Development and Acceptability of Electric Dough Flattener as Technical Device in Teaching Bread and Pastry

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***Abstract*: This research undertaking made use of the quantitative design, particularly the descriptive method, utilizing a questionnaire to determine the acceptability level of a developed electric dough flattener in terms of design, functionality, cost- cost-effectiveness, and safety. This study involved 15 students from the Nueva Vizcaya State University- Bambang Campus and King's College of the Philippines –Bambang Inc.; 15 faculty members teaching Hospitality Management, and 15 practitioners in the baking industry around Bambang, Nueva Vizcaya. Data gathered were treated statistically with the mean to determine the acceptability level of the technical device and F-test to establish significant differences on the evaluation of the developed electric dough flattener. The material, tools and equipment needed in the construction of the electric dough flattener are available in the local market. The electric dough flattener is suitable for use in teaching and demonstrating dough preparation in bread and pastry production. The developed device is highly acceptable in terms of design, functionality, cost- cost-effectiveness, and safety. It can be used for more effective instruction or bread and pastry production. The three sets of respondents differed significantly in their assessment of the device in terms of safety. Some modifications may be undertaken to ensure 100% safety in the use of the device. More technical devices may be improvised, not only in bread and pastry but also in other fields of specialization in technology to help solve the problem of scarcity in instructional materials. The developed technical device assessed as highly acceptable may be used in institutions offering bread and pastry production.**

***Keywords*: acceptability, development, electric dough flattener, evaluation.**

1. Introduction

Technology is a significant concern in many disciplines, including education. This is because in most nations, technology has replaced traditional means of knowledge sharing. Technology has significantly impacted how lives are shaped, how industries are changing, and how the economy is growing over time. Schools and other educational institutions that aim to educate students for life in "a knowledge society" should think about incorporating technology into their curricula as part of this.

Moreover, technology development describes the ongoing progress and enhancement of diverse technological systems, instruments, and procedures. It includes coming up with, improving, and putting into practice creative answers to problems facing society. Technology development continues to be a major force behind progress in today's fast-paced world, allowing us to solve challenging issues, increase productivity, and improve our general quality of life. As cited by Raja et al. (2018), technology has revolutionized the field of education and modern students prefer the use of technology how does their learning impact if they use technology, it was revealed that the use of modern equipment technology and tools, the learning and interactivity of students increases (Ghavifekr et al., 2015). Additionally, innovation and technology provide accessibility and instant information on the vital presence of the classroom. Advanced technology in teaching equipped educational systems with various educational technologies.In addition, the trend of technology that faces in the 22nd century, especially on the devices in the classroom setting. It explores the creation of meaningful experiences in teaching and learning for students of all ages. As cited by Mallillin et al. (2020), utilizing the various technologies in the classroom will engage the learners actively in the objectives of learning and integration. This is due to the significant pedagogical contributions made by technology in education, where technology application would result in successful learning with the aid and assistance of technology elements and components (Blau et al., 2020). It is accurate to claim that technology-based tools and equipment help students study nearly all subject areas more efficiently, starting with mathematics, physics, languages, the arts, and other important fields.

Technology and Home Economics is essential to achieving the aims and objectives of the recently improved curriculum. Due to its commendable importance, Technology and Home Economics courses draw a large student body; yet, the opposite has really happened. This is most likely the result of people's beliefs that it does not need a specific type of instruction. People do not realize how important vocational subjects are, as they could benefit both men and women. After receiving instruction,

students can solve issues on their own. Additionally, it helps students learn new abilities, skills and knowledge, as well as values necessary for an independent existence that satisfy needs of the family and self, particularly in light of the current financial challenges and to improve the academic achievement of the students (Tan 2021).

Teaching Technology and Home Economics explores the integration of technology and home economics education. It entails the application of various technological tools and resources to improve teaching and learning in the field of home economics. Technology and Home Economics seeks to enhance the teaching and learning experience by leveraging technology's experiences, promote critical thinking and problem-solving skills, and prepare them for the digital age. When students are accustomed to technology, they learn better in a tech-based environment.

Teaching students to make bread and pastries entails importing the abilities and know- how required to create bakery goods such bread, cakes, pastries, gateaux, tortes and petit fours. Bread and Pastry Production is a Technical Educational and Skills Development Authority (TESDA) regulated technical-vocational program that aims to develop the skills of students in the production of baked bread and other pastry products and help them acquire competencies that would increase employability (TESDA 2015). These skills- based programs empower students to transition directly into the work force, upon graduation or pursue more advanced skill development and educational opportunities. For a successful Bread and Pastry Production assessment, it is imperative that basic concepts of bread and pastry production be meticulously taught and laboratory venues adequately equipped with the needed laboratory devices (Formalejo, 2020). The Bread and Pastry Production competency, "Prepare and produce bakery products," and "Present desserts," are the main concerns of this study.

The National Research Agenda for Teacher Education (NRATE) and the College of Teacher Education Research and Development Agenda of the university highlights the need for continual improvement in teaching strategies and the integrating of technology to augment the caliber of education. The researchers' investigation into the development and acceptability of an electric dough flattener as a technical device for bread and pastry production would supplement the school's other instructional resources. The researcher has noticed that when it comes to hands-on activities, the college is faced with inadequate equipment. Many technological tools, devices, and equipment are still in used today, but due to the quick advancements in science and technology, they are becoming outdated. Addressing these resource limitations is vital to ensure that program delivers its intended outcome of empowering students with job ready skills and contributing to a global competitive workforce (Geraldizo & Dabasol, 2022.) By creating and building trainers, mockups, tools, and equipment specifically for instruction, professors and instructors can address the inadequacies of teaching resources. Aware of this problem the researcher's objective of the study is to develop a technical device for Bread and Pastry Production, and would supplement the school's other instructional resources. The primary beneficiaries of this study as a tool for the teaching and learning process would students and teachers. Because it provides an extra tool for classroom instruction, it is also advantageous to the administration and school.Supplementary to the existing equipment, the developed electric dough flattener hopes to address issues regarding inadequate Bread and Pastry Production equipment, particularly in the uniformity of dough preparation. According to Cauvain (2015), uniformity of dough is critical to ensure consistent quality of the final product. Technical devices can ensure that each batch of bread or pastry is produced with the same level of precision and quality.

The device aims to facilitate a more efficient and safe teaching-learning experience for both instructors/teachers and students. Using an electric dough flattener, students can easily flatten and shape dough for various projects, allowing them to explore different textures, forms, and designs. The electric dough flattener is designed with safety features, such as guards and shut-off mechanisms to prevent accidents during operation. This ensures a safe learning environment for both teachers and students. The device is user-friendly, making it accessible to students of different skill levels. By using it, teachers can provide a hands-on experience that closely resembles real-world baking scenarios. It is envisioned to be easy to operate, and suited to the level of the students. This device promotes fine motor skill development, spatial awareness, and problem-solving abilities.Additionally, it can be integrated into lessons on measurements, fractions, and geometry, as students can experiment with different dough thicknesses and shapes.

Overall, the electric dough flattener serves as a valuable tool for engaging students in interactive and multidisciplinary learning activities. Since it is an electric dough flattener, it is easily moveable and could use in dough demonstration anywhere.

This study, therefore, focused on the development of an electric dough flattener to be used as a technical device in teaching Bread and Pastry Production. Particularly, this study determined the requirements, specifications, design, and evaluation of the acceptability of the developed project in terms of its design, functionality, cost-effectiveness, and safety.

2. Methodology

The study utilized a quantitative research design to analyze the numerical data gathered from the target participants. Since an evaluation tool was used to determine the acceptability of the developed electric dough flattener as a technical device, the use of quantitative research is made applicable in this study. Specifically, the descriptive-evaluative method was used to assess the developed technical device along its design, functionality, cost-effectiveness, and safety as evaluated by the respondents.

The study was carried out at the Bambang Campus of the Nueva Vizcaya State University and King's College of the Philippines - Bambang Inc. because both offer Bread and Pastry Production. The respondents of the study are composed of 15 students of KCP and NVSU. Seven are from KCP Hospitality Management third-year students, and eight are from NVSU Hospitality Management sophomore students. In the 15 respondents of Teachers/Instructors/ Experts, eight are from KCP, and seven are from NVSU. Meanwhile, for the Bakery practitioners, 15 respondents are divided based on the availability of the bakeshop practitioners. Three practitioners are from Tabuyo's Bakery; three from Lolong's Bakery; four from Bautista's Shop; three from Macabenga Bakery Shop; and two are from Domino's Bakery.

Stratified random sampling with equal allocation was employed, the respondents are from the Bread and Pastry Production teachers and Hospitality Management sophomore students of Nueva Vizcaya State University-Bambang Campus and Hospitality Management third-year students from King's College of the Philippines- Bambang Inc. who are enrolled and who finished the Bread and Pastry Production Subject. Bakery practitioners around Bambang, Nueva Vizcaya were also involved.

Table 1
Summary of percentage distribution of respondents

Respondents	No. of Respondents	Percentage
Students of KCP and NVSU	15	33.33%
Teachers/ Instructors/ Experts of KCP and NVSU	15	33.33%
Bakery Practitioners	15	33.33%
Total	45	100%

The questionnaire was evaluated by the research panel using the content validity evaluation form adopted from Abalos (2023). Most of the criteria were rated high (4–5), indicating that the tool was appropriate, relevant, and clear. A few items received a lower score (3), which led to minor revisions. The overall validity rating was 4.54, showing that the tool was effective. After revisions, the tool underwent pilot testing for reliability. Overall, the questions are acceptable as indicated by the Cronbach's alpha index of 0.705. The questionnaire contains the criteria for evaluating the electric dough flattener in terms of its design, functionality, cost-effectiveness, and safety. The respondents were asked to respond to the items in the questionnaire to express their level of acceptance, following the 4-point Likert scale. The scale was interpreted as follows: 4 (3.50–4.00) Strongly Agree – Highly acceptable, 3 (2.50–3.49) Agree – Acceptable, 2 (1.50–2.49) Disagree – Fairly, and 1 (1.00–1.49) Strongly Disagree – Not acceptable

To gather data, the researcher personally administered the questionnaire to the respondents to inform them about the nature and purpose of the study, and retrieved them also personally to ensure that all the items in questionnaire were properly and completely accomplished. The study employed the Weighted Mean to evaluate the acceptability of the electric dough flattener based on design, functionality, cost-effectiveness, and safety. Additionally, the ANOVA/F-Test was used to determine if there were significant differences in the device evaluations among three distinct groups of respondents. All inferences were drawn at the 0.05 level of significance.

Table 2
Bill of supplies and materials

Quantity	Unit	Description	Unit price	Total price
1	pc	30mm diameter X 400mm laminated wood	100.00	100.00
2	pcs	3mm thick x 1 inch width x 1 ft Long Stainless flat bar	200.00	400.00
1	pc	PVC pipe	100.00	100.00
1	pc	40 watts/230 volts fan motor	600.00	600.00
4	pcs	Nsk bearing 2RS	20.00	80.00
1	pc	600mm x 600mm ¾ plywood	500.00	500.00
1	pc	Waterproof on/off push button	150.00	150.00
1	lot	Miscellaneous	1,000.00	1,000.00
Total				2,930.00

In the conduct of this study, the researcher considered only those who were willing to participate and assured them their responses were kept confidential. Ethical considerations, including data privacy and electrical safety were addressed.

3. Results and Discussion

The total estimated cost of supplies and materials used in the construction of the developed electric dough flattener is amounts to two thousand nine hundred thirty pesos (Php 2,930.00).Saracho (2016) proved that the minimal-cost improvised device can perform the same function as commercial ones.

Table shows the following basic tools and equipment needed in the fabrication of the electric dough flattener. The list of tools and equipment that were utilized in manufacturing the electric dough flattener. These are as follow: measuring tape, drill

machine, circular saw, angel grinder, drill bit, plier, screwdriver and electric tape with corresponding descriptions and functions.

The concepts, designs and guiding principles mentioned support the idea that creating low – cost but innovative device in lab shops can be a practical solution to addresses the issue of scarcity of laboratory equipment.

Furthermore, The construction of the electric dough flattener considers four (4) criteria namely, design functionality, cost-effectiveness, and safety. The construction procedures consist of the primary activities that were undertaken in the conduct of the study. Each part of the development of electric dough flattener is identified. The components of the project are fabricated first before its assembly, and some finishing touch-ups are made.

The structural framework of the electric dough flattener consists of four components: the main body frame which covers the electric motor to make the laminated round plate revolve, the electric motor, the plate, and the rolling pin. The body frame was three-fourth inch thick plywood. This served as the cover and protection of the electric motor and other electrical components of the project; the electric motor serves as the life of the project where the laminated round plywood rotates/revolves in flattening the desired thickness of the dough. It is located under the body frame or inside the body frame together with the wirings and switched; also, the laminated round plywood also serves as the plate for the dough. It is located above the body frame which is connected to the motor to make the plate revolve, it is also removable for replaceable plate and for easier cleaning; and the rolling pin which made of PVC pipe with threaded bar and bearing that is used to flatten the dough that is in the plate, which is located at the top of the plate with a stainless flat bar as a guide and handle for making a flattened dough.

The development flow of the project was constructed/ developed considering the four stages; The first stage is the planning stage, which is the stage of determining the design, specifications, construction, functionality, and safety of the electric dough flattener. The design is carefully crafts that is suitable to the functionality of the device. Next is the development stage. It is the stage for the fabrication of the electric dough flattener based on the design and specifications. The materials, tools, and equipment needed for the fabrication are provided. This can be seen in Table 3 which indicates the list of tools and materials. The fabrication of parts is done first before the assembly of every part (motor housing cover, laminated plywood plate and stainless support bar) following the procedures to finish the project. The revising stage is part of this stage because the researcher done some revisions in finding the best plate that fits to its design. The researcher first used the stainless plate with a diameter of 30 cm and a stainless rolling pin but this material failed to address its purpose because the material is too heavy and cannot hold the dough while operating. Then, the second material is the laminated plywood plate with the diameter of 20 cm and a PVC pipe rolling pin which fits and addresses the main purpose and it to flatten the dough. The third stage is the testing wherein, in this stage, adjustments are done while testing for the improvement of electric dough flattener. Some of the adjustment done is changing the 40 watts to 38 watts or 18 voltage capacities for the reason of the motor is too fast and this tends the plate revolve too fast. Lastly, the final stage is the evaluation where the respondents evaluate the design, functionality, cost-

Table 3
List of tools and equipment

Tools and Equipment	Description	Functions
Measuring Tape	A flexible tool used for measuring length.	Used to measure the exact length of the laminated plywood and also the other materials to be cut.
Drill Machine	A tool used for drilling holes in various materials, such as metal, ceramic wood, or plastic.	A machine that is used to operate the drill bit to make holes, and can be used as a screwdriver for easy screwing and removing of screws/knots.
Circular Saw	A power saw uses a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor.	Machine tools to cut the marine plywood into specific sizes to be used for covering the motor.
Angle Grinder	A machine for material removal with geometrically non-defined, bonded cutting edges.	A grinding machine is used for cutting the excess stainless-steel materials to be used and also used for the angles of the stainless-steel materials to grind to make them smooth and shine.
Drill Bit	Cutting tool used to create cylindrical holes, almost always of circular cross-section.	Used to create holes for the motor that connects of the motor and a round plate
Plier	*A hand tool used to hold objects firmly.*	Used for holding small materials to be cut like wire and protection for one's hand particularly when using machine tools.
Screwdriver	A tool that is used for turning screws. It consists of a metal rod with a flat or cross-shaped end that fits into the top of the screw.	Manual used tool for removing or putting screws
Electrical tape	A safety tape for wires, used to cover and insulate a broad range of cables, wires, and other materials that conduct electricity.	Shield a wide assortment of wires and cables that conduct electricity

Table 4
Summary of respondents' evaluation on the level of acceptability of the developed electric dough flattener as a technical device for bread and pastry production

Level of acceptability	Students	Faculty	Practitioners	Overall Mean
Design	3.80 Highly Acceptable	3.86 Highly Acceptable	3.63 Highly Acceptable	3.76 Highly Acceptable
Functionality	3.71 Highly Acceptable	3.71 Highly Acceptable	3.73 Highly Acceptable	3.72 Highly Acceptable
Cost-Effectiveness	3.68 Highly Acceptable	3.53 Highly Acceptable	3.57 Highly Acceptable	3.59 Highly Acceptable
Safety	3.99 Highly Acceptable	3.76 Highly Acceptable	3.73 Highly Acceptable	3.83 Highly Acceptable
Overall Mean	3.80 Highly Acceptable	3.72 Highly Acceptable	3.67 Highly Acceptable	3.73 Highly Acceptable

effectiveness, and safety of the developed electric dough flattener to determine its acceptability. The final stage is done during the actual demonstration while gathering of data.

Moreover, creating a new product with high- quality but cost-effective materials is one of the various actions taken to boost these products' perspective. Creating low-cost locally made machines that are simple to operate, manipulate, and comprehend through instructions helps to improve the quality of technology education. The proposed electric dough flattener is a minimal –cost improvised device that can perform the same function as those in the market ones.

The table shows that the evaluation of the electric dough flattener in terms of design, functionality, cost effectiveness, and safety as "highly acceptable", as attested by the grand mean of 3.73.

The three sets of respondents evaluated the device as highly acceptable with a grand mean of 3.73; specifically, 3.76 for design; 3.72 for functionality; 3.59 for cost – effectiveness; and 3.83 for safety.

This finding implies that the three sets of respondents strongly agree that the developed electric dough flattener is very acceptable technical device in teaching bread and pastry production both for instructional purposes as well as commercial use. It contributes to the solution of the problem on shortage or inadequacy of instructional materials for technology education, particularly Technology and Home Economics (THE). Instructional tools for teaching the subject are required because this entails" learning by doing" and there is no other effective way of performing tasks is THE than engaging the students to hands-on learning experiences and allowing them to manipulated learning tools to apply abstract concepts.

The point of view advanced by Abalos (2023) runs parallel to the preceding statements, which articulates that innovation and technical knowledge are the answer to the lack of equipment needed for the shop or laboratory facility. This initiative and creativeness will help the shop or laboratory teacher facilitate the hands-on activities of the students. This dilemma is most often attributed to the lack of modern, advanced and sophisticated equipment due to financial constraints and the only alternative solution to this situation is the improvisation of such instructional equipment and devices. Pagatpatan (2022) added those industries, factories and other technical firms need competent and skilled workers, so to manage these industries, technical schools must produce competent and technically skilled force. The next generation must be equipped starting in schools, with all the technical knowledge and skills necessary to become productive and successful adults.

These statements are supported by several studies pertaining to development and validation of instructional materials for technology education.Okoye and Caleb (2023) created and tested a task instruction sheet for electrical installation and maintenance to assist technical teachers finding to complement in learning that is based on problem in technical colleges. The conclusion indicated that the developed task instructional sheets are valid and reliable for use by technical teacher to implement learning environments that is based on providing solution to problems in programs under technical education. It was commended that the sheets of instruction that were developed should be adopted by the technical teachers to be applied in the institutions of technical training.

In addition, Sumaila et al. (2019) suggest that basic technology teachers should create electronic versions of some lesson materials and use a developed learning package for classroom instruction, especially for the electricity/ electronics portion of the curriculum. It also recommends developing similar packages for other basic technology topics.

In terms of its safety component, it is shown in table that the differences were tested for significance, and it yielded a computed F- value of 3.54 and p-value of 0.04, which is lower than the significance level of 0.05. The null hypothesis stating that there is no significant difference in the respondents' evaluation of the device along safety is rejected. The three sets of respondents rated safety significantly different from one another.

Apparently, the students' evaluation of the device in terms of safety is higher than the evaluation, this being the highest and the practitioners rating, is the lowest. The students either feel assured that the device is safe or are extra cautious due to the safety warnings they are given in advance. It could be attributed to the observation that the students are confident that the device is not risky and safe to use, knowing that their instructor would not allow its use if it puts them to danger. Perhaps, they are assured that the device would not cause them any harm; otherwise, it will not be used for any activity. Moreover, they are given extra caution in using the device because they are given precise instruction and precautions before using the device.

On the other hand, the faculty rated safety of the device lower, although it is still highly acceptable. It could be said that the instructors think that there is still possible modification that can be made to ensure that the device is indeed safe to use for

Table 5
Summary of computation on the differences in the respondents' evaluation of the developed device

Component/ Variable	Groupings	Mean	Computed F-value	p-value	Remarks
Design	Students	3.80			Not Significant
	Faculty	3.86	2.70	0.08	
	Practitioners	3.63			
Satisfaction	Students	3.71			Not Significant
	Faculty	3.71	0.04	0.96	
	Practitioners	3.73			
Cost-Effectiveness	Students	3.68			Not Significant
	Faculty	3.53	0.41	0.66	
	Practitioners	3.57			
Safety	Students	3.99			Significant
	Faculty	3.76	3.54	0.04	
	Practitioners	3.73			
Overall	Students	3.80			Not Significant
	Teachers	3.72	1.08	0.35	
	Practitioners	3.67			

instructional purposes.The study of Tabasa et al. (2023) emphasized that safety measures are put in place to reduce risks and dangers, allowing people to work and love without fear of injury. Individuals also bear responsibility for their own safety this includes obeying minimal instruction like protective clothing and following of safety manuals.

This could also be the line of thinking of the practitioner. They think that some modifications can be undertaken to make sure that the device can withstand wear and tear because the continuous use of the device for production may affect the operation of the device and may place the user in danger. Upgrading could enhance its performance, making it more effective for educational purposes. This could lead to better learning outcomes and more engaging experience for students.

Modifying the improvised device enhances safety, functionality and educational value while promoting creativity and critical thinking among students.

Design has a computed F- value of 2.70 and p-value of 0.08; functionality has a computed F- value of 0.04 and p-value of 0.96; and cost effectiveness has an F- value of 0.41 and p- value of 0.66. The p- values of these three components are higher than the significance value of 0.05. Hence, the null hypotheses are accepted.

Overall, the respondents' evaluation of the device has no significant difference as indicated by the computed F- value of 1.08 and p-value of 0.35, which is higher than 0.05 significance level. All the respondents find the device, taking the components as one, as highly acceptable.

The study of Antonio (2020) supports this finding. His study ascertained the acceptability of a multipurpose electrical circuit demonstration tester established at the Isabel State University. The study made use of descriptive analysis involving instructors teaching courses in electrical technology and students from the three campuses of Isabela State University-Angadanan Campus, Cauayan Campus and Ilagan Campus. The respondents assess the acceptability of the demonstration trainer with regard to its design, functionality, cost-effectiveness and safety. The results showed that the trainer has high acceptability and that there was no significant difference in the assessment made between the instructors and students. Thus, the trainer was patented, replicated and adopted for use by other universities and college offering courses in electrical technology.

It appears in table 6 the summary of Scheffe pairwise differences between groups on the difference in the evaluation of the three groups of respondents on the acceptability of the developed electric dough flattener in terms of safety.

The student and faculty mean difference is 0.22667 and the computed p-value is 0.158. Because the computed p- value exceeds the significance level of 0.05, the difference between students and faculty is not statistically significant, while the student and practitioner mean difference is 0.29333. The calculated p- p-value of 0.050 which is equal to the significance level 0.05, indicates a statistically significant difference, and the faculty and practitioners' mean difference is 0.66667. A p-value of 0.847 was calculated. Because this p- value exceeds the significance level of 0.05, the difference between faculty and practitioners is not significant.

Table 6
Post Hoc analysis

Groupings	Mean Difference	p-value	Remarks
Student and Faculty	0.22667	0.158	Not Significant
Student and Practitioners	0.29333	0.050	Significant
Faculty and Practitioners	0.66667	0.847	Not Significant

4. Conclusion

Based on the significant findings presented, the following conclusions were drawn. The materials and tools/ equipment needed in the construction of the electric dough flattener is locally available in the local market. The electric dough flattener may be used in teaching and demonstrating dough preparation in bread and pastry production. This implies that the developed electric dough flattener is very acceptable and may contribute to the solution of the problem on inadequacy of instructional materials for technology education. The developed electric device is highly acceptable in terms of design, functionality, cost- cost-effectiveness, and safety; therefore, it can be used for more effective instruction or bread and pastry production. The three sets of respondents differed significantly in their assessment of the device in terms of safety. It implies that modifying the developed technical device could enhance more safety features, functionality and educational value while promoting creativity and critical thinking among students.

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