Development And Evaluation of Automated Improvised Industrial Portable Animator's Desk (IPAD) in Teaching Animation

Rodelyn T. Vertudazo[1], Marites M. Cumbe[1], Billie Jack DR. Pasion[1], Patrick Neil M. Santiago[1]

[1]*Faculty, College of Industrial Technology, Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines.*

Corresponding Author: patrickneilsantiago1@gmail.com

Abstract: - This study focused on the development and assessment of an Automated Improvised Industrial Portable Animator's Desk in Teaching Animation. It is a piece of equipment that can be utilized in the field of traditional animation, both in academia and industry. The concept of the AGILE model was applied in this study. The research findings are summarized as follows: 1. the development of the automated improvised IPAD goes through planning and data collection, followed by the actual construction of the device, which involves materials estimation, and cost and benefit analysis; 2. the researchers evaluate the technical features of the Automated Improvised Industrial Portable Animator's Desk based on ISO/IEC 25010 Standards such as functional suitability, reliability, usability, and portability; and 3. the level of effectiveness of the implementation of the Automated Improvised IPAD was assessed and described. The researchers gathered animation teachers, TESDA assessors, and practitioners from the industry. The respondents' positive response qualifies the developed automated improved IPAD as an innovation in traditional animation technology.

Key Words: — ***Animation, Automated Improvised IPAD, Portable.***

I. INTRODUCTION

Now everyone can pick up a drawing tablet and express themselves to the world. Figure drawings can be humorous or can create a more inviting ambiance to put the viewer at ease. Sometimes, a compelling and thought-provoking story was told through drawings. Despite how different their beliefs and opinions may be, it enables individuals to come together around a single passion, such as a fandom, and collaborate on massive projects concerning that passion to produce something of the quality of an excellent professional film. Therefore, regardless of personal ideas, biases, or interests, art is one of the most potent creative instruments for bringing people together.

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Art is, in fact, pragmatic utilitarian.[1] Art plays a significant role in both the intellectual and industrial worlds, as well as in the daily lives of every individual. To audiences of all ages, artistic media is utilized to communicate views and thoughts in a particular, understandable way.

In the realm of contemporary art, animation has become increasingly popular. People from all over the world are now more unified as a result of animation. Animation is utilized on the internet to market goods and services to the target market in the information age. The usage of animation appears to be a unique audience engagement technique that helps convey the information and message.

Technological innovation and advancement in the economic sphere have made animation increasingly useful and necessary. It is now impossible to overlook the importance of animation in business.[2] It is only logical to put technology into practice as it is transforming so many aspects of business. While in academia, the value of animation in instruction is practically necessary because of all the ways it can benefit pedagogy. Educational quality can be raised by including animations into lessons. Animation is known for its educational advantages. Any concept can be expressed in a lively and aesthetically pleasing manner. It has been demonstrated through research that dynamically depicted processes are easier to remember

than oral memorization. Additionally, the educational system significantly affects the opinions and personalities of students who will go on to lead the globe in a variety of roles in the future.

Animation created by hand on paper is frequently referred to as traditional animation. For the majority of works produced in the 20th century, it served as the method used. Del Rosario promotes Filipinos' inventiveness and creative talent, and their mission is to challenge animators and artists to produce more original work.[3] The Animation Council of the Philippines, Inc. (ACPI) is a non-stock and non-profit group whose member companies mostly specialize in conventional and digital 2D and 3D animation. By offering Filipino animators workshops, ACPI helps to grow the industry. In fact, when developing the curriculum and training regulations, ACPI worked with the Philippine education sector, including the Department of Education (DepEd) for basic education, the Technical Education and Skills Development Authority (TESDA) for technical-vocational and middle-level education, and the Commission on Higher Education (CHED) for tertiary and graduate education. All industries now encourage innovation-inspired creativity, which is timely given that staying at the top of the ladder needs all of one's acquired skills and that competition is increasing daily.

The demands of children's comprehension can no longer be fully met by the old learning framework, which has not kept up with recent pedagogical advancements. As a result, training in animation is promoted for teachers, ideally traditional animation like Animation NC II and 2D and 3D computer animation.

A short TESDA course called Animation NC II will teach participants how to create cleaned-up and in-between drawings both during production and post-production.[4] The majority of an animation student's training time is spent in front of a light box. They must produce cleaned-up and in-between two-dimensional (2D) drawings in order to finalize the primary designs that have been provided. The light box's size, weight, and space are excessive, and it runs on electricity, which consumes a lot of power.

Based on the researchers' investigation, notably in drafting and animation technologies, respectively, the hardship of students when doing repetitive tasks is a common problem encountered during the practical exercises of the students when engaging in their shop activities. At the top of a typical drawing table, students frequently sketch their key and in-between pieces on animation paper.

In clean-up, line quality is crucial. Every production is unique, and everyone will have various needs in terms of the clean-up artist's line quality. The lines of body parts that are closer to the camera are drawn thicker than those that are farther away from it. Other examples of different production requirements for line quality include: a sketchy line that suits photocopying on cell; one clean straight line; a thick bold line on the outline and thinner lines on the inside of the character; each line moving from thin to thick and back to thin again, replicating the line produced by a brush and ink.

In response to this issue, researchers are of the view that new technologies in education are suited for removing technological challenges in order to enhance students' performance on their assignment sheets. The researchers sought to create and improve an innovative gadget that is less expensive than a typical light box and will aid and enhance student performance when completing repetitive exercises in order to address this issue while also incorporating novel and improvised technologies. Furthermore, the proposed animator's desk might be eligible for patenting in order to look into its potential for commercialization.

II. Review Literature

Today, all industries encourage innovation because the competition is increasing exponentially on a regular basis. One needs to possess all talent they can to stay at the top of the ladder. It makes sense to use them because technology is transforming so many facets of company.

2.1 Technological Innovation

Branscomb defined technological innovation as the successful application of a technical notion that was novel to the institution that developed it (in management or commerce).[5] Innovations can come from any of the three, but they are distinct from inventions, technology, and research. Additionally, it has a significant impact on organizational populations by upending markets, altering the relative value of resources, testing organizational learning capacity, and changing the basis of competition.[6]

Berghoff claimed that technological innovation, whether it is self-started or begun by a third party, is essential to the growth of many firms and serves as a vehicle for the adoption of new technologies into the economy.[7][8] Moreover, technical innovation was prioritized over other types of innovation, and it has continuously changed how medicine and the provision of healthcare services are practiced.[9][10]

The last century has seen an evolution in how people may engage and communicate with one another because to technological advancement. Also, it can help reduce energy consumption by improving appliance efficiency, which entails finding ways to provide the same amount of output (or more) with a smaller amount of energy input.[11]

Furthermore, technical advancement in the creation of the automated improvised Industrial Portable Animator's Desk has a significant impact on both students and instructors. It will ease many students' challenges in juggling their various tasks. If students have this device, the automated, improvised IPAD's involvement in their daily lives and during their activities will decrease. Students won't have as much of a daily hardship using the large and energy-guzzling standard light box.

2.2 The Role of Technological Innovation in Education

The education system has a significant part in forming the attitudes and personalities of students who will go on to lead the world in a variety of roles in the future. The traditional learning framework, which is in line with the most recent pedagogical advances, can no longer fully satisfy the understanding needs of these young people.

At all levels of education, technological advancements are having a big impact. The traditional classroom setting is being disrupted by online courses, teaching aids, educational software, social networking tools, and other developing technology. In addition, as the world enters the 21st century, technology has assimilated into people's daily life. Every aspect of society has been affected by technological advancements, which have changed how individuals go about their daily lives. It altered how people study, work, shop, and interact.

Technology is finally being integrated into school, but using it for teaching and learning is still difficult, according to a study on its place in the educational process. The usage of technology in the classroom is still minimal even though many schools today are fortunate to have ready access to technology, trained instructors, and a supportive regulatory climate.[12]. As the Fourth Industrial Revolution begins, it is obvious that technology will be a major factor in almost every area of people's lives.[13]

The approaches utilized in the classroom, according to Thrasyvoulou, not only need to keep improving, but also must harness the effects of the digital revolution in a beneficial and constructive way.[14] Increased classroom engagement and easier, more effective learning can result from developing curricula that recognizes the value of technology in the learning process. A crucial component of enhancing education is also showing individuals what learning might be like. Students, educators, administrators, parents, decision-makers, and community members all share strikingly similar perceptions of what education entails, and these perceptions have remained mostly unchanged since that time.[15]

2.3 The Role of Technological Innovation in Commerce

The Philippine animation market is already established. For the past 30 years, local animators have offered animation services. Although the nation enjoyed first-mover advantage, its present proportion of the global animation business is still underwhelming compared to the demand for animation services outside. It is past time for the Philippine animation sector to take a larger share of the world market. The Asia-Pacific area has been able to further establish itself as a top location for outsourcing animation because to the ongoing demand in the global animation business. China, India, Singapore, South Korea, and the Philippines are the key nations in the area.

The management effectiveness of businesses can be improved, according to a study on the role of technology innovation in business administration. Enhancing an organization's operational effectiveness benefits the organization and promotes long-term growth. Innovation not only enables businesses to remain competitive in the market, but it also has a significant impact on economic growth.[16] New technologies are necessary to solve pressing issues, and developing nations in particular need them more than ever.

Holyoak asserts that there are countless reasons why technology is significant in business.[17] Technology's influence in business is growing and will continue to do so in the future. Utilizing the latest technical advancements is something that companies owe to their operations, personnel, and bottom line. Businesses must embrace the advantages of technology rather than downplay its significance in the workplace. Holyoak also listed the reasons why technology is crucial to commerce, including the following: (1) technology enhances business communication; (2) technology increases efficiency; (3) technology keeps employees engaged; (5) tons of new resources exist that can improve business; (6) technology increases the capacity of businesses; and (7) technology saves lives.[17]

On the other hand, Gerber claimed that with so many new applications and innovations at work, he wrote down the following potential innovative technologies with potential impact in commerce: (1) 5G networks; (2) mainstream block

chain apps; (3) more AI-enabled platforms for automated work; (4) machine learning for customer service; (5) 3D printing; (6) new security measures; (7) augmented reality; and (8) more AI solutions for small- to medium-sized businesses.[18]

2.4 Patented Innovation

Innovation is defined as a novel action that enhances a good, method, or service. Intellectual property (IP) rights can be used to safeguard many innovations.[19] Protected innovation, according to White, paves the way for more of the same. They are directly responsible for the formation of more variants, yet they are unknown and unknowable to the creators of one version.[20] Modeling an original item or accurately replicating the structure of a piece of gear or equipment could be considered improvisation.

The "Light Box Assembly" invention by Newman was granted a patent by the United States on February 5, 1974, whereas the "Light Box with a Solar Panel Cover" invention by Fogerlie was authorized on September 27, 2005. The same patenting agency also reviewed and granted Jacqueline Durand's "Photographic Light Box" idea on February 15, 1972. The United States has filed a patent for Sigurd A. Johnson's invention, the "Light Box." Patented on November 29, 1983, whereas Francesca Allen's invention, the "Art and Animation Light Box," was given a United States Design Patent on July 27, 2004. The invention of the makeshift Industrial Portable Animator's Desk was inspired by these patent developments (IPAD).

2.5 Relevance of Reviewed Literature and Studies to the Present Study

The literature reviewed in this section made the researcher aware of the need for the automated improvised Industrial Portable Animator's Desk (IPAD) to be developed in order to teach animation. The suggested animator's desk could be used to produce clean-up key drawings (provided by the trainer) and in-between drawings (drawn by the trainees).

III. RESEARCH METHODOLOGY

The research method for the study combined descriptive and developmental approaches. According to Richey and Nelson, developmental research is a systematic investigation of the design, development, and evaluation of instructional processes, products, and programs that must meet internal consistency and effectiveness standards.[21] On the other hand, descriptive research, which is frequently utilized in the behavioral sciences, nutrition, epidemiology, and education, is a study of status.[22] The value of descriptive research is predicated on the notion that by observation, analysis, and description, problems can be resolved and processes can be enhanced. It has been said that developmental research is given special attention in the field of instructional technology. One of the most widely researched designs is for product development, where the developed product is examined, described, and then evaluated.

Twenty-eight (28) participants evaluated the automated improvised Industrial Portable Animator's Desk (IPAD). The distribution was as follows: three (3) TESDA Assessors; three (3) Animation Trainers; twelve (12) Animation Teachers; and ten (10) Industry Practitioners in the provinces of Tarlac, Nueva Ecija, and the City of Quezon, Philippines.

The content validity of the instrument was evaluated by the research critics. A number of gatherings and discussions were held in order to confirm the legitimacy and trustworthiness of the items in the surveys. Respondents were given questionnaires to complete in order to evaluate the primary instrument's content.

The developed questionnaires' reliability was confirmed by the Cronbach's Alpha of 0.87, which indicates that using the questions' usual consistency as a good indicator of the instrument's reliability.

IV. RESULTS AND DISCUSSION

This study utilized the AGILE model concept to build the automated improvised (IPAD).

4.1 Development of the Automated Improvised Industrial Portable Animator's Desk according to the AGILE Model

The development of the automated improvised IPAD followed the phases of the AGILE model such as Plan, Design, Develop, Test, Deploy, Review, and Launch. The planning phase described requirements gathered while the design phase focused on the draft plan and electrical circuit diagram. The development phase is the actual construction of the developed device and considers the materials and its cost and benefits analysis. Likewise, it is in this phase that the test phase was performed. The deployment phase is the actual set up of the automated improvised IPAD for its intended users, and they were asked to assess the developed device. The review phase focused on scrutinizing the evaluation tool used by the respondents. The launch phase is the final product's launch into its designated learning environment.

4.1.1 Plan

It is in this phase that the researcher collects all the requirements needed in the development of the automated improvised industrial portable animator's desk, such as the features of the developed device and Gantt chart of development.

The automated improvised IPAD, being considered as innovative equipment in the animation industry and institutions, has the functionality of the traditional light box. However, it has notable features that make it unique from others. The researchers' developed device is automated, meaning that the animation disc can rotate in a clockwise and counterclockwise direction automatically. It has a built-in stand that can be adjusted to different angles, a built-in compartment that houses animation tools, and a built-in sharpener.

Table.1. Gantt chart of the Automated Improvised Industrial Portable Animators Desk

ACTIVITIES	SEPT 2021				OCT 2021				NOV 2021				DEC 2021			
PLANNING																
DESIGNING																
DEVELOPING																
TESTING																
DEPLOYING																
REVIEWING																
LAUNCHING																

4.1.2 Design

The design phase focused on the draft plan and electrical circuit diagram of the automated improvised IPAD.

4.1.2.1 Blueprint

The construction of precise representations of objects or buildings for technical, architectural, or engineering reasons is known as drafting. In drafting, objects are drawn to scale, and usually the draft comprises a top view, a main view, and a side view of the object or building. Draft plans are usually very detailed and are often used as blueprints for the construction or assembly of an object.

The orthographic and isometric views describe the draft plan of the researcher's developed device that helps her a lot during the construction of her automated improvised IPAD. The draft plan was designed and presented in a 2D wireframe model using a Computer-Aided Design (CAD) system. Figure 1 shows the 2D orthographic view of the top box of the automated improvised IPAD. Likewise, Figure 2. shows the 3D isometric of the product.

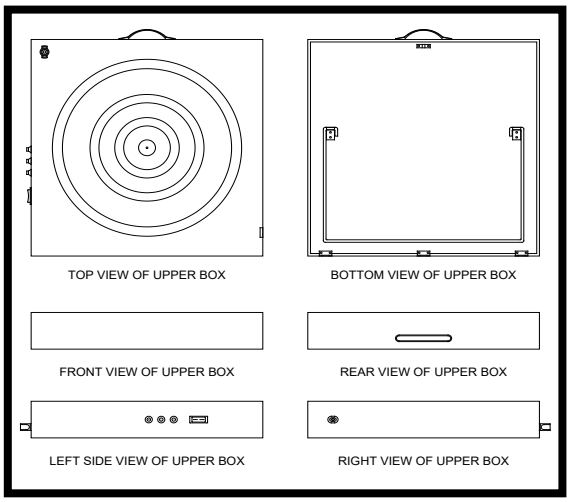

Fig.1. 2D Orthographic View of the Automated IPAD's Top Box

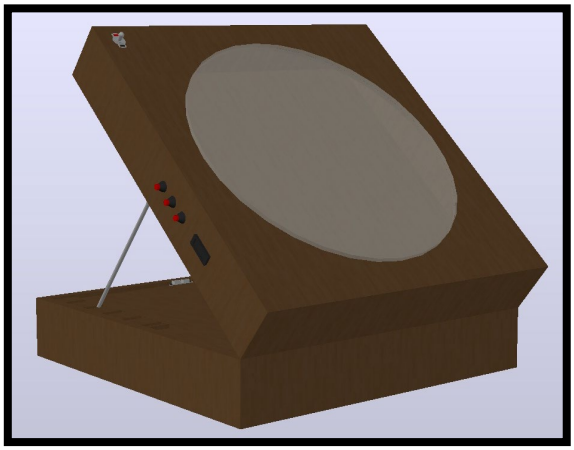

Fig.2. 3D Isometric View of the Automated Improvised IPAD

4.1.2.2 Electrical Circuit Diagram

The electrical circuit diagram of the researcher's automated industrial IPAD is composed of a 12V – 6000mAh lithium-ion battery, a 12V DC motor, LED (circular panel), motor controller, LED controller, buck converter, toggle switch, and push button switch. The function of the 12V–6000mAh lithium-ion battery is to supply power to the DC motor and light-emitting diode. The function of the motor controller using the reverse-forward switch is to control the rotation of the animation disc in a clockwise and counter-clockwise direction. Furthermore, it has its own push button switch to turn on or off the motor controller. The toggle switch controls the overall operation of the electrical circuit functionality of the device. The function of the LED controller is to manually dim or brighten the luminance of the LED.

A buck converter is a DC-to-DC power converter; the sole purpose of it is to step down voltage from its supply to its load. Figure 3 shows the electrical circuit design of the IPAD.

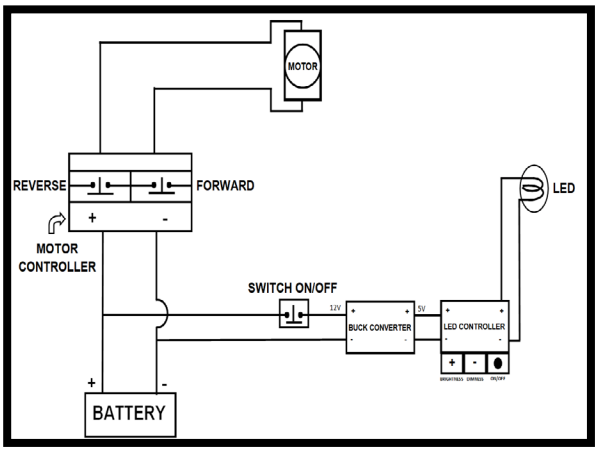

Fig.3. Electrical Circuit Diagram of the Automated Improvised (IPAD)

4.1.3 Develop

The development phase of the automated improvised IPAD begins with the purchase of the materials needed in the construction of the device. It is also in this phase that the cost and benefit of the project have been analyzed.

4.1.3.1 Materials

Materials play a vital role in the construction of any project. They can be classified into consumable and non-consumable materials. Consumable materials used in the project are epoxy primer, body filler, sanding sealer, paint thinner, tinting color, wood glue, sand paper, and finishing nails. The body filler was utilized to make the surface of the wood smooth and repair minor damage on the wood, while the epoxy primer was used as the binding ingredient between the wood and the topcoat paint used in the developed device. To make an ultra-smooth foundation, the researcher used sanding sealer as the base coat of an automated IPAD and sandpaper to make it smoother. The wood glue and the finishing nail were used to connect and bind the different components of the developed device. The tinting color was used to de-saturate the epoxy primer to make it less intense, while the paint thinner was used to clean up the paint brush after use.

There are two groups of non-consumable materials used in the construction of the automated improvised IPAD. These are the materials used in the main body of the device and the electrical materials.

Plywood, plank wood, acrylic glass, stainless rod, butt hinge, cabinet handle, and plastic sharpener are the materials used in the main structure of the device. Figure 4 shows the non-consumable materials utilized in the project.

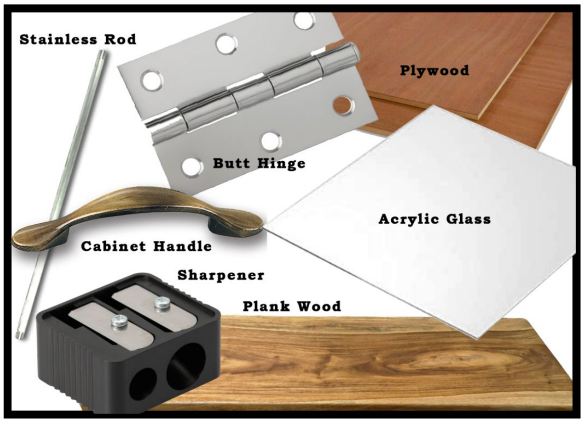

Fig.4. Non-Consumable Materials used in the Main Body of the Automated Improvised (IPAD)

The main components of the developed device were plywood and plank wood, while acrylic glass was engineered to serve as the animation disc. On the other hand, the stainless rod was fabricated and utilized as the stand of the inclining part of the automated IPAD. Moreover, the butt hinge was used as the connector between the upper and lower boxes, while the cabinet handle served as the knob of the researchers' device. Moreover, the plastic sharpener was an additional feature of the IPAD with a separate drawer.

On the other hand, electrical components of the device are also considered non-consumable. Figure 5 shows the electrical non-consumable materials used in the development of IPAD.

Fig.5. Non-Consumable Electrical Components used in the Automated Improvised IPAD

The lithium-ion batteries' purpose is to provide power to the DC motor and LED, while the reverse-forward switch on the motor controller controls the rotation of the animation disc in both clockwise and counter-clockwise directions. The push button switch was used for turning the motor controller on and off, while the toggle switch is in charge of the device's entire electrical circuit performance. The LED controller's purpose is to manually lower or brighten the LED's brightness with the aid of the buck converter.

4.1.3.2 Cost and Benefit Analysis

When developing new technological innovations, it is critical to consider the product's cost and benefits. The researcher imagined the automated improvised IPAD, taking into account all variables that may assist her in providing alternative solutions and advantages to targeted end-users while conserving and decreasing costs. The project's expenditure was composed of consumable and non-consumable materials and labor costs. Table 2 shows the total cost of the project.

Table.2. Total Costing of the Automated Improvised IPAD

Quantity	**Unit**	**Materials**	**Price**
1	pc	16.5" x16.5" Transparent Acrylic Glass	₱990.00
4	pcs	20cm x 20cm ¼ Nebraska Plywood	₱200.00
4	pcs	20cm x 3.5cm Plank Wood	₱100.00
4	pcs	20cm x 3cm Plank Wood	₱100.00
1	pc	Cabinet Handle	₱20.00
1/4	kl	1" Finishing Nail	₱10.00
1/4	kl	1 ½" Finishing Nail	₱10.00
1	pc	Plastic Sharpener	₱12.00
100	gm	Wood Glue	₱30.00
1	m	16mm Stainless Rod	₱100.00
3	pcs	1" Butt Hinge	₱30.00
250	gm	Sanding Sealer	₱130.00
100	gm	Body Filler	₱50.00
400	ml	Paint Thinner	₱30.00
2	pcs	Sanding Paper	₱30.00
1	pint	Tinting Color	₱70.00
1	pc	Toggle Switch	₱20.00
3	pcs	Push Button Switch (Normally On)	₱15.00
1	pc	12V Battery Charger	₱150.00
9	pcs	12V 6000mAh Lithium Ion Battery	₱315.00
1	pc	12V DC Motor	₱250.00
3	mts	Automotive Wire	₱24.00
1	pc	26cm Ring Light	₱120.00
1	pc	20cm Ring Light	₱100.00
1	pc	12V – 5V Buck Converter	₱190.00
1	pc	Forward-Reversed Switch	₱300.00
		Labor Charge	₱1500.00
		Total	**₱4,896.00**

According to the table, the total cost of the researchers' project was ₱3,396.00 plus an additional ₱1,500.00 for labor, for a total cost of ₱4,896.00. A light box costs ₱12,200.00 on the market right now. This means that the developed automated improvised IPAD is significantly less expensive than the existing animation light box. The researchers created the automated improvised IPAD in two (2) weeks. If the maker of the animator's desk were a professional or skilled worker, the construction may be done in a couple of days as long as all the materials are available, all set and accessible.

The researchers' project, aside from being automated and having a built-in sharpener, is indeed very economical and very useful. The animation industry, schools, and training centers offering animation competencies will benefit if this device is available in the market. It will eliminate the manual rotating of the animation disc, which usually consumes minimal time.

4.1.4 Test

The testing phase of the product was carried out throughout its development so that the researchers could spot any flaws in the device as soon as possible. This makes it possible to address issues as they arise throughout development. Figure 6

demonstrates the various tests the researchers are running on the apparatus.

Fig.6. The Automated Improvised IPAD was tested

4.1.5 Deploy

This phase saw the deployment of the product to its target users following the researchers' thorough development and testing of the product. The researchers also ask them to evaluate the automated, homemade IPAD once they've used it. All of the data was, according to the researchers, utilized solely for research.

4.1.6 Review

The assessment tool responses given by the respondents during the deployment phase are scrutinized, analyzed, and interpreted by the researchers at this stage. The study used two different kinds of evaluation tools: a real instrument and a Google form. The responders who wished to respond to the instruments right away after reviewing and using the built IPAD used the actual instrument. However, several respondents preferred to use the tool using a Google form rather than the actual tool.

4.1.7 Launch

The Automated Improvised Industrial Portable Animator's Desk (IPAD) has reached this point and is always available in the College of Industrial Technology. It has been finally deployed into its intended learning environment. Figure 7 depicts how the finished product is set up in CIT's drawing room.

Fig.7. The Automated Improvised Industrial Portable Animator's Desk

V. CONCLUSION

Based on the findings of the study, the following conclusions are drawn:

- The Automated Improvised (IPAD) has been successfully designed and operates very well using the AGILE Model and the Gantt Chart of development.
- The respondents considered the technical features of the Automated Improvised (IPAD) to be extremely functional, very reliable, very usable, and very portable.
- The Automated Improvised (IPAD) was a very practical piece of drawing equipment in Animation NC II, and the respondents described its efficacy as being very significant.

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