail in hand, the plasterer puts on only an apron and does not wear gloves or a protective mask. The process of cleaning the table begins with the help of a spatula and a planer. In the period observed, sometimes the table had objects and marks of previously manufactured goods.

After ensuring that the conditions of the table are ideal, the preparation of the dough begins. It is up to the plasterer to determine the amount of putty that will be used according to the dimensions demanded.

The container used is usually impregnated with plaster remaining from the last manufacture and, therefore, it is necessary to use a stick similar to a broomstick, which the plasterer uses to deliver blows to the bucket so that it is easier to remove the solid part. In addition to this process, the employee throws the bucket on the floor and steps on it to ensure that solid waste deposited on the walls inside the bucket comes off. While the mixture of plaster and water settles, a combination of diesel oil and washing powder is spread with the help of a sponge on the table. The mixture has the function of greasing and facilitating the removal of the frame when it is ready.

Before starting the molding, the worker performs a texture test on the dough with his index finger and only starts the process when through touch and observation he identifies the ideal point. The process with the formwork is started and the operator repeats the cycle a few times, refilling the plaster at the beginning of the process whenever necessary. A cycle in the situation in question was considered a passage of the rail through the side of the table on which the frames will be made. This cycle aims to model, remove holes and leave the piece with the ideal dimensions.

At the end of the process, the frames are marked with the saw so that each piece is 1 meter long, using as a reference a piece of tape measure or the table itself that has meter marks. Once the pieces are sawn, they are removed from the table through specific techniques such as the use of the hands together, in addition to a technique that consists of using the first removed frame to apply a small horizontal force to the second, thus causing it to detach from the table.

Once the frames are removed, they are stored on the shelf located in the factory environment.

4.2. Regulations at work

Based on the results of the ELA, the identified regulations were broken down according to the intentions of the individuals in carrying out each of them. Criteria more related to space, production methods and quality criteria were found, as described below.

4.2.1. Manufacturing expertise

When a certain mold is not found, the employee asks the manager to manufacture the part. Several times it is not possible to find the mold to be used and only the company manager manufactures them.

Before starting manufacturing, the employee cleans the table and the tools that will be useful in the process, in addition to checking the availability of plaster in the bin. "You have to clean the tools before you start stirring the dough, because then the time is counted. If you make a putty and need to make another without having plaster in the box, it is dangerous for the frame to dry out without being ready" (plasterer 1).

The plasterer passes the rail that will be used (simulating a passage of the tool on the table) in order to mark and facilitate the visualization of the path to be taken by the mass.

If the metal sheets of the formwork are rusty or scratched, the moldings from such molds tend to have horizontal scratch-like marks. To prevent this from happening, it is necessary to sand the molds in the region that gives shape to the frame.

The exact weight of the plaster to be used per process is not defined, due to the volume and different shape of each frame, in addition to the fact that some rails have double formwork.

The plaster should not contain lumps, and after being added to the water, the putty goes into a hardening process. It is through touch that the plasterer identifies the ideal moment of dispersion on the table to start the process. "If you run your finger over the dough and it is smooth, recovering the line you made is still not good, but if you pass it and see that the dough is firmer, letting the mark made by the finger stay on the dough it is in the way." (plasterer 1). The sweet spot is then defined when after the texture test the path made by the finger in the dough remains sharp. This point indicates that the plaster is ready to be manipulated.

The use of clean water makes a difference in the production process. In one of the manufactures, water from a barrel installed in the production environment used to wash hands and objects used in manufacturing was used.

The fact that the barrel was contaminated with traces of diesel oil, laundry detergent and gypsum that was once hydrated, caused the chemical compositions of the mixture to be altered in some way, thus generating a mass with characteristics of a "dead mass" even with the appropriate proportions of gypsum and water.

It is known by employees that the plaster impregnated in the dry form forms layers that overlap the rail, creating deformations in the frame and hindering the development of the activity.

When the molding process is finished, plasterer 1 marks the entire frame with the saw before actually sawing off the solid board that is formed. For him, it is faster to mark before and saw all the marks at once.

In the allo-confrontation, plasterer 2 stated that he prefers to use the spatula to cut the newly manufactured frames; In this case, at the end of the rail passage, the plaster is solid, but adopts a slight state in which, with the appropriate force applied, it undergoes a precise cut.

When removing the pieces from the table, caution is necessary: plasterer 1 uses a technique of physical shock between frames where he removes the first one and uses it to apply a small force to the next one to be removed, while plasterer 2 prefers to remove each section at a time, pulling the frame of the table so that it detaches in parts.

Lack of knowledge of techniques for removing frames from the table can cause them to come out broken or cracked, thus rendering the manufactured object unusable.

The proximity of the shelf where the frames are stored and the manufacturing table makes it easy to transport after production and reduces the risk of breakage. Figure 2 shows the moment when the plasterer removes the frames on the table and positions them on the shelf.

Figure 2: Storage of manufactured frames.

4.2.2. Time optimization

After dispersing the plaster in the water, while waiting for it to be decanted, with the help of a sponge, the plasterer passes a mixture of washing powder and diesel oil, which greases the table and reduces the adhesion of the already dry frame at the end of the process.

When the dough and the table are ready for the manufacturing process, the dough is dispersed on the table and using the rail the plasterer repeats movements that shape the mixture. It is necessary for the operator in question to channel the newly added soft plaster in the molding and observe the deficient parts, guiding the mass so that it fills spaces that have not yet been filled.

While one hand firms the rail and passes it on the table, the other hand performs the repetitive movements as many times as necessary so that the frame does not present any more deformations.

When asked about the origin of the movement, plasterer 1 stated that in addition to observing the previous plasterer, he realized for himself the importance of using these movements, which advance the process of directing the plaster to unfilled places, thus reducing the time spent on production.

When analyzing the video of the "clash between frames", plasterer 1 stated that he uses the technique with the objective of reducing the waiting time for the plates to dry, since they would leave the table without difficulty if the waiting time was longer: "... Sometimes there are more than 8 meters of frame and we have to do the same thing twice. If waiting for it to dry it takes too long, then we know when it's almost all dry and we hit one frame on the other for them to release more easily" (plasterer 1).

As soon as the process is finished, residues remain stuck in the bucket and, after a certain time, when these residues are completely dry, they become brittle, which facilitates cleaning and removal of plaster that has not been used. This factor justifies the fact that the plasterer does not clean the container immediately after using it.

4.3. From observations to implementation: results of participant observation

After the training received by the analyst, the demands began to be performed by him with the plasterer 3. From that moment on, then, the process of participant observation begins, the results of which are described below.

4.3.1. Rail fabrication tricks

The manufacture of the rail was carried out only by the company's manager and, basically, through the use of a model (either from the reference notebook, drawn on paper or with a piece of the frame to be manufactured) the mold is created and, with the help of carbon paper, the "silhouette" of the expected shape is transposed to a metal sheet.

After comparing the marks made on the sheet metal and confirming the similarity between the mold traces, the cutting process begins. Using specific scissors for cutting metal sheets and the help of tools such as file and sandpaper, the blade is formed.

Manual skills are fundamental in this process. The cuts must be precise and, if errors occur, the plate must be discarded and replaced by another that has already gone through the processes mentioned above.

Throughout the study, the analyst had the opportunity to manufacture a rail, an occasion that, due to inexperience regarding the number of nails needed to fix between the wooden pieces, caused an inefficient part to be manufactured that, after a short time of use, presented failures.

In order for the rail to obtain sufficient resistance for the process, it would be necessary to use a larger nail accompanied by two or more smaller nails that would ensure that the tool did not lose firmness during the molding, explained plasterer 1.

The manufacture of the form is not present in all manufactures, considering the fact that it is often already ready, requiring only its location. One of the problems identified in the first visits to the company was the lack of enumeration of forms. This factor caused the plasterer to spend an average of 15 minutes until he found the desired shape and caused a delay in production.

4.3.2. The "secret of the recipe"

The process of preparing the mixture is, if not the main one, one of the most fundamental for the manufacture of the frame. Knowledge of the ideal point characterizes the quality of the product that will be made and the time that the plasterer will have to carry out the molding process. Small variations in the amount of plaster added directly influence the "setting time" of the putty, which determines how much time the plasterer will have available for repetition of movements in manufacturing.

A mixture with a lot of plaster solidifies very quickly, making molding difficult and making it most of the time necessary to make a new mass to complete the required frame. While as explained above, little gypsum tends to generate dead mass.

If too little plaster is added or the mixture is contaminated, it will result in a "dead mass" as known by plasterers, a mass that does not fully solidify and if used will generate brittle frames with no commercial value.

For an ideal mass, it is necessary that the gypsum powder is dispersed evenly over the water placed in the bucket until the plaster begins to pass through the surface of the water. After waiting for it to settle for about 5 minutes, the mixing movement makes the plaster approach its ideal grip faster and removing a certain amount of it ensures a smaller portion of softer mass, which facilitates use in the final stages of manufacturing.

To prepare a mixture of plaster and water, it takes about 7 minutes, so the lack of putty throughout the process causes the time spent on manufacturing to increase, if there is no precision on the part of the plasterer.

The average time spent by plasterers who have practice to make 4 meters of frame (a table) is about 45 minutes and for this time to be achieved, it is necessary that the plaster channeling movements are precise, since with the proper orientation of the material it easily fills the empty holes.

A dough with ideal concentrations adopts a stiffer liquid texture that remains for a longer period in the same state. Higher concentrations of gypsum reduce this available time and cause the mixture to dry quickly, also reducing the possibilities of regulating and requiring the operator to speed if he does not want to repeat the mixing process again.

4.4. Participant Observation as a support

As demonstrated in the results, the development of the ETS generated data related to the activity that brought more clarity regarding the regulations and the ways found by individuals to continue the development of their functions.

The use of Participant Observation did not discredit or eliminate the hypotheses arising from the ELA, but it served as a basis for new aspects to be observed. The hypotheses raised during the Ergonomic Analysis provided data for the researcher, thus facilitating the direction of the systematic observation to the details not yet answered by the hypotheses.

Leininger (1985) states that the process of systematic observation, when there is detailing, description, documentation and analysis of patterns, is fundamental to understand culture, whether local or in greater proportions.

It was through the participant observation tool that different moments were observed, enabling participation in different situations that, if they had not been experienced, would go unnoticed by the analyser, since active participation in the process raises the level of interaction between the analyst and the information available in the environment (Spradley, 1980).

The fact of developing contact with the tools used in production, interacting with those who have the knowledge and practice the activity on a daily basis, in addition to executing the manufacturing process without interference from third parties, allows adversities to arise and with them the need to regulate oneself aiming at the quality expected by the management and by the executor himself.

In fact, the perspective of the researcher and the executor merged through the development of the activity, as stated by Silva (2013) when he refers to the fact that participant observation is a qualitative protocol that aims to help researchers understand the perspectives usually adopted by the populations under study.

Participant Observation increased the level of detail of the hypotheses, for example: the amount of gypsum added to the water. This quantity directly influences the quality of the mixture (a factor that will determine the time available to carry out the process), and the quality of the product that will be generated (resistance and uniformity). Knowing that the mixture is made of gypsum and water is the result of open observation and interviews. Knowing about "how is the mixture made?", was not enough for the analyst to perceive, for example, the moment when the consistency of the mixture presented ideal characteristics to be used. It was necessary to use the participant observation tool, because through it the analyst performed the mixing process several times and could realize how fundamental this part of manufacturing is to the process.

5. FINAL CONSIDERATIONS

The present work brings several analyses of the gypsum manufacturing activity, including the execution of the activity by the analyst himself, in order to deepen the understanding of the plasterer's work. The Participant Observation tool allowed the analyst to reach a level of detail only possible by those who are very close to the operational reality.

The script used by the analyst to perform the activity in the last fabrications was no longer exactly the same as the sequence adopted by the experienced plasterers, but rather a combination of what was learned and intuitively perceived as a possibility closer to the ideal.

When the activity was no longer just observed but started to be performed, it became clearer to the analyst the reality experienced by the plasterers, the time and quality pressures experienced daily, and how the regulations previously perceived in the AET have their importance in each part of the process.

The observations and interviews at different levels provided theoretical knowledge about how the manufacturing process is developed. This information is fundamental for the construction of knowledge and as a reference for the execution of the activity, but only the practice and experience of real work make it possible to know in more depth the variables and the ways to deal with them.

With the development of the present work, it was possible to directly experience the participation in a living organization, in addition to confirming how the use of tools with different observation approaches, in ergonomics, consequently generate a greater number of data to compose a research.

This research corroborates the content of its theoretical framework and demonstrates how active participation in the execution of an activity allows us to lay bare reality, to bring to light situations that were previously "hidden" in the middle of the process. This is the importance of using participant observation as a qualitative tool for analyzing the work.

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