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Convertible Bread and Pastry Production Table

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ABSTRACT

This study sought to develop and fabricate a Convertible Bread and Pastry Production table with the following technical features such as easy conversion, space-saving, and easy cleaning; the study further aimed to evaluate the level of performance in terms of the time of conversion and determine the level of acceptability in terms of design, functionality, and usability. The researcher used developmental and descriptive methods of research. The research instrument used was a modified questionnaire among 50 respondents consisting of an Assistant School Principal, Technical Vocational and Livelihood Home Economics teachers, and students. The results reveal that the product has a shorter time to convert and a foldable platform that can be stored easily. Overall, the average mean score of 5.00 was interpreted as Very High. Moreover, all criteria obtained a mean score of 5.00, interpreted as Very High in all items. The respondents rated the product as Strongly Agreed regarding acceptability in areas such as design, functionality, and usability. The researcher recommended a user manual to effectively and efficiently execute the transformation of the convertible bread and pastry production table without supervision. The table can be an alternative table for bread and pastry production. Relative to the findings and conclusion derived from the study, the researcher highly recommended the mass production and utilization of the table for classroom instructions, cooking demonstrations, and outdoor-related culinary activities.

Keywords: baking tool, culinary equipment, demonstration device, bread and pastry, food production

INTRODUCTION

The field of food technology is constantly evolving, and the demand for innovative and efficient tools in the laboratory setting is on the rise. However, traditional laboratory setups often lack the versatility and space efficiency needed to accommodate the diverse range of bread and pastry production techniques.

The development of efficient and versatile equipment is crucial in the field of food technology education. One of the most critical aspects of food education is hands-on training, where students can apply theoretical knowledge to practical applications. In the context of bread and pastry production, a convertible table designed for the production of bread and pastries can serve as a valuable laboratory tool. It allows students to gain hands-on experience in baking, understand the processes involved, from mixing and kneading to proofing and baking, and enhance their comprehension of the subject matter.

Previous studies have underscored the importance of providing students with practical tools to facilitate learning. For instance, [1] emphasized the significance of incorporating interactive elements into laboratory equipment to enhance student engagement and understanding. Similarly, [3] suggested that the design of laboratory tools should prioritize user-friendliness and adaptability to accommodate various educational needs. Moreover, the literature suggests that the development of a convertible bread and pastry production table aligns with the growing trend of interdisciplinary approaches in food technology education. As [4] mentioned, integrating concepts from different disciplines, such as engineering and design, can lead to innovative solutions that improve the quality of education. These studies provide strong support for the development of a convertible table in the field of food technology education.

Currently, in some technical schools in the Philippines, students are still facing challenges in learning, like no conducive laboratories to conduct hands-on activities for Food related courses, the insufficient number of tools

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that students need to wait or use one at a time, or students are required to bring their tools, and the lack demonstration and working tables. Tables that are usually provided are made of wood covered with plastics that students also use as desks and are too high for students' practical work. Sinks and tool cabinets are separated and are far from each other. Space is limited, and this furniture makes students travel from one place to another when having a practical performance. Some existing tables in the market are foldable, convertible, and multifunctional. Each table has unique and distinctive functions, but these become common. The problem concerning functionality begins to surface. These problems are related to flexibility, multifunctionality, low table heights, and small racks. It has the same features, including foldable legs, foldable surfaces, and adjustable table sizes. However, these multiplicities in assembling and conversion give difficulties to the users [2].

Reference [5] study indicates a substantial mismatch between the students' bodily dimensions and the classroom furniture. Most students use desks that are too high. Moreover, [8] suggested guidelines for designing adjustable tables. According to his study, table height must be 5th–95th percent of the elbow rest heights, and table width 95th percent of shoulder breadth (elbow to elbow length). Achieving this will help to create safety, comfort, adaptability, suitability, and ultimately satisfaction for users, as stated by [7] .

In response to this need, the study seeks to answer the following questions:

1. How can a bread and pastry production table be designed to be adaptable and convertible for different student laboratory needs?

2. What features would be integrated into a working table suitable for students learning Bread and Pastry Production?

3. What functionalities are essential in testing the performance of the Bread and Pastry Production table?

4. What are the parameters suitable for evaluating the acceptability of the Bread and Pastry Production table?

Objectives of the Study

This research study aims to develop a convertible bread and pastry production table designed specifically for use as a food technology students' laboratory tool. The proposed table will be designed to be modular, adaptable, and space-efficient, allowing students to transition between different bread and pastry production tasks easily. By providing a versatile and functional laboratory tool, this study seeks to enhance the learning experience of food technology students, improve their practical skills, and foster a deeper understanding of the bread and pastry production process.

Specifically, this study also aims to:

1. design and fabricate a Convertible bread and Pastry Production Table with the following technical features:
    a. easy conversion
    b. space-saving
    c. easy to clean
2. test the performance of the Convertible Bread and Pastry Production Table in terms of:
    a. time of conversion
    b. space-saving

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3. evaluate the acceptability of the Convertible Bread and Pastry Production Table in terms of the following quality dimensions:

    a. design

    b. functionality

    c. usability

4. develop a user's manual.

METHODS

Research Design

This study adapts the development and technology research approach. This design was employed to achieve the study's objective, purposely developing a new product or process. The development of the present study used transformation processes like planning, designing, constructing, assembling, technical testing, and converting inputs such as easy conversion, space-saving, easy cleaning, and acceptability in terms of design, functionality, and usability into output, the Convertible Bread and Pastry Production Table using a research instrument modified from Suelto (2020).

In this study, the researcher employed descriptive research to accurately and systematically describe and use various quantitative methods of investigation with the parameters used.

Design Criteria

The design criteria include the product's technical features, product quality, and capabilities of the Convertible Bread and Pastry Production table.

1) *Easy conversion.* The product has extendible platform assembly for converting into an object such as a cabinet, long table, individual and group work station, a demo table, and full function table, which comprises automatic, heavy-duty foldable bracket lock hinges that allow faster conversion from one function to another.

2) *Space-saving.* The product was space-saving due to its foldable surface extension to hide the sink, foldable table surface rest to cover the back and left part of the table, and converted into a cabinet that can be folded and transformed from one function to another for easy storage.

3) *Easy to clean.* The product was easy to clean because it was made of stainless steel that can withstand a bit more muscle from acidic or mildly abrasive cleanser to scour away food particles and hard water stains and buff out scratches. The product material used for its development can perform for an extended time and survive over a specified period under stated conditions of use.

Capabilities

The Convertible Bread and Pastry Production table can prepare and process food. It can aid in cutting, slicing, mixing, kneading, and similar processes in bread and pastry production. It is convenient to use and easy to operate.

Design, Plan, Preparation, and Fabrication

This section discusses product development, parts and functions, materials, tools, construction procedures, and construction time frame. Figure 1 illustrates the development process of the production table.

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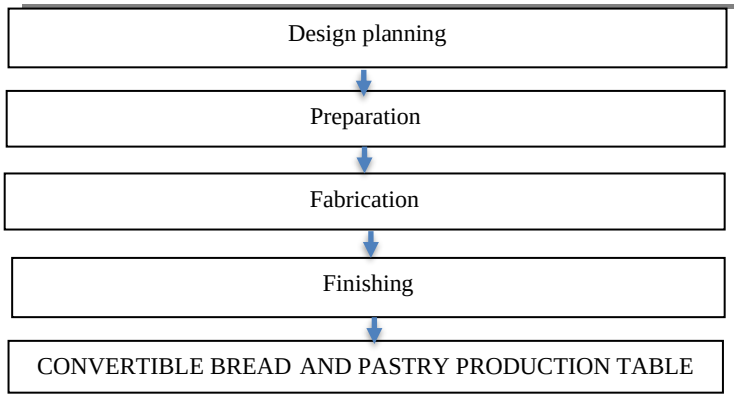

Fig.1. Illustrating the development of the product

The process involved designing the convertible bread and pastry production table, selecting the materials to be used, purchasing the materials to be used, and laying out the desired measurement of the product. In terms of preparation, the process involved measuring materials to the desired dimension, cutting, machining, welding, and joining stainless steel was then established.

The following process was the proof of fabrication stage, which accounts for the presentation of the final product, test result, and cost analysis of the convertible bread and pastry production table. The development of the user manual will then be established. The body or base is assembled, the folding surface is assembled, and the hinges are assembled and attached. Lastly, the finished product is dry-run, revised, fixed, and tested.

Evaluation Procedure

These include the process of final product evaluation in terms of technical testing and acceptability evaluation.

The researchers conducted field testing of the product on 50 respondents, including teachers and students of Doña Montserrat Lopez Memorial High School—Senior High School Department. The researcher then presented the product and discussed the instructions.

The first testing was the time of conversion. The participants perform a transformation of the table. The timer started the moment the participant opened the product extensions. Compared the time with the time taken on the second and third trials. Next, the test measured the space occupied by each table feature. The table was opened on different individual features or functions, and the researchers measured the occupied space's dimension and then recorded the data. The researcher opened all parts before the researcher measured the occupied space's size.

Then, testing the acceptability of the product in terms of design, functionality, and usability with 50 respondents who evaluated the product using the research questionnaire modified from the work of Suelto (2020). Each respondent was given an evaluation sheet and enough time to fill out the needed data. The researcher made Instructions for data answering clear, and the researcher assured them they would observe utmost confidentiality.

Instrumentation

The survey questionnaire has been modified from the study of [6] entitled Foldable Culinary Working Table. The first part is the respondents' profile, and part II contains an actual evaluation of the acceptability. The questionnaire was validated by five experts, including five (5) Technology Professors of the College of Technology, Carlos Hilado Memorial State University. Then, the requested experts were to evaluate the questionnaire using the research instruments evaluation from statements taken from criteria developed by Carter v. Good and Douglas F. Scates to assess the questionnaire. The validity index resulted in 4.48, rendering the instrument valid. The value obtained for r was 0.784, meaning the tool was reliable.

For acceptability criteria, there were 50 respondents comprising Senior High School Assistant School Principal

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II, T.V.L. teachers specializing in Cookery, Bread and Pastry Production, and Food and Beverage Services, and T.V.L. home economics students in the same field of specialization. Additionally, three teachers were given a chance to evaluate. Ask the respondents to rate the design, functionality, and usability of the Convertible Bread and Pastry Production Table. The researcher used a five-point scale to determine its acceptability in the following values: 5 was the highest, and 1 was the lowest score.

The interpretation of scores is found below:

Score Range	Response
4.50 – 5.00	Very High
3.50 – 4.49	High
2.50 – 3.49	Moderate
1.50 – 2.49	Low
0.50 – 1.49	Very Low

Data to be gathered

In technical testing, the following parameters should be gathered and measured.

A. Features:

1. easy conversion
2. space-saving
3. easy clean

B. Performance testing:

1. time of conversion
2. space-saver

C. Acceptability:

1. design
2. functionality
3. usability

1) Parameters for analysis

The specific parameters for the analysis of the Convertible Bread and Pastry Production Table are outlined as follows:

2) Quality Components:

1. time of conversion
2. dimension measurement
3. visual inspection

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3) Acceptability:

1. Design
2. Functionality
3. Usability

The researchers conducted field testing of the product with 50 respondents who evaluated its acceptability. Each respondent was given enough time to fill out the necessary data. The researcher made the instructions for data answering clear and assured them they would observe utmost confidentiality.

Cost analysis

The cost analysis of the Convertible Bread and Pastry Production Working Table will be based on the cost of the materials utilized, mainly steel and other consumables. Labor costs are 50% of the total material cost.

Table 1. The estimated Labor and Overhead cost of the project

Sources of Cost	Cost
labor cost (50%)	Php 10,455.00
overhead cost (30%)	Php 4,182.00
Total	Php 14,637.00

The project cost consists of a bill of materials, the overhead cost, which is thirty percent (30%), and the labor cost, which is fifty percent (50%) of the bill of materials cost.

Table 2. Bill of Materials Used in Fabricating the Project

Quantity	**Unit**	**Materials Description**	**Unit Price**	**Total Price**
5	sheets	4 x 8 202 stainless plain sheet	2,394	11,970
12	ft	stainless square tube 1	1,080/20 ft	648
1	length	8 ft 6 x 12 stainless square tube 1 1/2		1,450
1	pc	Faucet	1,745	1,745
6	pcs	4" emery	48	192
10	pcs	4" cut-off wheels	50	200
1	pc	7" flap wheels	750	750
24	inches	3 16 shafting		350
4	pcs	24" piano hinges	350	1,400
4	pcs	2" rubber caster wheels w/ lock	170	680
1	kg	1 16 stainless welding rods	1300	1,300
2	pcs	barrel bolt 3."	45	90
1	pcs	barrel bolt 1."	35	35
2	pcs	magnetic lock	50	100
		Total		20,910

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The bill of materials determines the materials used in fabricating the convertible bread and pastry production table. The table used 202 stainless steel, which is usually easy to maintain and has superior corrosion resistance.

Table 3. The Estimated Cost of Convertible Bread and Pastry Production Table

Sources of Cost	Cost
Bill of Materials	Php 20,910
Labor cost (50%)	Php 10,455
Overhead cost (30%)	Php 4,182
Grand Total	Php 35,547

The product cost in designing and constructing one unit of convertible bread and pastry production table is outlined as a bill of materials used in the project's fabrication, the overhead cost, and the labor cost to complete the product. The total cost of the Convertible Bread and Pastry Production Table consists of the bill of materials, labor cost, and overhead cost amounting to Php. 35,547.00

RESULTS AND DISCUSSION

Technical Features of the Product

The first objective was to design and fabricate a convertible bread and pastry production table with the following technical features; easy conversion, space-saving, and easy cleaning.

A. Easy conversion.

The folding surface was easy to transform. The foldable surface of the table is the back table extension covering the back part of the cabinet and can be flipped outward for maximum storage of any baked products; the right table extension hides the sink and can use as a working table, and the left side platform as an additional table extension. The leg is the part that can support the top surface. All of these folds are for particular purposes.

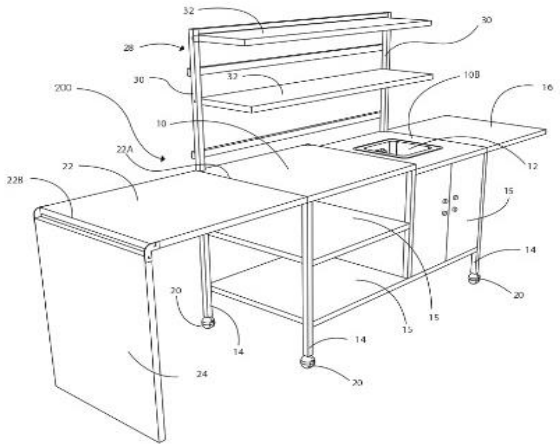

Fig. 2. The final prototype of the full function Table mode convertible bread and pastry production table

B. Space-saving.

The tables are designed with a folding platform to store them easily. The table were showcased with unique folding parts to maximize space. When the table is not in use, this can be folded and converted into a cabinet for storage.

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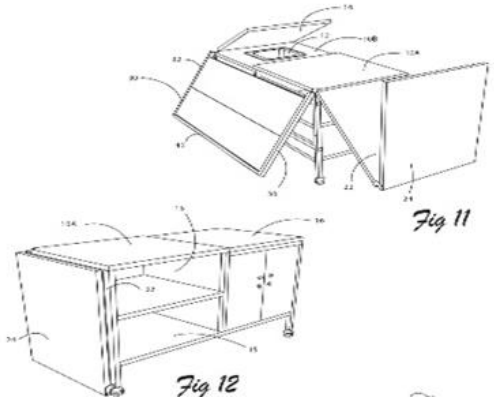

Fig. 3. The final prototype of the cabinet mode convertible bread and pastry production table

C. Easy clean.

A visual inspection is a standard method to check that the cleaning has been completed. Table surfaces were made of stainless steel that food particles could quickly scour away using a microfiber cloth, hand towel, and hot water.

Performance Testing

The second objective was to test the performance of the convertible bread and pastry production table in terms of; time of conversion, dimension measurement, and visual inspection. The time of conversion is shown and discussed in Table 4.

Table 4. Time of Conversion of Convertible Bread and Pastry Production Table

Operations	Trial 1	Trial 2	Trial 3	Average
	Time/Seconds	Time/Seconds	Time/Seconds	Time/Seconds
Activity 1: Opening left side table extension to a long table	7	5	3	5
Activity 2: Opening right side Sink cover to individual workstation	8	5	3	5.33
Activity 3: Opening Back platform to 90° as group workstation	9	8	5	7.33
Activity 4: From the group workstation, flip outward the upper half surface to make a demo table	13	10	8	10.33
Total	37	28	19	28

Table 4 shows the product conversion time. For the time of conversion, there are three tests performed. The time consumed to complete the task from the first trial was recorded and compared with the time taken on the second and third trials. For trial 1, from the first trial with 7 seconds recorded to 5 seconds on the second trial to 3 seconds on the third try with an average time of 5 seconds. In activity 2, the first trial has 8 seconds, and lower to 5 seconds on the second trial and down to 3 seconds, then the third trial with an average time of 5.33 seconds. For activity 3, the first trial time recorded was 9 seconds. The second trial lasts 8 seconds and becomes 5 seconds on the third with an average time of 7.33 seconds. Activity 4 has 13 seconds of recorded time on the first trial, 10 seconds for the second trial, and 8 seconds for the third trial, with an average time of 10.33 seconds. The total time of conversion, from cabinet to all functions and features, was open 37 seconds on the first try, down to 28 seconds on the second time, and lower to 19 seconds on the third trial, with an average time of 28 seconds.

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The result indicates that the time consumed to complete the conversion for trial 3 becomes shorter than the first trial 1. The table becomes easier and faster to convert the more the user becomes familiar with the functions and parts of the table.

Table 5. Dimensional Measurement of Convertible Bread and Pastry Production Table.

Features/Concept	Dimension (L x W x H) m
Cabinet	1.20 x 0.58 x 0.76
Long Table	1.96 x 0.58 x 0.76
Individual Work Station	1.76 x 0.58 x 0.76
Group Work Station	1.20 x 1.16 x 0.76
Demo Table	1.20 x 0.58 x 1.34
Fully Operational	2.51 x 0.58 x 1.34

Table 5 shows the dimensions of the full-function convertible bread and pastry production table and having it individually. The whole function table dimension includes 2.51 min in length, 0.58 m in width, and 1.34 m in height. The cabinet dimensions include 1.20 m in length, 0.58 m in width, and 0.76 m in height, which is easily stored and is a space-saver.

Table 6. Summary of Mean Scores on the Level of Acceptability of the Convertible Bread and Pastry Production Table

Items	Mean	Interpretation
Design	5.00	Very High
Functionality	5.00	Very High
Usability	5.00	Very High

Acceptability of the Convertible Bread and Pastry Production Table

The third objective of the study was to evaluate the level of acceptability of the convertible bread and pastry production table in terms of Design, Functionality, and usability. Tables 6 on the next page discuss the summary mean scores regarding acceptability.

The results indicate that the Convertible Bread and Pastry Production table is highly accepted in the food industry by the Department of Education, schools teaching culinary arts, TESDA-accredited training centers, and students as direct product users.

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Development of User's Manual

The fourth objective of the study was the development of a User's manual for convertible bread and pastry production table.

The researcher develops a user manual to give brief and clear directions to the user on how to use the working table. The manual includes the product's safety standards and preventive maintenance.

CONCLUSIONS

Based on the findings of the study, the researcher draws the following conclusions:

I. The fabricated convertible bread and pastry production table was developed following the design plan preparation and fabrication.

II. The convertible bread and pastry production table has a shorter time to convert and has a foldable platform that can be stored easily. It is space-saving, and food particles can easily be cleaned and scoured away using a microfiber cloth or hand towel and hot water.

III. The convertible bread and pastry production table is helpful in the teaching-learning process for skills application. It is responsive to the needs of the students and teachers in culinary subjects.

IV. The researcher formulated a user manual for using the convertible bread and pastry production table to maximize easy storage after use.

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