

Design and Development of Improvised Pivotal Animation Board

Pasion, Billie Jack DR.¹, Cumbe, Marites M.², Vertudazo, Rodelyn T.³, Santiago, Roberto R.⁴, Marte, Aldrich Nathaniel B.⁵

^{1,2,3,4,5} Nueva Ecija University of Science and Technology, Gen. Tinio St., Quezon District, Cabanatuan City, Nueva Ecija, 3100 Philippines

*Corresponding author's email: billiejackpasion@ineust.ph.education.com

Abstract. This research project aimed to create and refine an innovative tool for animators called the Improvised Pivotal Animation Board (IPAB). The IPAB differs from existing Light-emitting Diode (LED) tracing boards in terms of its unique functionality. The researchers employed the Analysis, Design, Development, Implementation, Evaluation (ADDIE) model, adapting it to suit the specific requirements of the study. During the analysis phase, the researchers examined the features of commonly used lightboxes in the animation industry and academic settings. They focused on traditional animation techniques to identify key aspects to incorporate into the IPAB. Additionally, the researchers considered the overall cost of developing the IPAB, ensuring an economically feasible design. Moreover, the design of the IPAB was aligned with the Harmonized Gender & Development Guidelines, guaranteeing inclusivity. The development phase followed a Gantt chart, serving as a roadmap for the researchers. They used this framework to guide the creation and testing of the IPAB. The results of the study indicated that the IPAB was successfully developed and exhibited optimal functionality. The device's stability was verified, and it demonstrated the ability to pivot in both left and right directions. Furthermore, the IPAB was designed to be rechargeable, enhancing its convenience and usability.

Keywords: Animation board; Education; Pivotal; Portable; Rechargeable

1. Introduction

Welcome to the captivating world of traditional animation, a timeless art form that has been enchanting audiences for generations. In this cherished technique, each frame is meticulously hand-drawn, bringing characters and stories to life with an authentic, personal touch. The term animation comes from the Latin word *animatio*. In general, animation is the process of displaying still images in a rapid sequence to create the illusion of movement Madison (2022) on lifeless things, drawings, and models (Ows, n.d.). These images can be hand drawn, computer

generated, or pictures of 3D objects. Hand drawn animation is known as the traditional animation. Traditional animation usually refers to animation hand-drawn on paper. It was the process used for most of the productions throughout the 20th century (Traditional Animation | Toon Boom Learn, n.d.). Characters, layout, and backgrounds are all drawn by an animator on animation paper on top of a light box. When everything is put onto film, there will appear to be movement because each sketch in the animation will be a little bit different from the one before it and the one after it.

In the Philippines, animation is well-known in industry and in academic institutions. Filipino animators have been penetrating and succeeding in the international animation scene (Ciit.Content.Admin.,2018). These animators became good and talented because of what they learned in school. They are shaped and trained properly in their respective alma maters. In academia, animation courses are being offered in basic, vocational-technological, and higher education. Academic institutions must ensure that they have teaching materials at least the basic tools and equipment when offering skill courses like Animation NC II. According to Magno (2017), animation disc, pencil and eraser, peg bar, brush, light box, and animation paper are some of the tools and equipment for hand drawn animation. Pencils, erasers, and brushes are always available in the market. Moreover, the animation paper can be bought from a particular manufacturer. Likewise, the peg bar, animation disc and lightbox can be bought separately or as a package which is very costly.

Animator's lightboxes are extremely versatile pieces of equipment for animators and artists. An animator's lightbox is also one of the most essential pieces of equipment to own if you are a traditional animator since it drastically cuts down on the processing time it takes to duplicate each frame of an animated film (Bizofan, 2023). Further, according to Bizofan (2023), lightboxes come in a few general size categories, and there are a couple of things to consider before deciding which animator's lightbox to buy, this includes things like price, workspace, light source, materials, and weight. Additionally, he said technology has advanced significantly, and animators can now buy a compact animator's lightbox at an affordable price. If combined with a simple rotating stand and a peg bar, any animator's lightbox can become part of a professional setup for a fraction of the cost.

Commercialized devices related to a light box is A4 LED Light Pad. It is a USB powered light board with adjustable brightness used for drawing, streaming, sketching, animation, stencilling and diamond painting (Real Canadian Superstore Supermarket | Grocery Shop Online or Instore, n.d.). Further, based on the review made by Nguyen (2018) on RH A4 LED Tracing Board, she said it is a USB powered device, the board is made of acrylic, and it has 6 levels of light intensity which is controlled by a touch sensitive switch. In general, she is very pleased with this tracing board. However, based on the observation of the researchers on the said devices it can only be used if the device is connected to a power source which means that you need to stay near the outlet or you may use it anywhere if you have a portable source like power bank that may supply the LED tracing board. Moreover, they are only light boxes and do not have a rotating stand and peg bar.

It is in this juncture that the researchers designed and developed an improvised pivotal animation board. This animation equipment is the amalgamation of animation disc, lightbox, and peg bar. Additionally, it has the capability to be charged because of the built-in 18650 lithium-ion batteries that supply the integrated LED in the device. Likewise, the board compartment can house pencils, erasers, and animation papers. Further, it has a pivotal, lockable, and foldable stand that makes it unique compared to the existing animation lightbox used in the industry and academic institutions.

2. Methodology

The research design employed in this study was developmental research. According to Richey and Nelson (2001) as cited by Pasion, Cumbe & Vertudazo (2022), developmental research is a systematic investigation that focuses on designing, developing, and evaluating instructional programs, processes, and products. These endeavors aim to fulfil the criteria of internal consistency and effectiveness. Moreover, developmental research involves examining the entire instructional design, development, and evaluation process or specific elements within it (Richey, Klein, & Nelson, 2004). The research and development (R & D) design was also used to design and develop the IPAB. Educational R & D is a research process that aimed to design, develop, and evaluate educational outputs, products, and the like (Tolentino, Miranda, Maniago, & Sibug, 2020). This study utilized the Analysis, Design, Development, Implementation, and

Evaluation (ADDIE) model as its research framework. The ADDIE model is a systematic instructional design framework used to guide the development of effective learning experiences and training programs (Molenda, 2003).

The study was conducted at the College of Industrial Technology of Nueva Ecija University of Science and Technology – General Tino St. Campus, specifically during the first semester of the academic year 2022–2023. This period allowed for a concentrated exploration of the subject matter, focusing on the design and development of the IPAB.

3. Results and Discussion

3.1. *Designing and developing the Improvised Pivotal Animation Board*

The designing and developing phase of the IPAB followed the stages of the ADDIE model. However, the researchers excluded the last two stages such as the implementation and evaluation to suit the needs of the study which is to design and develop an improvised pivotal animation board.

3.1.1. Analysis Phase

During the analysis phase of the study, the gathered information is thoroughly examined and processed (Kovacich & Jones, 2006). This transformation of raw intelligence into a cohesive and decision-ready outcome occurs when relevant data pieces are integrated into a useful final product (Sanders & Smith, 2014). The analysis phase of the study, the researchers focused on examining the features of existing lightboxes commonly used in the animation industry and academic institutions that offer traditional animation courses. Through careful observation, the researchers identified several common characteristics of these lightboxes.

Firstly, the physical structure of the traditional lightboxes was found to be bulky, resulting in their large and heavy nature. This bulkiness made them inconvenient to handle and transport. Additionally, the removable animation disc with peg bar was observed to be excessively thick, making it difficult to manually rotate in both clockwise and counter-clockwise directions.

Another aspect that the researchers noted was the use of light bulbs in these traditional lightboxes. These light bulbs consumed a significant amount of electricity and emitted a luminance that was too bright. Furthermore, the brightness level of the light bulbs could not be adjusted, which limited the flexibility in controlling the lighting conditions. In terms of power source, the researchers observed that the traditional lightboxes relied on electricity from an outlet. While this provided a steady power supply, it also meant that the lightboxes were restricted to a fixed location. This lack of mobility posed a challenge for animators who needed to work in different settings or desired a portable solution.

In addition to analyzing the features of the existing lightboxes, the researchers also conducted a thorough cost analysis for the development of the IPAB. This analysis aimed to evaluate the total expenses associated with designing and producing the IPAB, ensuring that the project remained economically feasible as shown in table 1.

Table 1 IPAB’s Total Costing

Quantity	Unit	Materials	Unit Price	Price
1	pc	1 ft x 2ft White Acrylic Sheet 3.0mm	₱295.00	₱295.00
4	pcs	60 x15 mm 12V 2W White COB LED Light Module Chip	₱63.00	₱252.00
6	pcs	18650 Lithium-Ion Battery	₱120.00	₱120.00
8	pcs	Hand Screw Five Star Shaped Head	₱20.00	₱304.00
1	pc	Double Pole Double Throw Switch	₱44.00	₱44.00
1	pc	12V DC Male Socket	₱16.00	₱16.00
2	mts	Speaker Wire	₱34.00	₱68.00
4	pcs	30x30 mm L Bracket	₱7.00	₱28.00
6	pcs	Stainless Steel Toggle Box Lock	₱14.00	₱84.00
1	pc	4” Square 360° Rotating Bearing Plate	₱107.00	₱107.00
1	pc	1” x 2” x 12” Wood	₱158.00	₱158.00
4	pcs	1” Stainless Steel Door Hinge	₱20.00	₱80.00
Total				₱1,556.00

Furthermore, to anticipate and address any potential gender-related issues that might arise after the IPAB is introduced to its users, the researchers conducted a gender analysis based on the Harmonized Gender & Development Guidelines (HG DG). Using the Gender and Development (GAD) Checklist 2: For the Project Identification and Design Stages, the GAD score of the IPAB is 13.16 which means that the proposed project is gender-sensitive (proposal passes the GAD test). In this study, researchers conducted an extensive analysis to explore how the design and functionality of the IPAB could affect individuals of various genders. By considering gender-specific requirements and preferences, the aim was to create an inclusive and accessible IPAB design that caters to the needs of all users.

3.1.2. Design Phase

Industrial research means the planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products, processes, or services or for bringing about a significant improvement in existing products, processes, or services (Industrial Research Definition: 269 Samples | Law Insider, n.d.). In this phase, the researchers conceptualized their designed in contrast with the present attributes of lightbox but with the same functionality and additional features. The conceptual design of the improvised pivotal animation board was presented in both orthographic and isometric projections, as illustrated in Figure 1. To ensure precise measurements, the design was created using Automatic Computer-Aided Design software.

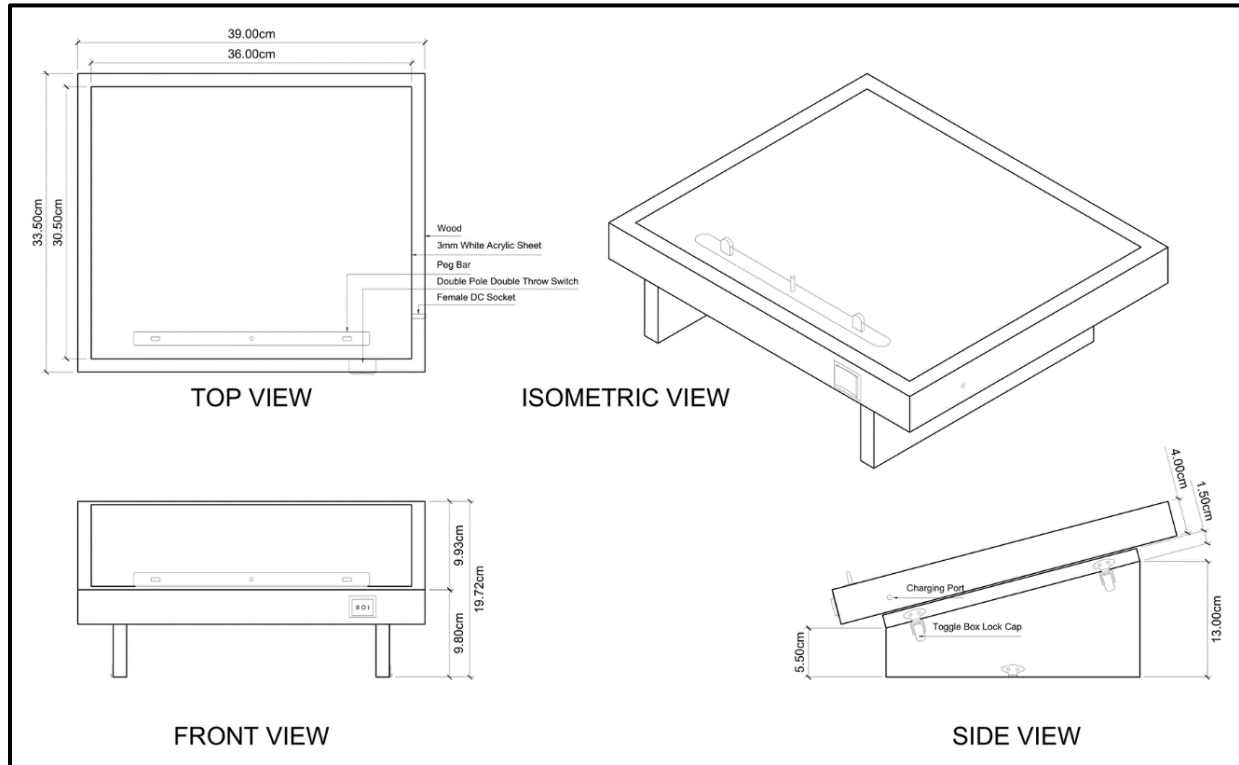


Figure 1 Orthographic and Isometric View of IPAB

The orthographic projection of IPAB is the representation of the top view, front view and side view which means that the object's lines are perpendicular to the viewing plane. On the other hand, the isometric projection of the IPAB is the axonometric projection that represents a three-dimensional object by tilting it at 30 degrees from the horizontal plane which allows for a more realistic and visually appealing representation of objects.

The IPAB design incorporates several key features. Firstly, it includes a square rotating swivel plate seat with a metal bearing, allowing for effortless circular motion in both directions. Secondly, it consists of a detachable rectangular animation board that can be customized to suit individual preferences. Additionally, the design incorporates an improvised peg bar, facilitating the secure placement of animation sheets. The board also integrates built-in 18650 lithium-ion batteries and LEDs, controlled by a double pole double throw switch, ensuring reliable power and adjustable lighting options. To provide stability during animation, the board includes a fixed 15° stand with a folding and interlocking system. Despite its robust design, the improvised pivotal animation board remains lightweight and compact, occupying minimal space.

Furthermore, it incorporates a compartment for convenient storage of essential accessories and materials. The researchers also draft the schematic diagram of the developed device which serves as the guide during the installation of the electrical components to avoid mistakes as shown in Figure 2. The diagram was illustrated using Adobe Photoshop software to make it presentable.

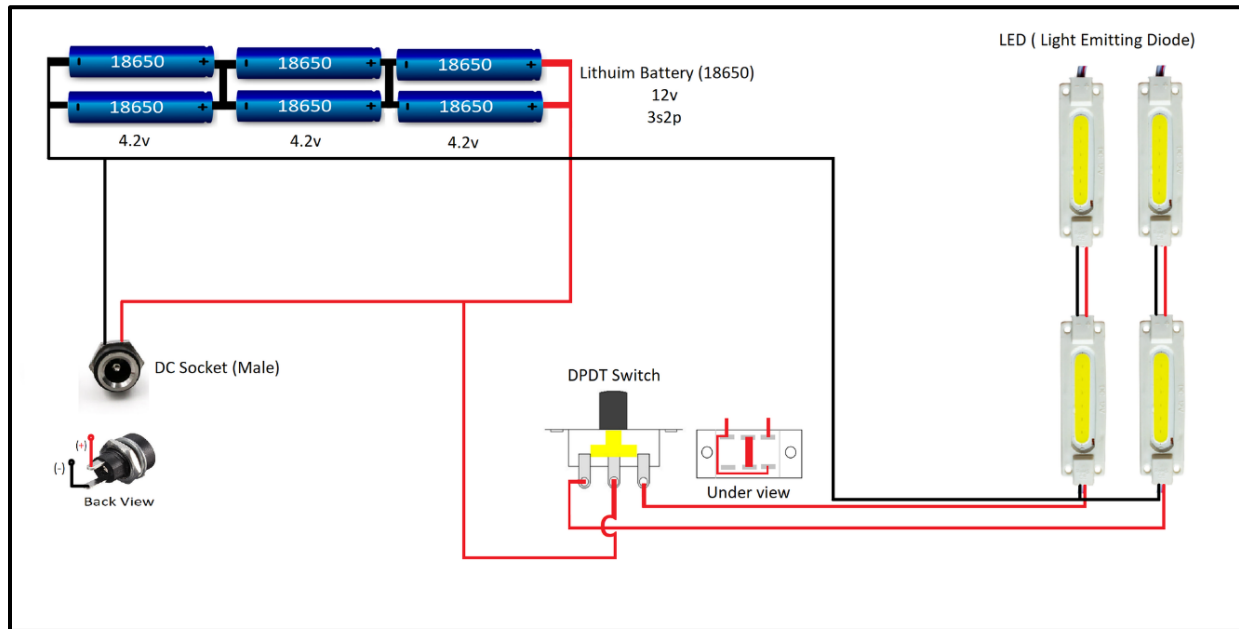


Figure 2 IPAB's Schematic Diagram

The IPAB (Improved Pivotal Animation Board) features a schematic diagram consisting of several components. It comprises six (6) 18650 lithium-ion batteries connected in a 2P 3S configuration, four (4) chip-on-board (COB) LED light module chips, one (1) double pole double throw (DPDT) switch, and one (1) 12V DC male socket.

The DPDT switch plays a crucial role in controlling the COB LED lights of the IPAB. When the single throw is activated, two (2) COB LED lights are turned on, providing a specific lighting configuration. Conversely, when the double throw is activated, all four (4) COB LED lights illuminate simultaneously, producing a different lighting arrangement. The 12V DC male socket serves as an electrical connector designed to facilitate the connection of low-voltage devices that require a 12-volt direct current (DC) power supply to the IPAB. This socket allows for a convenient and secure connection, ensuring proper power transfer to the IPAB. To power the IPAB, the six lithium-ion batteries are connected in a 2P 3S configuration. This means that two (2) batteries are connected in parallel, increasing the overall capacity, while the three (3) sets of parallel batteries are then connected in series, boosting the total voltage.

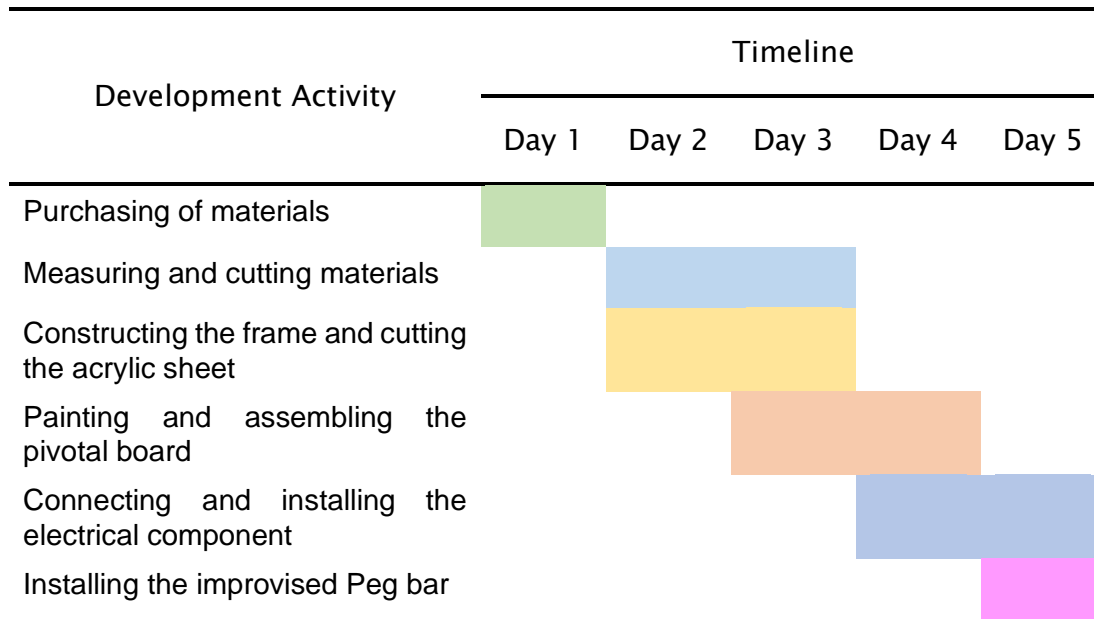
3.1.3. Development Phase

Prototyping is an essential part of product development in companies, and yet it is one of the least explored areas of design practice. As defined, prototype are tools for enhanced communication, increased learning, and informed decision-making (Lauff, Kotys-Schwartz, & Rentschler, 2018). A prototype might be anything from an intricate pen-and-paper drawing to a fully functional version of the product. Meanwhile, prototype development is simply a series of processes that the manufacturer uses to produce the prototype (Rapiddirect, 2022).

The development phase of the study marked the actual construction process of the Improvised Pivotal Animation Board (IPAB). During this stage, the researchers demonstrated meticulousness by carefully selecting the appropriate materials and ensuring they aligned with the projected design of the animator's equipment. The researchers paid close attention to detail to ensure that the IPAB would meet the desired specifications and functionality.

To effectively manage and monitor the progress of the IPAB's development, the researchers utilized the provided Gantt chart as shown in Table 2. A Gantt chart is a commonly used graphical depiction of a project schedule. It is a type of bar chart showing the start and finish dates of a project's elements such as resources, planning, and dependencies (Grant, 2022). This visual representation of the project timeline and key milestones served as a valuable tool in organizing and tracking the construction process. By referring to the Gantt chart, the researchers could ensure that each task was completed within the designated timeframe and that the overall project remained on schedule.

Table 2 Gantt Chart of IPAB’s Development



The development of IPAB starts from the conceptualization of the design, buying of materials needed during its assembly, measuring, and cutting the wood, attaching the wood frame components and the foldable inclined stand, filling, sanding, and painting the device, mounting and installation of the COB LED, batteries, switch, charging port and speaker wires, cutting the acrylic sheet, fixing the peg bar and lock magnet of the animation board. Images are taken when the IPAB is being developed as shown in Figure 3.



Figure 3 IPABs Development

Throughout the development phase, the researchers' expertise and attention to detail were evident. They worked diligently to assemble the IPAB, carefully following the projected design and ensuring the precise integration of components. The researchers' technical skills and knowledge were instrumental in achieving the desired outcomes and creating a functional and stable animator's tool. Figure 4 shows the fully developed improvised Pivotal Animation Board.



Figure 4 The Improved Pivotal Animation Board

The improvised pivotal animation board may revolutionize the animation industry and bring about significant implications. As this innovative tool may gain adoption, it may shape the future of animation, empower animators with new possibilities and drive the industry towards greater creativity and innovation.

4. Conclusions

In conclusion, the research project effectively accomplished its goal of creating and enhancing the Improved Pivotal Animation Board (IPAB) as a groundbreaking tool for animators. Guided by the ADDIE model, the study met its objectives and surpassed the capabilities of traditional LED tracing boards. The findings demonstrated the IPAB's exceptional functionality and addressed existing limitations, making it an asset for animators to elevate their creative process and workflow significantly. This research serves as a significant contribution to the animation field, empowering animators with an advanced and improved tool to foster innovation and artistic excellence.

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