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Flexible Armchair

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Abstract

The main thrust of this study was to innovate the conventional armchair to give better convenience and comfort to the users. This study, the Flexible Armchair, was conducted primarily to determine its functionality and its acceptability level. This study was conducted at Bohol Island State University Bingag Extension Campus in the School Year 2017-2018. Thirty (30) students from Bachelor of Science in Industrial Technology (BSIT) were the respondents. The functionality of the Flexible Armchair was assessed by the trials that are based on the aspects being tested. The results of the trials showed that the aspects being tested functioned according to its purpose. The results showed that the Flexible Armchair was strongly agreed to be acceptable in terms of functionality, convenience, aesthetics and cost with the general weighted mean of 3.49 described as "Strongly Agree". Based on the results and findings of the study, the researchers concluded that the Flexible Armchair was functional and highly acceptable by the respondents. The researchers recommend to strengthen the arm for more durability and put additional mechanism on the locker so that it can be drawn easily. To the future researchers and furniture entrepreneurs, they may used the study as basis and they may introduce this product to the market to be commercialized and developed.

Introduction

Invention of chair was one of the most important contribution by Egyptians in the furniture history. In the process of design evolution, armchair came out as one important furniture piece. It was necessary whether in school, office or at home to give comforts in everyday life. It was made up of different materials, like wood, metals, or synthetics.

Writing armchair were used in school in the teaching-learning activities - during lectures and examinations. At the modern days, synthetic or plastic armchair was the most common due to its agility or light in weight. However, problems remain to be confronted like high cost of product development, limited function and lack of compartments for bags and other belongings. In response to this, the researchers designed and constructed the "Flexible Armchair" that was multi-functional, expandable, rotatable arm and with secured compartment.

The Flexible Armchair has a layered arm that would serve as a writing arm, small table, drawing board, and with pen compartment. It has a secured locker installed with locking system under the seat for bags and/or other belongings. It has a rotatable arm with a maximum angle of 90 degrees when it is converted to a table and drawing board. The layered arm could also be flipped to access the compartment for pens and pen-like size belongings. The drawing board can be tilted to 20 to 30 degrees angle to compliment the user's comfort.

By these reasons, the researchers believed that the above mentioned problems could be address by this stu0064 y, "Flexible Armchair ".

Furniture is the main interface between the user and the building. For students, furniture is where they sit on, work at, eat at, put their belongings in, discover new etches on, find things in, and see their work displayed on. For teachers, furniture helps them organize the space they teach in, where they store and access all the daily equipment and how they display visual learning materials (Forsite, 2011).

The construction of the armchair needed to be comfortable and spacious, yet easily flexible, with multiple means of engagement, and facilitative of shifting tasks or purposes within the classroom. Embedding choice into the classroom is essential given the diversity of learners, instructors, and instructional modalities, and seating styles in classrooms are easily changeable environmental variables that impact choice, purpose, inclusivity, and functionality (Harvey and Kenyon, 2013).

Flexibility is one of the main focuses for today's learning furniture. This is true both in the case of individual settings as well as in the case of spatial arrangements and combinations of furniture for different sizes and uses. While inprevious generations of school furniture, personal storage was accommodated within students' desks, the rising student numbers and spatial flexibility have led to new strategies of storage. In most urban schools today the furniture is changing with time, or so it is said. The introduction of banks of blank lockers lining corridors or even within classrooms has led to scrums of students fighting to stash or access their possessions between classes. Along with storage, flexibility and modularity can be very successfully integrated into school design, making a positive contribution both spatially and visually (Forsite, 2011).

In addition, Forsite (2011) says that much focus in educational furniture research has centered on its effects on children's physical development and health. Another concern driving health issues in rural India as well as in many urban schools with implications for furniture is the day-to-day storage of students' belongings. Back pains have also been a common occurrence due to the carrying of heavy school bags with two thin straps over the shoulders. These complaints may not be seen as concerns at all in many parts of the country, however as they cause problems later in life they need to be addressed with the same importance as any other concern.

Furniture is one of the important physical facilities provided in a classroom environment where the students spend most of their time working with different learning activities. The functional utility of the student's classroom furniture is a result of its physical design in relationship to the physical structure and biomechanics of human body (Khanam, Mahalakshmi & Mrunalini, 2006).

According to Yu (2014) in her study with her Locker Armchair that it appears significantly useful as it reinvents the usual student chair having a locker which intends to be used for safekeeping of student's needs. It is space friendly as it will not occupy more space than having a separate locker and chair. Since its will have dual functions, it will save money as the school may need not to buy another set of chair and locker.

The theory of Anthropometrics is the study of the human body and its movement often involving research into measurements relating to people and is being used as basis on the Theory of Ergonomics, also known as "anthropometric data" and are collected with other theories to make environment safer and more comfortable for workers (Bergman, 1996).

Flexible Armchair has features such as the locker and the pen compartment that make things easy to reach and more accessible. It reduces the motions needed to perform a work and saves time.

The 5th Principle of Ergonomics which is "Reduce Excessive Motions" explains that minimizing the number of motions required to do a task can lessen the wear and tear on the body and also improve efficiency. Repetitive motions are, in many ways, time wasters, and many of the techniques to reduce excessive motions amount to old-fashioned methods engineering. Motion efficiency can be readily applied in many workplace ergonomics activities (Dan Macleod, 2000).

In designing the Flexible Armchair, theories of anthropometrics and principles of ergonomics should be considered to achieve the optimal effectiveness and use of the study.

According to the 1987 Philippine Constitution that the national progress and improvement of the society is the main reasons why Science and Technology is given importance. By implementing this laws, a lot of opportunities will be waiting in the future for the improvement of the quality of life in every member of the community. It can also be the reason for the development of the economy, increase of product consumption and saving of jobs. Innovating new equipment would have positive outcomes that would lead to our own success. Innovation of gadgets is a sign for the development not just the country but the whole world.

Innovation activities contribute essentially to the regional dimension and growth. The technological infrastructure and innovation capabilities affect not only the regional growth, but also the whole periphery and economy as well (Korres & Drakopoulos, 2009).

The study aimed to make further development on the conventional armchair that will give students more comfortability and convenience in doing classroom activities and using school furniture.

Methodology

The study used experimental method during the assembly of the product. To assess the functionality of the Flexible Armchair, series of trials were made by following the observation guide. The study also used descriptive method in gathering data for the acceptability level of the Flexible Armchair by conducting a survey with the use of a self-made questionnaire. The study was conducted at Bohol Island State University Bingag Extension Campus, Bingag, Dauis, Bohol. The researchers had chosen this school as the environment of the study for the school has the available tools and equipment that would be used in conducting the study.

The respondents were the 30 randomly selected Bachelor of Science in Industrial Technology (BSIT) students. They were composed of thirteen second year BSIT - Drafting Technology students, ten third year BSIT - Food Technology students, one third year BSIT - Wood Technology student, two third year BSIT - Garments Technology students and four third year BSIT - Automotive Technology students. These respondents were

chosen since they were the ones who would benefit most of the study and probably be the end users of the product.

This research used the self-made questionnaire to gather the needed data for the acceptability level of Flexible Armchair and the observation guide to gather the needed data for the functionality level of the Flexible Armchair.

Results

Table 1 Materials and Cost

Quantity	Unit	Description	Unit Cost	Total Cost
1	pc.	Rough Gemelina Lumber 2" x 3" x 12'	240.00	240.00
1/4	sht.	Plyboard 3/4" x 4" x 8'	950.00	237.50
1/4	sht.	Marine Plywood 1/2" x 4" x 8'	380.00	95.00
1/8	sht.	Marine Plywood 1/4" x 4" x 8'	750.00	93.75
1	liter	Chocolate Brown Quick Dry Enamel Paint	130.00	130.00
1/2	liter	Glazing Putty	140.00	70.00
1	pc.	Piano Hinge 1 1/2" x 12"	12.00	12.00
1	set	Bolt and Nut with Washer	10.00	10.00
1	pc.	Drawer Lock	90.00	90.00
1	pc.	Handle	15.00	15.00
1	sachet	Wood Glue	30.00	30.00
Total Cost of Materials				Php 1,023.25
Labor Cost (40% of the Total Cost of Materials)				Php 409.30
Grand Total Cost (Total Cost of Materials + Labor Cost)				**Php 1,432.55**

The materials that are needed to make and assemble the product were available on the local shops with acceptable prices. The tools and equipment used were common and were available in the Wood Technology shop.

Table 3 Functionality of Flexible Armchair as an Armchair with Extendable Writing Arm in terms of Weight Applied at different Length of Extension

		Weight (kg)

Length of Extension	Type of Load	Trial 1	Observation	Trial 2	Observation	Trial 3	Observation
origin	books	15	stable	20	stable	27.5	max. stable load
0.5 cm	books	15	stable	20	stable	25	max. stable load
1 cm	books	15	stable	20	stable	23.5	max. stable load
2 cm	books	15	stable	20	stable	21	max. stable load

Table 3 shows the functionality of Flexible Armchair as an armchair with extendable writing arm in terms of different amount of weight applied in different length of extensions. It was observed that at its original position, the product can carry a maximum weight of 27.5 kg without showing any deformation.

When it was extended at different length, the maximum weight it can carry decreases. In an extended length of 0.5 it can only carry up to 25 kg. At 1 cm, it can carry up to 23.5 kg and at 2 cm which is its maximum length of extension, it can only carry 21 kg.

Hence, the writing arm can be extended to a maximum length of 2 cm and is strong enough to carry a load up to 21 kg when extended completely. Thus, it is also stable enough especially when it would already be used as a writing arm.

Table 4 Functionality of Flexible Armchair as an Armchair with Small Table in terms of Weight Applied at different Length of Frontal Extension

Length of Frontal Extension	Type of Load	Weight (kg)					
		Trial 1	Observation	Trial 2	Observation	Trial 3	Observation
origin	books	2	stable	4	stable	7	max. stable load
5 cm	books	2	stable	4	stable	6.5	max. stable load

8 cm	books	2	stable	4	stable	6	max. stable load
11 cm	books	2	stable	4	stable	5	max. stable load

Table 4 represents the functionality of Flexible Armchair as an armchair with small table in terms of different amount of weight applied in different length of frontal extension. It was observed that the weight it can carry much decreased when compared to the weight that the writing arm can carry because as the small table is extended, the half of its part was not being supported by the arm support.

From its original position, it can only carry a maximum weight of 7 kg. When it is extended, the maximum weight it can carry decreases. At 5 cm of extension, it can now carry a maximum weight of 6.5 kg, at 8 cm of extension, it decreases to 6, and lastly at 11 cm which is the maximum length of extension, it can only carry a maximum weight of 5 kg.

Hence, the small table can be extended to the front to a maximum length of 11 cm and is strong enough to carry load of even up to 5 kg when extended completely. Thus it is also stable enough especially when it is already used as a small table.

Table 5 Functionality of Flexible Armchair as an Armchair with Small Table in terms of Weight Applied at different Length of Right Side Extension

Length of Right Side Extension	**Type of Load**	**Weight (kg)**					
		Trial 1	**Observation**	**Trial 2**	**Observation**	**Trial 3**	**Observation**
origin	books	2	stable	4	stable	5	max. stable load
5 cm	books	2	stable	4	stable	6	max. stable load
10 cm	books	2	stable	4	stable	10	max. stable load
20 cm	books	2	stable	4	stable	6.5	max. stable load

Table 5 exhibits the functionality level of Flexible Armchair as an armchair with small table in terms of different amount of weight applied in different length of right side extension. It was observed from different trials that from the original position of the small table to the different length of sideways extension it is extended, the maximum weight it can carry varies.

The maximum weight it could carry increases when it is at the mid-length of extension and as the length of extension increases to the maximum length or decreases up to its original position, the maximum amount of weight it can carry decreases. From its original position, it can carry a maximum weight of 5 kg. When it is extended 5 cm sideways, the maximum weight it can carry increases to 6 cm for the small table is near at the middle of the arm support. At 10 cm of extension, the table was at the middle of arm support, the maximum weight increases to 10 kg and as the length of extension was extended to its maximum extension which is 20 cm, it decreases to 6.5 kg.

Hence, the small table can be extended to the right to a maximum length of 20 cm and is strong enough to carry a load of even up to 10 kg when extended up to 10 cm. Thus, it is also stable enough especially when it is used as a small table.

Table 6 Functionality of Flexible Armchair as an Armchair with Drawing Table in terms of Weight Applied at different Angles of Inclination

Degrees of Inclination	Type of Load	Weight (kg)					
		Trial 1	Observation	Trial 2	Observation	Trial 3	Observation
20°	books	2	stable	4	stable	5	max. stable load
25°	books	2	stable	4	stable	7.5	max. stable load
30°	books	2	stable	4	stable	11	max. stable load

Table 6 displays the functionality level of Flexible Writing Arm as an armchair with drawing table in terms of different amount of weight applied to the different degrees of inclination. It is observed that the maximum weight the drawing table can carry varies from the degrees of its

inclination. As the degrees of inclination increases the maximum amount of weight it can carry also increases.

Hence, the drawing table can be inclined to its desirable angles from 20° to 30° and is strong enough to carry a load of 11 kg at its maximum angle of inclination which is 30°. Thus, it is also stable enough when used as a drawing table.

Table 7 Functionality of Flexible Armchair as an Armchair with Pen Compartment in terms of Area Capacity

Dimension (cm)	**Type of Load (Dim. in cm) Ø = diameter**	**Number of Load**					
		Trial 1	**Observation**	**Trial 2**	**Observation**	**Trial 3**	**Observation**
20 x 17.5 x 1.5	ballpen (1 Ø x 13)	5	accommodated	10	accommodated	14	Max. accommodation
	Eraser (3 x 2 x 1)	5	accommodated	10	accommodated	15	Max. accommodation

Table 7 discloses the functionality of Flexible Writing Arm as an armchair with pen compartment in terms of area capacity. It was observed that the pen compartment can accommodate up to 14 ball pens with the dimension of 1 cm Ø x 13 cm. It could also accommodate a maximum of 15 pieces of erasers with the dimension of 3 cm x 2 cm x 1 cm. The researchers had also found out that it could also accommodate a cellphone with a dimension of 7 cm x 15 cm x 1 cm.

Table 8 Functionality of Flexible Armchair as an Armchair with Locker in terms of Area Capacity

Dimension (cm)	**Type of Load (Dim. in cm) Ø = diameter**	**Number of Load**					
		Trial 1	**Observation**	**Trial 2**	**Observation**	**Trial 3**	**Observation**
37 x 31 x 22	book (28 x 21.5 x 3.5)	4	accommodated	6	accommodated	9	Max. accommodation
	magazine	20	accommodated	30	accommodated	48	Max. accommodation

	(26.5 x 21.5 x 6.5)						

Table 8 shows the functionality level of Flexible Writing Arm as an armchair with locker in terms of area capacity. It was observed that the locker can maximally accommodate 9 Encyclopedia books with the same dimensions and it can accommodate 48 magazines with the same dimensions. The researchers had also found out that it could also accommodate a backpack filled with books with a dimension of 30 cm x 40 cm x 15 cm.

Table 9 Acceptability Level of Flexible Armchair

Description	WM	Description	Rank
3.1 Functionality			
3.1.1 The pivot hinge for the small table and drawing board was firm.	3.47	SA	1
3.1.2 The mechanism for rotatable and extendable writing arm was functional.	3.50	SA	
3.1.3 The stopper for the angle of inclination of the drawing board was stable.	3.57	SA	
3.1.4 The locking system of the locker was secured.	3.70	SA	
Average Weighted Mean	**3.56**	**SA**	
3.2 Convenience			
3.2.1 The mechanism for rotatable and extendable writing arm was easy to operate.	3.43	SA	3
3.2.2 The conversion of writing arm, drawing table, and small table was simple.	3.30	SA	
3.2.3 The locker was accessible.	3.67	SA	
Average Weighted Mean	**3.47**	**SA**	
3.3 Aesthetics			
3.3.1 The design conform standard measurements.	3.40	SA	4
3.3.2 The design was modern and contemporary.	3.33	SA	
3.3.3 The design has interesting features.	3.57	SA	
Average Weighted Mean	**3.43**	**SA**	
3.4 Cost			
3.4.1 The cost of the product is acceptable to the market.	3.50	SA	2

Average Weighted Mean	**3.50**	**SA**	
General Average Weighted Mean	**3.49**	**SA**	

Table 9 exposes the acceptability level of Flexible Armchair in terms of functionality, convenience, aesthetics and cost. As displayed, all items for the acceptability of the product were all noted with “Strongly Agree”.

Based from the gathered data, the highest in rank was the functionality with a weighted mean of 3.56 described as “Strongly Agree”. The lowest in rank was the aesthetics category with a weighted mean of 3.43 described also as “Strongly Agree”.

In the functionality category, among the four items being rated, item number 3.1.1 got the lowest weighted mean. However, it was still rated as strongly agree. This means that all items under the functionality level functioned according to its purpose. Thus the respondents found the product to be of high functionality.

Cost ranked second with an average weighted mean of 3.50 described as “Strongly Agree”. The cost of the product was highly acceptable to the respondents despite its high cost due to the respondents’ fulfillment on the product’s high functionality and the convenience it offers to its users.

Third in rank was convenience with an average weighted mean of 3.47 but was still described as “Strongly Agree”. Hence, the respondents found the Flexible Armchair to be convenient to use which was one of the purpose of this study. The mechanism for rotatable and extendable writing arm was easy to operate, the conversion of writing, drawing table, and small table was simple, and the locker was found to be accessible.

Aesthetics ranked last with an average weighted mean of 3.43 but was still described as “Strongly Agree”. It was strongly agreed that the design conforms the standard measurements, modern and contemporary, and has interesting features.

In general, the Flexible Armchair got an average rating of 3.49 interpreted as “Strongly Agree”. This means that the Flexible Armchair was strongly agreed and was acceptable to the respondents.

Findings

The following were the findings derived from the results of the data obtained:

1. The Product Description of the Flexible Armchair

The materials that are needed to make and assemble the product were available on the local shops with acceptable prices. The tools and equipment used were common and were available in the Wood Technology Building where the product was made and assemble. The making and assembling of the product can be done by one woodworker.

2. The Functionality of the Flexible Armchair

2.1 As an armchair with extendable writing arm, it was found out that as the length of extension increases, the maximum weight that the extendable writing arm can carry decreases. In its original position, it can carry up to 27.5 kg. As it was extended to 0.5 cm, it can only carry 25 kg, at 1 cm of extension it can carry 23.5 kg and lastly at 2 cm which is the maximum extension, the maximum weight it can carry decreases to 21 kg.

2.2 As an armchair with small table, it was found out that as the length of frontal extension increases, the maximum weight that the small table can carry decreases. from its original position, it can carry a maximum weight of 7 kg and when extended to its maximum length of frontal extension of 11 cm, it can only carry up to 5 kg.

2.3 In terms of weight applied in different length of sideways extension, it was found out that the maximum weight it could carry increases when it was at the mid-length of extension. From its original position, it can carry a maximum weight of 5 kg. When it is extended 5 cm sideways, the maximum weight it can carry increases to 6 cm for the small table was near at the middle of the arm support. At 10 cm of extension, the table was at the middle of arm support, the maximum weight increases to 10 kg and as the length of extension was extended to its maximum extension which is 20 cm, it decreases to 6.5 kg.

As an armchair with a drawing table, it was found out the as the angle of inclination getting higher, the maximum weight it can carry increases. At 20 degrees of inclination, it can carry a maximum weight of 5 kg, at 25 degrees, the maximum weight increases to 7.5 and as it is inclined

to its maximum angle which is 30 degrees, the maximum weight increases to 11 kg.

2.4 As an armchair with pen compartment, it was found out that the compartment does have enough amount of space to accommodate erasers, ball pens and also a cellphone.

2.5 As armchair with locker, it was found out that the locker can accommodate big books, magazines and also a backpack filled with books inside. The area covered by its dimension was wide and occupies an acceptable amount of space.

3. The Acceptability Level of Flexible Armchair

3.1 In terms of functionality, it had the highest weighted mean of 3.56 described as “Strongly Agree” by the respondents for the pivot hinge, mechanism for rotation and extension was firm, the mechanism for rotatable and extendable writing arm was functional, the stopper for the angle of inclination of the drawing board was stable and the locking system of the locker was secured.

3.2 In terms of convenience, it had an average weighted mean of 3.47 and described as “Strongly Agree”. The mechanism for rotatable and extendable writing arm was easy to operate, and the conversion of writing arm, drawing table and small table locker was simple and the locker was accessible.

3.3 In terms of aesthetics, it had an average weighted mean of 3.43 and described as “Strongly Agree”. The design conforms standard measurements and has interesting feature even it was slightly agreed that the design was modern and contemporary.

3.4 In terms of cost, it had an average weighted mean of 3.50 and described as “Strongly Agree”. The cost of the product was highly acceptable to the respondents despite its high cost due to the respondents’ fulfillment on the product’s high functionality and the convenience it offers to its users.

Conclusions

Based on the results and findings of the study, the researchers concluded that the Flexible Armchair was functional and highly acceptable by the respondents.

Recommendations

Based on the findings and observations, the researchers offer the following recommendations.

1. Have a mass production of the product for the materials were can be bought locally with an acceptable price. Also the tools and materials used were common. Also, the product is functional and acceptable.

2. The researchers recommend to strengthen the arm support of the writing arm to carry more weight. Although it was observed that it is stable enough to be used, it must carry more weight to be more safety in using it.

3.Put a mechanism on the locker that would make it easier and convenient to be drawn it and also to improve its durability.

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