

DESIGN AND DEVELOPMENT OF IMPROVISED ERGONOMIC DRAFTING CHAIR (ErgoDraCH)

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Abstract: This study aimed to build an ergonomic product to provide good posture and prevent discomfort. It is called the Ergonomics Drafting Chair (ErGoDraCH). Inspired by the notable Ergonomic Universal Working Table (NEUWT) introduced by Dr. Billie Jack Pasion, the researchers identified a research gap regarding the absence of an ergonomic chair as a companion to the working table. The ErgoDraCH is different from the other existing drafting chairs in terms of the uniqueness of its features and functionality. ErgoDraCH has various features: an adjustable, rotatable, and a cabinet under the lower part of the chair together with the wheel that can include some drafting equipment. The researchers utilized the input, process, and output (IPO) model to visualize the outcome of the products while conducting them. Within the research design and developmental research methods, this study will progress through distinct phases. In the design phase, the researcher planned and designed the tools, equipment, and materials to ensure that they were feasible for the design of their draft plan, and they also considered the cost and benefit analysis of developing ErgoDraCH. In the development phase, the researcher used the Gantt chart as a guide while constructing and testing the ErgoDraCH. The focus of the study is to fill the needs of the drafting students and make them feel comfortable while they are studying or drawing. The study results show that the ErgoDraCh was successfully developed and executed for the users' functionality, durability, and comfortability. Ergodrach was tested by the Research Adviser, along with the researchers and experts, to determine that the products were very functional, usable, comfortable, and durable.

Keywords: *ergonomic, rotatable, ergonomic chair, drafting students, adjustable, drafting equipment.*

Introduction:

A lot of researchers have conducted drafting tables; however, the researchers came up with the idea to conduct a study to improvise an ergonomic drafting chair to make users feel comfortable, especially when studying and drawing. According to Emily McAdams (2021), Ergonomic chairs are built to support the body, promote good posture, and prevent discomfort.



The Bataan Peninsula State University. (n.d.). The Drafting Technology course provides students with a comprehensive knowledge of drafting using traditional drawing boards, computer-aided drafting (CAD), and a balanced mix of mechanical, architectural, civil, and structural drafting. There are different drafting equipment, tools, or supplies that are used by drafting students drafting scales, drafting triangles, T-squares, drafting compass, drafting templates, mechanical pencils, lead, drafting paper, fine liner sets, protractors, drafting tables, and chairs.

These days, ergonomic chairs are becoming popular, especially with instructors and students. However, we must admit that they are quite expensive. However the researcher develop an improvised ergonomic drafting chair which is different from other existing drafting chairs in terms of the price and uniqueness of its features and functionality, such as an adjustable, rotatable, movable chair with a cabinet that has two drawers that they can use to organize their plates and art materials and has a backrest wherein to support their back to prevent back pain. However, this study aimed to fill the needs of the drafting students and make them feel comfortable to enhance their productivity while studying, making plates, or doing schoolwork.

The researchers found that one of the research gaps in the study of Dr. Billie Jack Pasion entitled Notable Ergonomic Universal Working Table (NEUWT) is the partner of his working table which is the ergonomic chair. Therefore, the researchers want to fill that gap to partner with that working table the researchers conducted a study entitled Construction and Evaluation of Improved Ergonomic Drafting Chair (ErgoDraCH).

Methodology

The study used a developmental research design. According to (Richey & Nelson. (2001) as cited in Pasion (2021), developmental research is the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness. Additionally, developmental research is the examination of the instructional design, development, and evaluation process in its entirety or concerning specific process elements (Richey, Rita C., Klein, James D. and Nelson, Wayne A.).

Developmental research is useful, particularly in the area of educational technology. This study also makes use of one of the most popular kinds of developmental research design: the product-development approach, in which the generated products are developed, implemented, and then evaluated.

In this study, Improved Ergonomic Drafting will be developed in the following phases specific to product development and the model to be used.



This study focused on the design and development of the Improvised Ergonomic Drafting Chair. The study was conducted during the first semester, academic year 2023-2024, at the College of Industrial Technology of Nueva Ecija University of Science and Technology, Gen. Tinio St. Campus. The participants of the study are the researchers and their thesis adviser.

This Study only aims to develop and propose an improvised ergonomic drafting chair with the object to satisfying all the basic needs of the student of Drafting. The study will mainly focus on the workplace, and environment with the proper body position, or posture that makes the students continue to finish the work correctly in a comfortable situation.

Results and Discussion

Designing and Developing of the Improvised Ergonomic Drafting Chair (ErgoDraCH)

The designing and developing phase of the improvised Ergonomic Drafting Chair utilized the IPO model. However, the researcher focused on the design and developmental research methods, this study will progress through distinct phases which is the design phase and development phase.

1. Design Phase

The design phase of the study was composed of these stages: Draft Plan, Tools, Materials, and Equipment, and Cost and Benefit Analysis. While the researcher conducted this study, they explore all the materials that they used to conceptualize the designed based on the availability of its intended tools, materials, and equipment.

1.1 Draft Plan

A draft plan was used by the researchers as the guideline for the process of the study that will be conducted. By doing this, the researcher can visualize the outcome of their research. The draft plan is a drawing of your prototype that includes the design and dimensions.

Under the design concept of the Improvised Ergonomic Drafting Chair utilized the draft plan to show the isometric projections, as depicted in Figure 1. Isometric drawing is a method used by technical illustrators, engineers, and occasionally architects to graphically portray three-dimensional objects. The technique aims to accurately represent the object's principal dimensions or those parallel to a selected set of three mutually perpendicular coordinate axes, in an undistorted manner while also creating the appearance of depth similar to that of a perspective rendering. The researchers drew an isometric drawing of Improvised Ergonomic Drafting Chair designed using Computer-Aided Design (CAD) software.

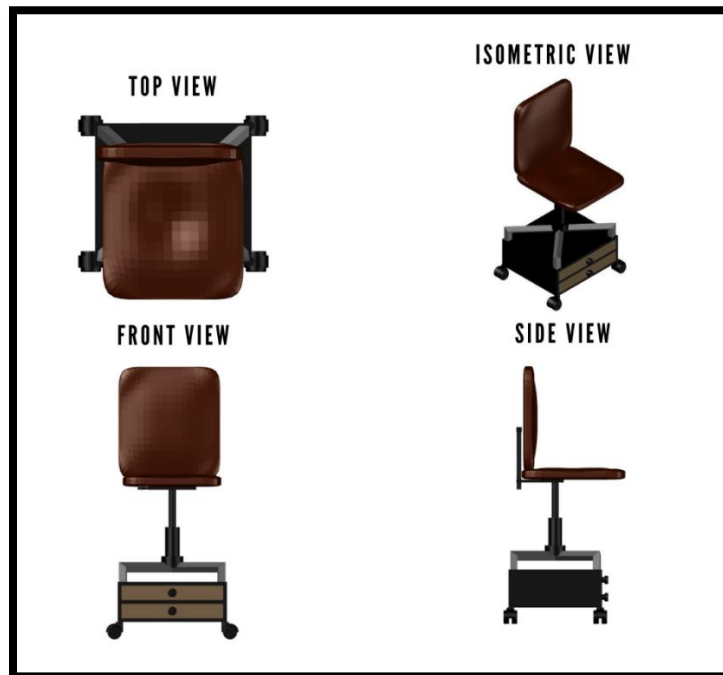


Figure 1 *Isometric View of Improved Ergonomic Drafting Chair*

1.1.1 Tools, Materials and Equipment

The most important things to be able to conduct research were tools, materials, and equipment. Based to the design of the draft plan, finding and choosing materials was the most difficult process of conducting research since the materials to be purchased must be durable to provide a good product of high quality.

Under the design concept of the Improved Ergonomic Drafting Chair the tools, materials, and equipment show the materials needed for construction of the ErgoDraCH, as depicted in Figure 2.

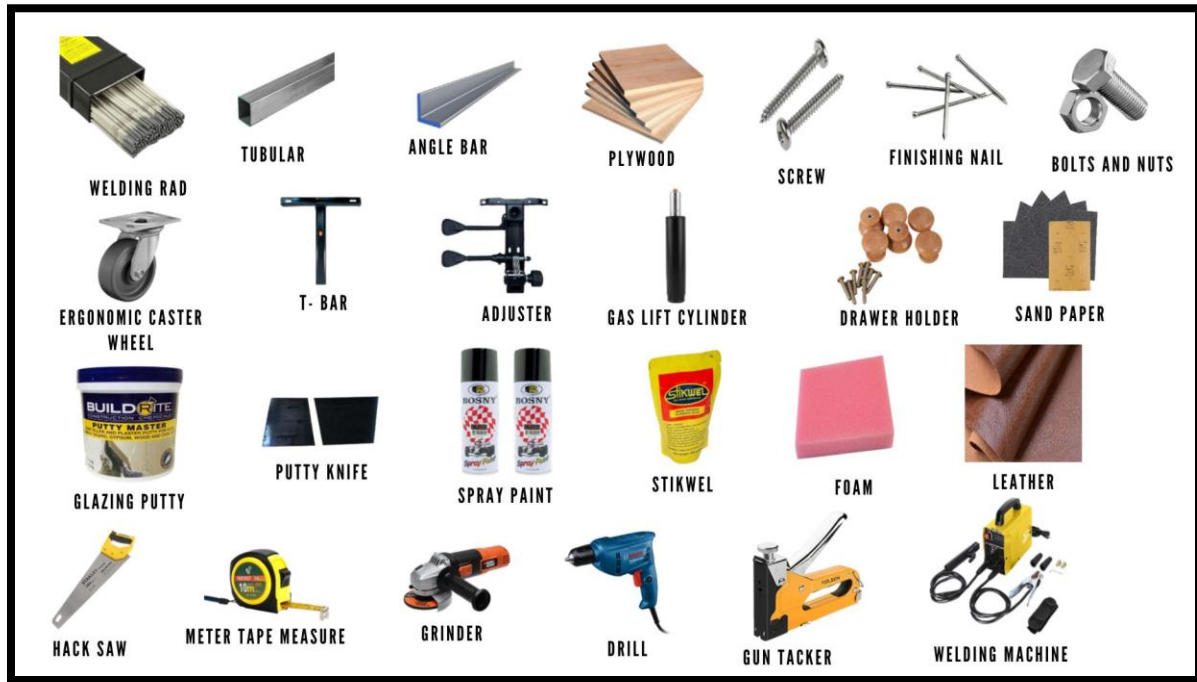


Figure 2. Tools, Materials, and Equipment for Improved Ergonomic Drafting Chair

1.1.2 Cost and Benefit Analysis

The cost and benefit analysis were computed based on the tools, equipment, and materials that they used. "However, conducting innovative studies is difficult; the materials needed are quite expensive. Therefore, it is necessary to carefully determine both the costs and benefits connected with the prototype. The project's costs contain both consumable and non-consumable materials, along with expenses related to labor. This analysis aimed to evaluate the overall expenses involved while conducting the Improved Ergonomic Drafting Chair and compare the total expenses of the existing product.

Under the design concept of the Improved Ergonomic Drafting Chair the cost and benefits analysis show the overall expenses involved while conducting ErgoDraCH, as shown in Table 1.



Quantity	Unit	Materials	Price
¼	kl	Welding rad	₱ 30.00
1	pc	Tubular	₱ 50.00
1	pc	Angle Bar	₱ 200.00
1	pc	Plywood	₱ 300.00
10	pcs	Screw	₱ 10.00
4	pcs	Ergonomic Caster Wheel	₱ 184.00
4	pcs	Drawer Handler	₱ 41.00
1	yard	Leather	₱ 40.00
1	pc	T-Bar	₱ 50.00
1	pc	Adjuster	₱ 500.00
1	pc	Gas Lift Cylinder	₱ 150.00
¼	kl	Finishing Nail	₱ 15.00
1	pc	Stikwel	₱ 20.00
2	pc	Sandpaper	₱ 40.00
1	pc	Bolts and Nuts	₱ 40.00
1	pc	Foam	₱ 20.00
Total			₱1,970.00

Table 1 Total Costing of Improvised Ergonomic Drafting Chair



2. Development Phase

The development stage of the study was composed of these stages: Gantt Chart, Construction, and Testing. The actual development of an Improvised Ergonomic Chair was the researcher's main emphasis during the development phase of the study. At this stage, the researchers need to be more mindful when it comes to selecting the materials that will be needed to conduct this research. To achieve the improvised ergonomic drawing chair functioning based on the design, researchers must pay more attention to this stage for their concepts and ideas to turn into reality.

2.1 Gantt Chart

The Gantt Chart was the summary of the total time duration of conducting the final output of products. Gantt Chart consists of planning and canvas of materials, consultation with research adviser, collecting of materials, construction of ErgoDraCH, and lastly finishing wherein all this procedure was pass by the researchers.

Under the development phase the researchers utilized Gantt Chart, as shown in Table 2, in order to see the timeline and progress of conducting the Improvised Ergonomic Drafting Chair. The Gantt chart shows the graphical representation of activities of the development of Improvised Ergonomic Drafting Chair starting from conceptualization, designing, construction, and testing. The researcher can make sure that every step is completed within the allotted time by using the Gantt chart. Although it is an innovative study, it takes a lot of time and requires a lot of processes to make sure it works.







DEVELOPMENT OF ERGODRACH	September (20-22)	September (28-30)	October (6-8)	October (16-18)	October (28-30)
PLANNING AND CANVAS OF MATERIALS					
CONSULTATION WITH RESEARCH ADVISER					
COLLECTING OF MATERIALS					
CONSTRUCTION OF ERGODRACH					
FINISHING					

Table 2 Gantt chart of Improvised Ergonomic Drafting Chair

2.2 Construction

Construction was a step-by-step procedure of constructing and developing of product. The Gantt chart consists of material planning and canvassing, in which the researchers canvass the materials they will use based on the design of their prototype. The researchers begin with conceptualizing and analyzing the design of their prototype followed by purchasing the materials and equipment's that they will used for constructing, assembling, measuring, cutting the wood and metal, attaching the gas lift cylinder, adjuster, T-bar, and ergonomic caster wheel, sanding and painting. Figure 3 shows images that were taken during construction of Improvised Ergonomic Drafting Chair.



Figure 3 Construction of Improved Ergonomic Drafting Chair

2.3 Testing

It will be tested by the study participants during the testing phase to see if it is efficient or not, and if they have any recommendations or suggestions, it will really help the research to improve to produce a better outcome.

During the testing phase of the Improved Ergonomic Drafting Chair each feature was tested and evaluated to determine if it is functional and indestructible. This study aimed to design and develop an ErgoDraCH to make the users feel comfortable while doing their assignments, papers, drawing, etc. The Improved Ergonomic Drafting Chair was tested by the drafting students and drafting teacher. Therefore, the results showed that the ErgoDraCH met the approval of teachers, draftsmen, and students, was more reliable than traditional drafting chair, and helped make user drawings and plans more accurate and faster. The researchers received positive feedback and suggestions from participants. Figure 4 shows the fully developed Improved Ergonomic Drafting Chair.



Figure 4 *Improved Ergonomic Drafting Chair*

Conclusion

The goal of this study was to provide good posture and prevent discomfort to the users. It is called Ergonomics Drafting Chair (ErgoDraCH). ErgoDraCH is not usually an ordinary chair it has different features: adjustable, rotatable, and a cabinet under the lower part of the chair which can include some drafting equipments. In order to execute this study, the researchers utilized the input, process, and output (IPO) model to visualize the outcome of the products while conducting them in terms of planning, designing, and constructing.

In the cities of Cabanatuan this study was assessed and evaluated by the two types of participants, the drafting students and drafting teachers. To select the respondents, the researchers conceptualized and analyzed who and how their study would benefit their chosen respondents. The study has undergone two phases the design phase and development phase which help to execute the study effectively and efficiently. However, before it was given to the participants, the ErgoDraCH was tested by the research adviser, along with the researchers and



experts, to determine that the products were very functional, usable, comfortable, and indestructible. The implementation of the Improvised Ergonomic Drafting Chair was tested as fully implemented by the drafting teachers and drafting students.

References:

Administrator, W. (n.d.). Draftingtechnology.

<https://www.bpsu.edu.ph/index.php/citprogrammenu/bsitmenu/draftmenu>

Gantt.com. (n.d.). Gantt.com. <https://www.gantt.com/>

McAdams, E. (2022, February 10). What is an ergonomic chair? Posture People.

<https://posturepeople.co.uk/what-is-an-ergonomic-chair/>

Pasion, Billie Jack DR. (2021), "Development and Assessment of Notable Ergonomic Universal Working Table". Nueva Ecija University of Science and Technology. Dissertation. Unpublished

Richey, R. C., & Klein, J. D. (2013). Design and development research. In Springer eBooks (pp. 141–150). https://doi.org/10.1007/978-1-4614-3185-5_12