

DEVELOPING AND EVALUATING THE INNOVATED PORTABLE WORKING-DRAWING DESK AS AN INSTRUCTIONAL TOOL FOR INDUSTRIAL TECHNOLOGY STUDENTS OF MINDANAO STATE UNIVERSITY- MAIGO SCHOOL OF ARTS AND TRADES (MSU-MSAT)

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ABSTRACT. *The Mindanao State University – Maigo School of Arts and Trades (MSU-MSAT) Bachelor of Industrial Technology (BIT) students rely heavily on the campus drawing resources, particularly the drawing table, for their drawing activities. Even before the pandemic, there was already a need to build a portable drawing table so that students may generate standard drawing output even if they were not working on campus. This research aimed to create and test the Innovated Portable Working-Drawing Desk as an instructional aid for MSU-MSAT Industrial Technology students. This study used a mixed-method research design. According to the study's results, the instructional tool was built using the ADDIE Model and was assessed using a Likert scale for quantitative data in terms of its (a) Usability, (b) Flexibility, (c) Durability, and (d) Cost-effectivity, yielding a result of Highly Acceptable. Thematic analysis using open-ended questions was used to analyze the qualitative data in terms of features that are liked most by the respondents, which yielded three (3) key themes: (a) Comprising Design, (b) Suitable Design, and (c) Sturdy Design. The Innovated Portable Working-Drawing Desk is a great instructional drawing tool for MSU-MSAT Industrial Technology students.*

Key Words: Usability, Flexibility, Durability, Cost-effectivity, Portable Drawing Table

1. INTRODUCTION

The coronavirus disease, more popularly known as COVID-19, has dramatically affected the education sector in the Philippines [1]. Since the confirmation of local transmission way back in March 2020, the government has issued policy measures in response to the growing capacity of the pandemic, and the effect has impacted the education sector, suspending classes at all levels in the entire country [2]. Hence, Colleges and Universities in the different parts of the Philippines are left with no option but to shift from the traditional style of face-to-face teaching to an e-learning format [3]. Most students in engineering departments, especially in architecture or drafting courses, spend most of their time operating on the drafting tables [4]. During the height of COVID-19 cases, the Bachelor of Industrial Technology (BIT) Students of MSU-MSAT were not allowed to use the drawing facilities of the campus. Because of the restriction implemented by the Inter-Agency Task Force (IATF) makes it hard for these students to produce a standard drawing output without the help of the drawing facilities that are exclusively available only inside the campus. Many drawing tables exist in the market today, but each has its limits and disadvantages [5]. This makes it not practical to use among the BIT students of MSU-MSAT. The researcher developed an Innovated Portable Working-Drawing Desk that will be evaluated in terms of Usable, Durable, Flexible, and Cost-efficient which will aid the BIT students in making their drawing activities off-campus. Figure 1 shows the parts of the Innovated- Portable drawing table.

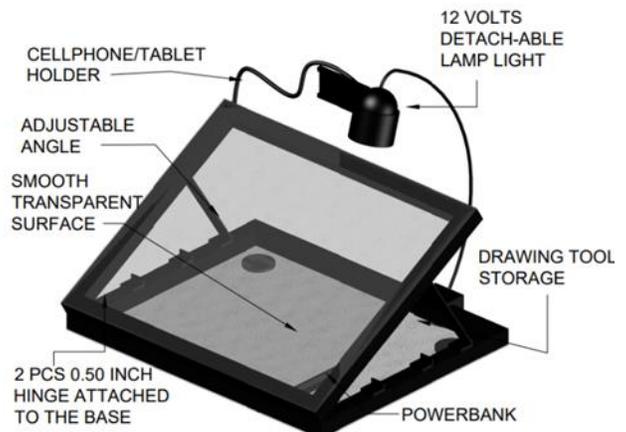


Figure 1. Parts of the Innovated-Portable-drawing Table

Conceptual Framework

This section of the research paper discusses the direction of the study. Figure 1 shows the conceptual framework of the study. It determines the four (4) factors of the level of acceptability upon evaluating the study's dependent variable. These factors include usability, cost-effectivity, flexibility, and durability. In addition, thematic analysis was also used to determine the features of the said innovation that the respondents liked. Figure 2 presents the flow of the study.

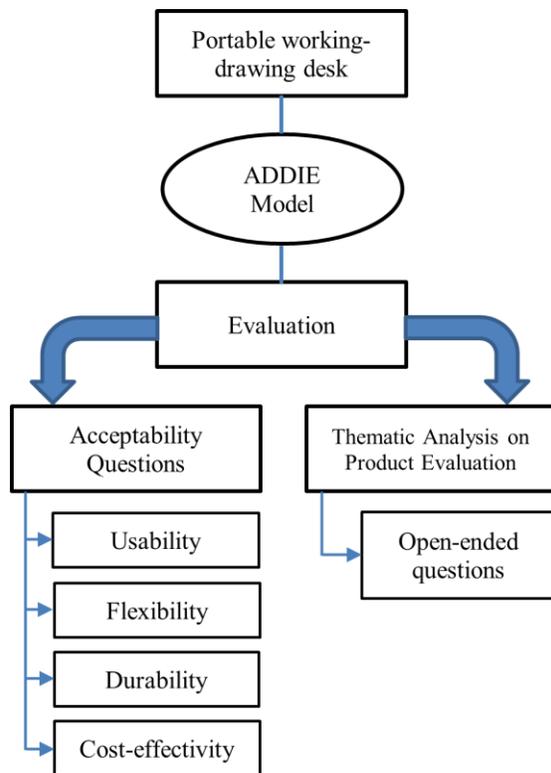


Figure 2. Process flow of the research project

2. METHODOLOGY

This study utilized the mixed-method research design to gather quantitative and qualitative data. Mixed methods research incorporates quantitative and qualitative research parts to answer the research problems [6]. The research questionnaire was adapted from the recent study by Casas et al. (2018) entitled "Development and Evaluation of the Multi-functional Drafting Table." The said research questionnaire was further validated by two expert faculties of the same universities. For the quantitative data, the researcher measured the level of acceptability of the Innovated Portable Working-Drawing Desk using a Likert scale in terms of its (a) Usability, (b) Flexibility, (c) Durability, and (d) Cost-effectivity. Using the four-point scale forces respondents to choose [7]. Table 1 shows the scoring guidelines on the four variables in the Likert scale used.

Table 1. Likert Scale for evaluating the usability, flexibility, durability, and cost-effectivity satisfaction of the respondents on the portable working-drawing desk

Weight	Scale	Verbal Interpretation	Descriptive Rating
4	3.26 – 4.00	Extremely Satisfied	Highly Acceptable
3	2.51 – 3.25	Very Satisfied	Very Acceptable
2	1.76 – 2.50	Slightly Satisfied	Not Acceptable
1	1.00 – 1.75	Not at all Satisfied	Highly Not Acceptable

Thematic analysis through open-ended questions was also deployed to determine the best features of the said innovated drawing tool. The researcher began the permission process by writing a letter to the Dean of Instructions' office. Meanwhile, the researcher observed and explained to the respondents the ethical considerations in data collection that they are taking part in the research, the objective of the study (without identifying the primary research question), the research methods, the voluntary nature of research involvement, and the measures utilized to maintain anonymity [8].

The respondents were allowed to use the innovative table in their drawing activity during the testing phase. The respondents were given enough time to try and explore the innovative table. After testing and exploring, they were then given the validated research instrument to evaluate the level of acceptability of the innovated product in terms of its (a) Usability, (b) Flexibility, (c) Durability, and (d) Cost-effectivity. Included in the questionnaire were open-ended questions in which the researcher interviewed and asked the respondents about the features of the Innovated Portable Working-Drawing Desk that they liked the most.

The study participants comprised (1) BIT students who are currently enrolled for the academic year 2021-2022 at MSU-MSAT and who had experienced manual drawing courses and (2) active Faculty members of the same campus who are teaching drawing courses. There were 57 respondents for this study which was composed of 52 students and five (5) faculties who were selected through a purposive sampling technique. The 52 students are the department's entire four Industrial Technology Majors, namely the Drafting Technology (DT), Automotive Technology (AT), Electrical Technology (ET), and Mechanical Technology (MT).

3. RESULTS AND DISCUSSION

The acceptability of the Innovative Drawing Table

Table 2. Level of acceptability of the innovated portable-drawing desk in terms of usability, flexibility, durability, and cost-effectivity

Criteria	Mean	SD	Description	Interpretation
Usability	3.88	0.21	Extremely Satisfied	Highly Acceptable
Flexibility	3.90	0.20	Extremely Satisfied	Highly Acceptable
Durability	3.82	0.32	Extremely Satisfied	Highly Acceptable
Cost-effectivity	3.90	0.29	Extremely Satisfied	Highly Acceptable
Overall Rating	3.88	0.26	Extremely Satisfied	Highly Acceptable

Table 2 shows the acceptability of the innovative portable-drawing desk in terms of usability, cost-effectivity, flexibility, and durability. It shows that the usability ($m=3.88, sd=0.21$), cost-effectivity ($m=3.90, sd=0.29$), flexibility ($m=3.90, sd=0.20$), and durability ($m=3.82, sd=0.32$) are highly acceptable among the respondents. The overall rating of the product is highly acceptable. The standard deviation also shows how dispersed the data is about the mean, and it shows close to zero, indicating that data points are close to the mean.

Usability is related to user-friendliness[9], which is a character of the Innovated Portable Drawing Desk because it is easy to use and can perform just like the traditional drawing table. Good flexibility is one of the most significant merits of any industrial tool than its inorganic counterparts [10]. The Innovated Portable Drawing Desk is flexible enough to allow movements in joints in different angles of inclinations in preference of the end-users, which is not present on the traditional drawing tables. It is also flexible enough to be portable which means that it can easily be transferred from one place to another. The durability of this product also got a result of Highly Acceptable because it uses an aluminum frame and Fiber Reinforced Polymers (FRP), which is lightweight, with high strength, and highly durable [11]. The cost-effectivity of this product also obtain a result of Highly Acceptable because it uses materials that are cheap but don't compromise the quality.

Features of the innovative portable-drawing desk

The findings presented in this section sought to present the qualitative part of the study: What features of the innovative portable working-drawing desk were like most by the respondents? Personal interviews were done to collect the data to provide an in-depth understanding of the innovative portable drawing-desk features. A directed content analysis approach was employed in the thematic analysis of the data from 57 personal interviews conducted. Following the direct content analysis approach, three main themes emerged in the data analysis. These three main themes are labeled (a) Comprising Design, (b) Suitable Design, and (c) Sturdy Design. Presented in table 4 are the codes, categories, and themes.

Table 4. Themes that emerged from the personal interview data on the features of the innovative drawing table

Code	Categories	Themes
Easy monitoring for a synchronous class activity	Convenient to use	Comprising Design
Suitable for drawing activity in both online and offline	Multiple functionalities	
It has multi-function features.		
Can enhance the drawing activity		
Easy to adjust	Ease to set -up	Suitable Design
It gives comfort when sketching		
Suitable to use while in mobile	Transferable	
Easy to carry anywhere	Lightweight	Sturdy Design
It has a strong foundation	Firm in nature	

Comprising Design

The Comprising Design theme has two categories: the convenience to use and multiple functionalities and is further supported by 25 statements. During the personal interviews, respondents shared that using the innovative

drawing table can improve the monitoring of the students during synchronous class. It can also be used during offline classes. It has multi-function features that enhance their drawing activity.

The innovative table has a cellphone holder that can be used for online monitoring. According to respondent number 1, *"I like the mounted cellphone/tablet holder because I can monitor my students when we have a synchronous drawing activity. It assures me that my students are the ones who are doing their drawings because I can now watch them if we have online class/activity"*. This was also confirmed by respondent number 2, *"I like the most is it has a built-in cellphone holder because it helps me when copying a drawing from the internet. Also, the said innovation has multi functions that can enhance the drawing activity of the students"*. Respondent number 12 said, *"the product can be used easily, and it has a smooth surface good for drawing. It also has a lamp light that helps draw even in dark places"*. Also, respondent number 11 reiterated, *"It has a transparent surface... can make the student productive in drawing at home"*.

The cellphone/tablet holder being part of the Innovated Portable Drawing Desk makes the drawing much more comfortable and much modernized because they can look at their phones to access the drawing materials they want to draw. Because of this, it eliminates the usage of printed hard copies of drawing references. Because of the fast advancement of mobile communication, numerous functions and communication systems must be combined into a mobile phone[12]. Students nowadays have every reason to be concerned. They have witnessed a wave of change that has altered every aspect of their life [13]. Given this information, the Innovated Portable Drawing Desk included a smartphone holder, allowing students to set their phones in their desired comfortable location within the drawing space. Cellphones are increasingly the primary devices many students use to attend class and store data. Because of this widespread use, many educators are hopeful about mobile phones' potential as a learning tool [14].

.Suitable Design

The suitable design theme has three categories: (1) easy to set up, (2) transferable, and (3) lightweight, and of the 57 total respondents, 53 supported this claim. During the interviews, respondents shared their thoughts that the said innovation can be easily adjusted, which gives comfort while performing the drawing activity at their convenient place.

According to respondent number 22, *"the thing that I like about this product is it is adjustable, and also it is very easy to move from one place to another."* This was also confirmed by respondent number 23, *"It is easy to use because it is comfortable and can be adjusted to a different angle of inclination."* Furthermore, respondent number 14 said, *"the drawing surface can also be adjusted to a different angle, and it is portable."*

According to respondent number 3, *"What I like about this innovation is that it is very light and flexible, which means that our students can now do their drawings*

in their houses. They don't need to depend on the campus' facilities (drawing table). I will recommend this product because it is very timely and useful to anyone withdrawing subjects". Respondent number 5 also said, *"you can bring it anywhere, and it is so lightweight. The drawing surface is clear, and there is a comfort to anyone who will use the product".*

The most crucial aspect of successful innovation is the creation of value[15]. It accomplishes this by either enhancing current things, processes, or services or establishing valuable goods, processes, or services that did not previously exist [16]. The lightweight materials used in creating the Innovated Portable Drawing Desk are critical because this must at least match or exceed the usefulness of the present drawing table while being light enough to be moved easily from one location to another. A smooth and transparent drawing surface is also a priority in the design of the Innovated Drawing Desk since it adds functionality and comfort to end-users.

Sturdy Design

The durable theme has only one category, which is firm in nature and supported by ten respondents. During the personal interview, respondents shared their thoughts that the said innovated drawing table has a strong foundation and surface.

The innovative drawing table is made of polycarbonate glass, and the foundation is also made of alloy steel. Hence, respondent number 17 said, *"the drawing board is smooth and cannot be broken easily."* This was also confirmed by respondent number 25, *"I like it because it is portable and very easy to use. The drawing surface is also good for drawing, and it is very modern in design and the solid materials used"*.

Most innovations survive for a long time, while others die out after a brief period of prosperity[17]. The materials used in creating the innovative portable drawing desk were carefully chosen. Its life span expectation was thoroughly examined for lasting for a long time. The claimed innovation's construction is strong since it employs rivets rather than bolts and screws, which means it will not loosen with time. Furthermore, the metals utilized to create the invention are free of rust.

4. CONCLUSION AND RECOMMENDATIONS

According to the data gathered, respondents rated the innovated portable working-drawing desk as very acceptable in terms of functionality, durability, cost-effectiveness, and flexibility/portability. Additionally, it also has modern features and is significantly lighter in weight. Furthermore, the commercial drawing table is difficult to locate and obtain because it is mostly unavailable in Lanao del Norte.

Due to the portability and functionality of the Innovated Portable Drawing Desk, the BIT students of MSU-MSAT can now draw in their respective homes or outside the drawing laboratory of the campus. This will not compromise the quality of their drawing output because the instructional tool equally functions as a standard drawing table. The Innovated Portable Drawing Desk

outperformed the standard drawing table in many aspects such as functionality, usability, flexibility, and cost-effectivity.

The device is lightweight and portable in nature and can solve the problem of students relying upon the campus' drawing facilities, particularly the drawing table, to produce good and standardized drawing outputs. The device can be used anywhere, and the additional features, namely the built-in cellphone/tablet holder, help them to draw with ease by putting their cellphone in the holder while they follow the drawing reference sent to them by their instructors. Because of this, the instructor no longer needs to print hard copies to be given to their students for drawing reference, which was very hard, especially during a pandemic when students could not get hard copies from their instructors. Another feature that stands out is the smooth and transparent drawing surface which can also be used to trace drawings by putting the drawing at the back and placing the lamplight next to it to project the drawing. The lamp light is also included in the device, and it is also flexible and detachable.

Limitations of the Study

This study is limited only to the BIT students of MSU-MSAT. The researcher highly suggested conducting this study to other Universities offering Drafting-related programs and/or in Technical Education and Skills Development Authority specifically for Technical Drafting National Certificate Level II that, up to this date, still uses the standard drawing table as part of their programs.

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