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Development of Manual Bobbin Winding Holder

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Abstract: *This research study aimed to develop a Manual Bobbin Winding Holder as an alternative or a replacement for a broken built-in bobbin winder of industrial sewing machines. It made use of the Experimental Prototyping Research Design in which the study underwent a series of trials and errors – Prototypes 1, 2, and 3 or prototype design and process – to come up with an accepted well-constructed prototype. It utilized the survey questionnaire in gathering the needed data from the ten respondents, professional sewers from Lubao, Pampanga, who were selected using the Convenience Sampling Technique. The data gathered were organized, evaluated, and interpreted using a Likert-scale and Statistical tools – frequency, simple percentage, and the weighted mean respectively. Based on the results drawn from the study, the tool developed – the Manual Bobbin Winding Holder – was accepted by the respondents as an alternative and as a safe tool for Manual Bobbin Winding which may replace the impaired built-in bobbin winder on industrial sewing machines.*

Keywords: Bobbin, Sewing Machine, Sewers, Winding

CHAPTER 1: THE PROBLEM AND ITS BACKGOUND

Introduction

A sewing machine is a vital piece of equipment for making a garment. Its function is an efficient way to finish the garment beautifully. Throughout the years, sewing machines have been part of the progress, and industrial revolution along with this, the sewing machine's functions changed and improved gradually, and its features were made according to the needs of the users. Due to the demand for fast and efficient productivity in the sewing industry, industrial sewing machines have built-in bobbin winders on the right side to improve sewing productivity. Industrial sewing machines are made durable, they can be used for years – even for decades, despite this, the built-in bobbin winder breaks easily after several months or years of usage. Many industrial sewing machine users can't afford to get the built-in bobbin winder fixed because of its high cost and no specialized mechanic to restore the said part. With these problems, industrial sewing machine users think of an alternative solution: to manually wind the bobbin using any kind of object that can fit its hole. This act can cause harm in several instances, like handling sharp objects.

The researchers came up with the idea of producing a tool that can replace the broken built-in bobbin winder that is specifically made for manual bobbin winding without sacrificing the safety and efficiency of winding the thread on the bobbin. This tool was specifically developed for manual bobbin winding because there was no tool for this alternative method.

Guduru et al. (2018) stated in their research that sewing machines are used in various industries, particularly in the garment industry. Industrial sewing machines are greater, faster, and change in size, cost, appearance, and function. This machine is good for a single job, but it is for long hours of usage. Williams, P. (2020), said in his article, that industrial sewing machines can handle tricky sewing projects that simple machines cannot do. They can do heavy-duty sewing jobs. They can handle everyday jobs for years without breaking because they are designed with high-quality components and motor pieces. According to Jaouachi et al. (2019), a sewing machine is composed of four basic mechanisms, including the bobbin mechanism. Proper operation requires the balance of these mechanisms for the sewing machine to function fully. The breakage of the bobbin winder affects the entire procedure of sewing. Without the bobbin mechanism, many processes and actions will be affected.

In an article of Show, T.Q. (2020), they explained that a bobbin is a small tool used for winding the thread – a small spool used as the container of thread. It is placed underneath the sewing machine that forms the stitches below. The material and size of the bobbin vary depending on the sewing machine. The function of the bobbin is to complete the lockstitch of a sewing machine by making a loop underneath to hold the top thread in place. Shepler et al. (2011) indicate that the bobbin holds the thread for the sewing machine – the bobbin provides the thread from the bottom part of the machine which makes the wrong-side portion of the machine stitch. A bobbin is one of the essential tools when using the sewing machine. Lincecum S. (2017) articulated that the bobbin functions along with the bobbin case. A bobbin case holds the bobbin in place when sewing. To ensure that the thread is flowing at an even pace, the bobbin spins in the area inside the bobbin case, which has a tension-controlling mechanism.

A bobbin is an essential tool that completes the function of the sewing machine. The sewing machine will only work if the bobbin is placed underneath the machine. The primary function of the bobbin is to load and unload the thread as part of the whole sewing mechanism. The thread from the bobbin locks the thread that is distributed from the top – this makes the stitch sturdy. The breakage of the bobbin winder may affect the entire sewing operation. Without the bobbin mechanism, many processes and actions will be affected. Therefore, some Industrial sewing machine users think of alternatives when this happens; the common alternative is manual bobbin winding.

Bobbin Winding is a crucial step in sewing; it is one of the first preparations for using the sewing machine. Winding began to be considered more than the transferring of thread, it ensures the transportation or loading of thread without damage, as a process that facilitated the operation of the subsequent cycles. Bobbin winding is done to wind the thread on the bobbin. (English, W., 1958). In their research in 2021, Sevindikovna, V. Z., & Husenovich, B. S. (2021) stated that a bobbin winder of a sewing machine is composed of a base, frame, drive wheel, latch mechanism, thread tension mechanism, and a cutting mechanism which contributes somehow to the operation and productivity Placed near the hand wheel, a bobbin winder is a separate unit screwed onto the sewing machine. Its purpose is to wind thread evenly onto an empty bobbin and release it when full (Rice V.E., 2006). Bobbin winding goes hand in hand with the bobbin winder, in sewing. Bobbin winding is the act of winding the thread on the bobbin using the built-in bobbin winder or the alternative solution, manual bobbin winding using the hand wheel of the sewing machine.

This study created a safe and affordable solution to the manual bobbin winding of industrial sewing machine users. Industrial sewing machine users frequently encounter various problems with manual bobbin winding – which can cause danger to the users at times. Manual bobbin winding is done with the help of an alternative tool or object, and the hand wheel of the sewing machine. This action is done as an alternative when the built-in bobbin winder of the industrial sewing machine breaks. Manual bobbin winding is a dangerous act when sewing because the pointed parts of some of the tools used for this act are sharp and can wound or harm the users. Errors and repetitions are unavoidable in manual bobbin winding because the thread gets jammed on the alternative tool, or the bobbin jumps out from the alternative tool.

In the study of Selvam et al. (2016), hazards in the sewing machine operation and handling of the materials can happen if there is no identified and appropriate prevention or control on this matter. Injuries such as sharp edges of some tools and parts of the sewing machine piercing through the fingers, cutting injuries by threads on hand and hitting the projected parts of the sewing machine are commonly experienced by industrial sewing machine users.

Many cannot afford to get the built-in bobbin winder fixed, and some users cannot afford to buy a new machine to make the bobbin wind fast and easy. In an article on NBC news by Pardilla A. & Booth B. (2023), buying an industrial sewing machine is costly and will cost almost 1,800 dollars ($1800) or about 94,000 pesos (₱94,000) for a brand new and authentic one. On the other hand, domestic sewing machines are sold for around 99 dollars ($99) to 5 thousand dollars ($5,000) or 5 thousand pesos (₱5,000) to 200 thousand pesos (₱200,000).

The present researchers experienced these challenges on bobbin winding and the built-in bobbin winder. The study would significantly help by making a specific hand tool for manual bobbin winding that can be used in a minute without harm. The Manual Bobbin Winding Holder is easy to use because it is handy and does not use any electricity or machine. The Manual Bobbin Winding Holder prevents these problems with an easy and affordable solution, it is a simple hand tool that is designed for the safety of the users. It is not costly as getting a new machine or fixing the bobbin winder because it is a small hand tool that serves its function without paying for the electricity, machine, and labor.

Statement of the Problem

This study aimed to produce a Manual Bobbin Winding Holder as a replacement for the breakage of the built-in bobbin winder of the industrial sewing machine. It sought to answer the following questions:

1. What is the Demographic profile of the respondents in terms of:
   1.1 Age,
   1.2 Sex, and
   1.3 Years of experience?
2. What is the perception of the respondents towards the built-in bobbin winder?
3. How do the respondents evaluate the Manual Bobbin Winding Holder?
   In terms of:
   3.1 Effectivity;
   3.2 Design;
   3.3 Safety?

Conceptual Framework

Shown in figure 1 is the input-process-output diagram. In the input box, are the raw materials that were used for this study, the collection of data from the ten (10) professional sewers and set of designs used for the construction of the prototype.

The process box indicates such things as constructing, testing, and using the prototype, as well as the evaluation of the developed product through trial of the prototype, interview, and use of statistical treatment.

For the outcome box, was the development of the Manual Bobbin Winding Holder.

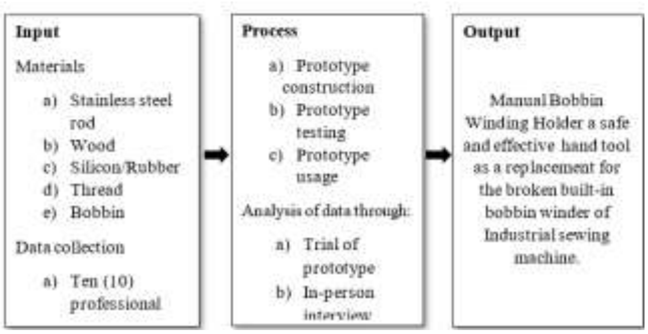


Figure 1

Conceptual Framework of the study

Hypothesis

H_0 - The Manual Bobbin Winding Holder cannot be used as a tool for manual bobbin winding in the garment industry.

H_a - The Manual Bobbin Winding Holder can be used as a tool for manual bobbin winding in the garment industry.

Significance of the Study

This experimental study sought to identify the effectiveness of the Manual Bobbin Winding Holder and to further validate it as an alternative tool for the built-in bobbin winder for industrial sewing machine users. The findings of the study will benefit not only the researchers but the following:

To the students of the College of Industrial Technology. Specifically Garments and Fashion Design major, to further understand this tool for the safety and easy use of manual bobbin winding.

To the faculty handling Garments and Fashion Design. This study can help them make use of an electricity free tool that is user friendly, safe, and inexpensive.

To the future researchers. This study will show them the importance of achieving progress through keen experimentation, time management, perseverance, and creativity. This research can also be used as a reference for future innovations that can effectively help the garment industry's productivity.

To the community. The study can help the people by saving the energy used for electric and machine-operated Portable bobbin winders, making it eco-friendly and sustainable.

Definition of Terms

To further understand the study made by the researchers, the following terms were defined literally and operationally:

Bobbin – is vital tool used to hold the thread.

Built-in Bobbin Winder – it is a part of the sewing machine where the bobbin is placed when winding the thread.

Bobbin Winding – is a part which handles the process of transferring the thread from the thread cone to the bobbin.

Garment Industry – it refers to small, medium, and large garment industry. These can be independent and dependent industries.

Hand Wheel – it is a part of the sewing machine where the bobbin is attached when doing the manual bobbin winding.

Industrial Sewing Machine – this is a sewing machine commonly used in industry; and is composed of bobbin winder on the right side; it is electrically powered and made to speed up the process of sewing a garment.

Manual Bobbin Winding – such is an alternative process of winding the thread on the bobbin using an alternative tool or object, and the hand wheel of the sewing machine.

Sewer – it is a user of sewing machines, either for personal or professional purposes. They use sewing to construct the garments.

Sewing – it is the process that needs to be done to create a garment.

Thread – this is a thin material used to be wound on the bobbin.

CHAPTER 2: METHODS

This chapter presents the research design used, instrumentation, the data collection, ethical consideration, the statistical tool, and the data analysis.

Research Design

This research utilized experimental prototyping research design because the study was processed and observed scientifically and systematically. The study underwent a set of trials and errors to produce a well-constructed prototype. The prototype was used to gather data from the respondents.

Building a prototype is a phase in the experimental prototyping process, which potentially answers a specific problem. The prototype was put to test in the actual environments before the development work started to determine its viability. The prototype may be tested only for the functions that are of relevance, or it may incorporate all predicted functions for the target system. (Mayhew, P. J., & Dearnley, P. A., 1987).

Instruments

The data collection techniques used in this study were in-person interview and questionnaires. The researchers created a Likert-type questionnaire based on the relevant questions reflected in the statement of the problem. The researchers used the in-person interview to gather the data and understand the respondents deeply. This technique is an excellent way to collect detailed information. The in-person interview provides opportunities to ask for information directly from the respondents—their personal experiences, suggestions, and questions about the study which can be recognized immediately. The questionnaire collection technique provides questions based on the research problem. This technique helped the researchers to analyze the data further scientifically. The collected data were recorded and analyzed by the researchers.

Data Collection

The gathering of data is done through a set of trials, an interview, and a questionnaire. The prototype undergone a set of trials wherein the researchers recorded the data gathered from each of the trials. The data are used to determine the errors and modifications needed for the improvement of the prototype. After the researchers found out the result of the set of trials, the prototype is used to gather data from the respondents.

After the researchers made sure that the questionnaire was validated, they prepared hard copies of the questionnaire to accommodate the respondents. Safety protocols were followed by the researchers and the respondents during the conduct of the data collection process.

The researchers provided a short orientation to the respondents on how to use the Manual Bobbin Winding Holder. The prototype was distributed to the respondents, who used it as a manual bobbin winding tool. The researchers also entertained the queries of the respondents regarding the Manual Bobbin Winding Holder.

Copies of the paper-and-pen questionnaire prepared by the researchers were personally distributed to the respondents. The researchers provided a brief explanation of the details to help the respondents understand the purpose of the study. The questionnaires were distributed and collected on the same day.

Ethical Consideration

The researchers considered the respondents' concerns. Assuring the safety and privacy of the respondents. The voluntary participation of the selected respondents was taken into consideration. Before the data collection, the researchers asked the respondents for their free time and their informed consent. During the data collection, the researchers assured the respondents of the confidentiality and anonymity of the data collected. Safety protocols due to the pandemic were strictly followed during the gathering of the data.

Statistical Treatment of Data

Statistical techniques such as frequency, percentage, and weighted mean were utilized in interpreting and analyzing the collected data.

1. **Simple Percentage**

$$P = \frac{F}{N}(100)$$

Where:

P = Percentage
F = Frequency of each category
N = Total number of respondents
100 = Constant multiplier

2. **Weighted Mean**

$$WM = \frac{\sum FW}{N}$$

Where:

WM = Weighted mean
$\sum$ = Summation Symbol
F = Frequency
W = Assigned weight
N = total number of frequencies

The Likert scale was also used in determining the descriptive ratings of the respondents' perception towards the built-in bobbin winder. It was also used to determine the descriptive ratings of the respondents' evaluation towards the Manual Bobbin Winding Holder.

Table 1. Respondents' perception towards built-in bobbin winder (Likert-scale)

Scale	Weighted Mean	Verbal Interpretation
5	4.51 – 5.00	Strongly Agree
4	3.51 – 4.50	Agree
3	2.51 – 3.50	Undecided
2	1.51 – 2.50	Disagree
1	1.00 – 1.50	Strongly Disagree

Table 2. Respondents' evaluation towards Manual Bobbin Winding Holder (Likert-scale)

Scale	Weighted Mean	Verbal Interpretation
5	4.51 – 5.00	Always
4	3.51 – 4.50	Often
3	2.51 – 3.50	Sometimes
2	1.51 – 2.50	Rarely
1	1.00 – 1.50	Never

Data analysis

To further analyze the results of this study, the researchers interpreted the data statistically. This presented the results of this research, consisting of the respondents' demographic profile, the respondents' perception of the built-in bobbin winder of industrial sewing machines, the evaluation of the respondents towards the Manual Bobbin Winding Holder, and the outcomes of the set of trials.

CHAPTER 3: RESULTS, FINDINGS, AND DISCUSSION

In this section, the results of the evaluation were discussed, evaluated, and interpreted. During the conduct of this research, quantitative data analysis is used.

1. Respondents` Age

1.2. Respondents` Sex

1.3 Respondents' Years of Experience Sewing

1. Demographic Profile

This section showed the personal profile of the ten (10) selected respondents who were professionals in the field of garment industry. The profiles consisted of age, sex, and years of experience sewing.

The largest age group was between the ages of 36 and 50 (60%), the second was ages 50 and above (30%), and the last one is from the age range of 21 to 35 (10%).

Table 3

Descriptive Analysis of Respondents` Age

Age	Frequency	Percentage
21-35	1	10%
36-50	6	60%
50-above	3	30%
	N = 10	

1.2. Respondents` Sex

The findings showed that there were more males (60%) than the female (40 %) respondents.

Table 4

Descriptive Analysis of Respondents` Highest Educational Attainment

Sex	Frequency	Percentage
Male	6	60 %
Female	4	40 %
	N = 10	

1.3. Respondents` Years of Experience

Thirty (30) years of sewing experience has the highest number (20%). One vote (10%) for forty (40) years of sewing experience, thirty-four (34) years, twenty (20) years, fourteen (14) years, thirteen (13) years, ten (10) years, nine (9) years, and seven (7) years.

Table 5

Descriptive Analysis of Respondents` Years of Experience.

Year of experience	Frequency	Percentage
40 years	1	10%
30 years	2	20 %
34 years	1	10%
20 years	1	10%
14 years	1	10%
13 years	1	10%
10 years	1	10%
9 years	1	10%
7 years	1	10%
	N = 10	

2. Respondents' Perception Towards Built-in Bobbin Winder

Table 6 showed the weighted means and descriptive ratings of the perceptions of the respondents towards the built-in bobbin winder of industrial sewing machines. The results showed that the respondents frequently use the built-in bobbin winder, which has the highest weighted mean (4.4). The respondents rarely experience danger while using tools not designed for manual bobbin winding, with the lowest weighted mean (1.8). The general weighted mean of 3.522, which was translated as "often," indicates that respondents' perceptions towards the built-in bobbin winder was that they often use the manual bobbin winding as an alternative method, were aware of the dangers while doing so, and were looking for a tool for manual bobbin winding to replace the broken built-in bobbin winder.

Table 6

Descriptive Analysis Respondents` Perception Towards Built-in Bobbin Winder

Items	Weighted Mean	Descriptive Rating
1. Is your industrial sewing machine's built-in bobbin winder working?	4	Often
2. How frequent do you use the industrial sewing machines' built-in bobbin winder?	4.4	Often
3. Do you experience any trouble while using the built-in bobbin winder?	3	Sometimes

4. How often do you experience trouble when using the industrial sewing machines' built-in bobbin winder?	2.7	Sometimes
5. Do you consider manual bobbin winding due to the breakage of the built-in sewing machine?	3.9	Often
6. Are you using any alternative or replacement tool for the bobbin winder?	3.7	Often
7. Are you aware of the danger of using other tools as a replacement for the bobbin winder?	4.2	Often
8. Do you experience any danger when using other tools for bobbin winding as a replacement?	1.8	Rarely
9. Are you searching for a replacement for the industrial sewing machines' bobbin winder?	4	Often
	GWM= 3.522	**Often**

2. Respondents' Evaluation Towards Manual Bobbin Winding Holder

The results drawn from the data revealed the respondents' perceptions towards the Manual Bobbin Winding Holder to be highly rated for its efficiency, design, and safety. Most of the questionnaire's items received the ratings of "strongly agree," which corresponded to the general weighted mean of 4.79. Most of the respondents agreed to keep using and promoting the manual bobbin winding in the garment industry.

Table 7

Descriptive Analysis Respondents` Evaluation Towards Manual Bobbin Winding Holder

Items	Weighted Mean	Descriptive Rating
1. The Manual Bobbin Winding Holder is durable.	5	Strongly Agree
2. The Manual Bobbin Winding Holder gives the best appearance as a sewing tool.	4.9	Strongly Agree
3. The Manual Bobbin Winding Holder is easy to use.	5	Strongly Agree
4. The Manual Bobbin Winding Holder is affordable.	5	Strongly Agree
5. The Manual Bobbin Winding Holder made the bobbin winding faster.	5	Strongly Agree
6. The Manual Bobbin Winding Holder is safe to use than the alternative tools.	5	Strongly Agree
7. The Manual Bobbin Winding Holder can replace the broken built-in bobbin winder on the industrial sewing machine.	4.9	Strongly Agree
8. I will continue to use the Manual Bobbin Winding Holder on manual bobbin winding.	4.1	Agree
9. The Manual Bobbin Winding Holder can be added as a sewing tool.	4.9	Strongly Agree
10. I will recommend the Manual Bobbin Winding Holder to be used in the garment industry.	4.1	Agree
	GWM= 4.79	**Strongly Agree**

2. Manual Bobbin Winding Holder through Set of Trials

Table 8 showed the results of the prototype's three trials. Trial one (1) was the initial design of the prototype, which was not approved based on the appearance, function, durability, and weight test. Design one (1) was rejected and it could not be tested because it was not yet safe to use. Trial two (2) has better outcomes than the initial design, yet it failed in terms of appearance and weight test. There were still modifications needed, especially in the weight and design. Trial three (3) or design 3 passed all the outcome tests by the researchers. Designs two (2) and three (3) were then ready to be tested by the respondents.

Table 8

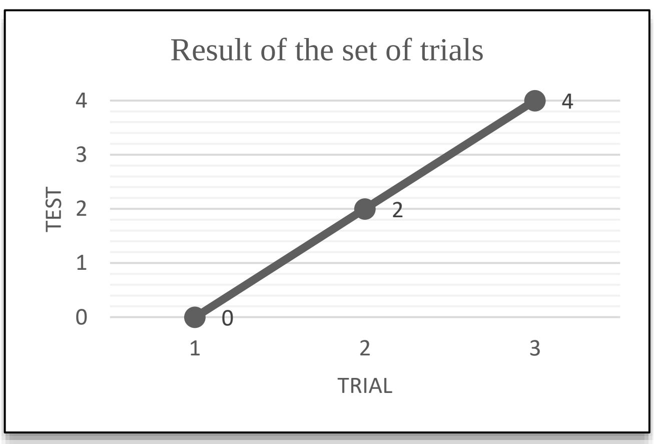
Manual Bobbin Winding Holder Through Set of Trials

	Trials		
Test	**1**	**2**	**3**
Appearance	×	×	✓
Function	×	✓	✓
Durability	×	✓	✓
Weight	×	×	✓
Summary of test	0	2	4

Figure 9 showed the outcomes of the set of trials. The trend line went upwards to the right side interpreted as a positive outcome. There were four types of tests that the researchers conducted for each trial; these were the appearance test, functionality test, durability test, and weight test. To establish positive results, the prototype underwent three trials. Trial one (1) failed all the tests, the second trial failed the weight and appearance test, and the third trial passed all the tests. After the third trial, the prototype was already well established. It was now ready to be used by the respondents.

Table 9

Analysis of Differences in the Respondents` Assessment of their Competencies in Using Virtual Workspace when grouped according to their Age



List of errors encountered in each trial:

Trial 1

- The body of the prototype was wide and too thin. The bobbin kept on jumping and moving too much while winding the bobbin.
- The bobbin stopper was too big and heavy.
- Needed decrease in overall length.
- Thread was jammed on the body of the bobbin. Creating a "bird's nest" like thread winding.
- The welding of the prototype was messy, and it was not durable.
- Inaccuracy of the measurements

Trial 2

- The handles were quite rough, which may cause harm to the users.
- The prototype was heavy and tiring to handle.
- The thread guide's diameter needed to be decreased.

**Trial 3 pass all the test set by the researchers*

Table 10 displayed how the respondents rated the appearance, function, weight, and durability of designs two (2) and three (3). For the prototype, most respondents chose design three (3) due to its weight, durability, and appearance. While design two (2) was chosen for its functionality.

Evaluation	Design 2	Percentage	Design 3	Percentage
Appearance	3	30%	7	70%
Function	8	80%	2	20%
Durability	2	20%	8	80%
Weight	2	20%	8	80%

CHAPTER 4: SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The research undertaking utilized the Convenience Sampling Technique in choosing the ten (10) respondents who were professional sewers from Lubao, Pampanga whose ages averaged from thirty (30) to sixty-five (65) years old and with average years of sewing experiences of twenty (20) years. Most of the respondents were male sewers who were quite knowledgeable on tools.

The results of the study indicated that the Manual Bobbin Winding Holder was acknowledged by the respondents as a new sewing tool, an alternative or a replacement for a broken Built-in Bobbin Winder. The developed tool was evaluated y the respondents in terms of effectivity as "Strongly Agree"; design as "Strongly Agree"; and safety as "Strongly Agree" also which means that the Manual Bobbin winding Holder could be used as an alternative or replacement to the broken Built-in Bobbin Winder on industrial sewing machines.

Conclusions

The following conclusions were drawn based on the results of this study:

1. Based on their sewing expertise and years of experience, the respondents were reliable sources of

data. The age range of the respondents was between 30 and 65 years old, and their average years of experience was 20. This demonstrated their expertise in the garment industry. When the built-in bobbin winder broke numerous times throughout the course of their experience and age, the respondents decided to switch to manual bobbin winding as an alternative.

2. Most of the respondents were men, who were quite knowledgeable about tools.
3. The results indicate that the Manual Bobbin Winding Holder was acknowledged as a new sewing tool – an alternative or a replacement for the broken built-in bobbin winder.
4. The respondents evaluated the Manual Bobbin Winding Holder in terms of effectivity as "strongly agree," design as "strongly agree," and safety as "strongly agree." This means that the respondents will use the Manual Bobbin Winding Holder as an alternative to the broken industrial sewing machines' built-in bobbin winder.

The respondents accepted design three in terms of appearance, safety, and durability while the second design in terms of its function. In conclusion, the Manual Bobbin Winding Holder will be used as a tool for manual bobbin winding and a replacement for the breakage of built-in bobbin winders especially in the garment industry.

Recommendations

Based on the conclusions drawn, the following recommendations are hereby offered:

1. Future researchers may take into consideration changing the prototype's material. It may be constructed entirely of wood, plastic, or resin. It can also be printed with a 3D printer. The tensioner disc can be incorporated into the prototype's thread loop.
2. Teaching professionals in this field may introduce the Manual Bobbin Winding Holder to their students as a tool use for sewing for security and convenience in using it.
3. The Manual Bobbin Winding Holder can be used by the sewing professionals in the garment industry, especially those who use the industrial sewing machines.

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