Drafting-Photographic-Physics (DPP) Activity and Experiment Table

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Abstract *– The lack or insufficient available instructional devices intended for teaching and learning Drafting Technology and Physics subjects delimits the attainment of subject objectives and competencies. This developmental study was conducted to develop Drafting-Photographic-Physics (DPP) Activity and Experiment Table for Technology and Engineering students of University of Rizal System, Philippines. The purposively chosen second and third year Technology and Engineering students with Drafting and Physics professors evaluated the activity and experiment table in terms of functionality, instructional applicability, usability, durability and safety and maintainability. Result shows that the student and professor respondents evaluated the DPP activity and experiment table as surpassing and more preferable over the existing equipment. The developed table is acceptable for use as educational device specially designed for Drafting/Drawing and Physics subjects and can improve the performance of the students. Usage of the developed table is highly recommended for students and professors of the College of Industrial Technology and College of Engineering. Further validation using other factors and evaluation criteria and periodic refinement of the device shall be done to accommodate ease of use and comfortability.*

Keywords *– Drafting Technology, Photographic Table, Experiment Table, Drawing Plates, Instructional Devices*

INTRODUCTION

The Science and Technology were used to be two distinct and unique fields but with our present situation one cannot exist without the other. They were espoused by destiny as needed by humanity. Education according to an unknown author is our bridge from our past to the present and from present to the future. Our educational system now plays a multidisciplinary approach.

Teaching Drafting/Drawing subjects in courses like engineering, industrial technology and even in education may not be an easy task. There is a serious need to design and construct a more convenient drafting table with a reduce cost for the high number of students using design studio according to Oladapo [1]. It may also be true in the teaching of Physics in almost all degree courses. It may pose some difficulties particularly if there is tremendous shortage of available learning resources and facilities. Majumdar [2] disclosed that presently students are handicapped with communicative competence which is very important in the educative process with the scarcity of available learning materials and facilities. Further, he stressed that teachers/instructors have the same sentiments which cause frustrations in the realization of their set instructional objectives.

Hundreds of thousands of future engineers, industrial technologists, technicians and other skilled workers must be exposed to drawings and interpretations of working plans and blueprints in order to carry out the nature of their works. The researchers believed that almost all three dimensional man-made objects and structures around us today originated from the drafting table of the designers. The conventional drafting table is bulky, heavy and occupies big space and can no longer accommodate the continuous increasing number of students. Therefore, there is a need to redesign and reinvent itself that may fit in to the present condition.

Same as true with the situation of teaching Physics, faculty were trained to effectively teach the subject but apparatuses, machines and equipment are limited where experiments are required to be performed in the subject.

If problems are prevailing in the tertiary level especially universities/colleges offering the subjects much are also experienced in the secondary level. Problems of the same magnitude were experienced and are continuously experiencing by the researchers. However, with the pressure of providing quality instructions as a primary function of all human resources in a university/college to the learners/ stakeholders, one should take the initiative of making innovative devices,

equipment, projects, or structures that may facilitate effective learning. The very reasons why the researchers dwell on this study to develop a combined Drafting and Physics activity and experiment table to improve the delivery of effective teaching-learning process.

Development of the combined Drafting-Photographic-Physics activity and experiment table is the process of constructing an alternative and innovative table to be used extensively in drawing plates, tracing and designing activities and performing experiments particularly on waves, optics and photonics. Among the purposes are providing instructional facilities, level up skills and competencies in drawing and physics and possibly generate income and jobs.

According to BeeDictionary.com [3], a drafting table has an adjustable top that can be angled and is used specifically for work. It is also often called a "drawing table." Originally drafting tables were elaborate desks in wealthy Victorian homes used for the art of map drawing (cartography). Today they have a variety of uses, but most commonly are employed by architects drawing up blueprints. Additionally, artists, structural steel engineers and advertising layout specialists use them to aid in sketching and to help them plan design. Some antique drafting tables are even placed in houses purely to be decorative pieces of furniture.

A drawing table is also sometimes called a mechanical desk because, for several centuries, most mechanical desks were drawing tables. Unlike the gadgetry mechanical desks of the second part of the 18th century, however, the mechanical parts of drawing tables were usually limited to notches, ratchets, and perhaps a few simple gears, or levers or cogs to elevate and incline the working surface.

Drafting tables are designed to assist artists, architects and draftsmen in their chosen professions. These tables have a top with hinges on the back and a raised lip, usually made of wood or aluminium, on the front end. There are various methods by which the top's angle can be changed, depending upon the design of the table. The height of the top is also adjustable and can be adapted to accommodate sitting or standing positions. The document, print or art paper is held to the slanted top by the combination of the lip and parallel rulers which are frequently used with drafting tables.

Nardo [4] constructed an improvised drawing board. Descriptive and experimental methods of research were used. It was revealed that the improvised drawing board is very acceptable for use in different drawing activities.

Curbano [5] conducted a study on the development of a multipurpose instructional board. The special feature of the board is the drafting table where large drawing paper may easily fasten and it was concluded acceptable and effective.

Both studies are related to the present study since they linked to the personal ideas of the researchers that development of drafting table greatly affects the performance of the students.

Photographic Table is an exposure unit for silk screen. It is a lighted table usually controlled manually or otherwise where artworks are transferred to the screen.

According to the article of the American Screen Printing Association [6] that the El Cheapo "Grow" Light Unit is a photographic table. This type of exposure unit is based on plans that you'll see in many "how-to" screen printing books. It is easy and inexpensive to make, but it is less than ideal for screen making due to the lower quality light source and the time it takes to burn a screen. This is the type of exposure unit that this author built to start a screen printing business in the early nineties and it was used to burn hundreds of screens. Some 15 years later, it still works and no parts were ever replaced!

Speaking of parts, this unit is pure simplicity. It consists of only a plywood box, (3) grow lights, an electrical strip (used as the "power switch") and a glass top for placing a screen onto. At this writing, this unit can be built for around $85. The dimensions of this unit are 31" X 19" X 6" and will easily accommodate average sized screens for printing t-shirts of 20" X 22 or similar sizes.

Zakaria [7] in their study on the development of multi-featured table found out that student and instructor respondents find the developed table acceptable since it has the elements of practicality and efficacy. Further, they both agreed that the developed table is very highly acceptable in developing skills or capability in silk screen printing teaching-learning activities. They stressed that the developed photographic table with multiple features showed a better alternative in the usual and traditional of manual teaching of the topics. Thus, the developed table is effective.

Cited literature and study are significantly related to the present study since they want to find out the effects of teaching-learning competencies to the educational growth and development of the learners.

Physics apparatuses are collection of instruments, machines, tools, parts, or other equipment used for a particular experiment in Physics. It is also referring to equipment designed to serve a specific function to carry out experiments.

In this study, a ripple tank is featured which simply refers to (in Physics and Engineering) a shallow glass tank of water used in schools and colleges to demonstrate the basic properties of waves. It is a specialized form of a wave tank. The ripple tank is usually illuminated from above, so that the light shines through the water. Some small ripple tanks fit onto the top of an overhead projector, i.e. they are illuminated from below. The ripples on the water show up as shadows on the screen underneath the tank. All the basic properties of waves including reflection, refraction, interference and diffraction can be demonstrated.

According to Otaringho and Oruese [8], the tools and equipment assists in the educative process. These supplement the teachers work in the development of skilled and potential worker. They further affirmed that machines, tools, equipment and laboratory rooms are vital factors in the success of any education.

Malonzo and Fajardo [9] in their study revealed that improvised science apparatuses greatly contributed to the increase in academic performance of the students in Physics and likewise they are useful and relevant instructional devices in teaching selected topics in Physics; hence, they are very much accepted by the respondents.

The study of Malonzo and Fajardo is cognizant to the present study both developed instructional devices for the purpose of enhancing teaching-learning process. It was further affirmed by the statement of Otaringho and Oruese the need of appropriate facilities for the project or experiments.

This research study focused mainly on the development and evaluation of an instructional device intended for students' Drafting/Drawing activities and Physics experiments.

The respondents involved in the study were professors and students of Industrial Technology and Engineering. They were purposively selected since they were exposed in Drafting and Physics subjects and they are in the best position to assess the device. They evaluated the DPP activity and experiment table using evaluative criteria such as functionality, instructional applicability, usability, durability, and safety and maintainability.

This study is limited on determining the competitive edge of the developed table over the existing and separate tools, equipment and devices utilizing the assessment criteria mentioned above.

The present study is one of the very few undertakings ever made in combined Drafting Technology and Physics. With the current direction of Science and Technology so with the rapid technological changes, the researchers were persuaded on the necessity to introduce new instructional device or utility model relative to Drafting Technology and Physics subjects to assure quality instructions.

OBJECTIVES OF THE STUDY

This study aimed to develop an activity and experiment table with multi-features and multi-purpose that strengthen teaching-learning process in science and technology. And, evaluated by Drafting and Physics Professors and students.

Specifically, it sought answers to the problems, how do the two groups of respondents evaluated the DPP activity and experiment table and the existing equipment in terms of functionality, instructional applicability, usability, durability, and, safety and maintainability; and, is there any significant difference on the result of the evaluation done by the respondents using the DPP activity and experiment table as compared to the existing equipment used in the laboratory in terms of the different criteria?

MATERIALS AND METHODS

Research Design

This study used developmental method of research. In developmental method of research according to Amante [10] that the focus is on finding or developing a more suitable instrument or process than has been available. Since, this study constructed a table with elaborations on designs where two separate conventional tables evolving into one with inclusions of other properties.

This method was of help in the pursuit of the study, since it gave insights, observations and critical evaluations of the respondents on the developed activity and experiment table.

The in-depth interview method and focused group discussions (FGD) were also utilized to different groups of experts in obtaining ideas for designing the project and to the respondents to validate the perceived answers made using the questionnaire checklist.

The Respondents

There are twelve (12) Drafting Technology and twelve (12) Physics Professors handling Drafting/ Drawing and Physics subjects either in a full time or part time basis in URS-Morong. Eight (8) of each subject were considered respondents and selected particularly those teaching in Industrial Technology and Engineering courses. Other experts were considered as resource

person in the focus group discussions conducted and those who validated the researcher-made questionnaire-checklist.

Among student respondents, a total of 60 students were selected randomly from those already have taken both Drafting/Drawing and Physics subjects from the College of Industrial Technology (CIT) and College of Engineering (CoEng). Twenty (20) students taking engineering courses with four (4) in each field were considered among the respondents. Another twenty (20) students taking Industrial Technology courses such as Bachelor of Technology (BT) and Biomedical Technology. Last twenty (20) students are BT major in Drafting Technology which researchers believe that all features and functions of the DPP table may be extensively utilized.

The researcher selected respondents and distributed informed consent forms for respondents. The following were taken into considerations and explained clearly the following: the purpose of the research, the right to decline or withdraw from the research without penalties, limits of confidentialities, assurance of anonymity, opportunity of knowing the findings if deemed so desired, brings no harm to the respondents, deception should not be used, maintaining objectivity and participation should be voluntary.

Instrument

A questionnaire – checklist was used as instrument in gathering the needed data. This was used to evaluate the combined Drafting-Photographic-Physics Activity and Experiment Table. The evaluation criteria used were based on set standards of the Bureau of Product Standards. Likewise, the criteria used in the study were also adapted from the studies of Allen Alejandro [11], Adam Mangulabnan [12] and Edwin Dignum [13]. It was content validated by experts in science, technology, research or education. The criteria included in the questionnaire – checklist is functionality, instructional applicability, usability, durability, and safety and maintainability. The two groups of respondents were instructed to provide additional comments.

Statistical Treatment

After the gathered data were classified, tallied and tabulated, the statistical treatments applied were weighted mean, standard deviation and independent t-test.

The weighted mean was the statistical tool utilized in the interpretation of gathered data in determining the level of acceptability of the developed Drafting – Photographic – Physics Activity and Experiment Table as perceived by the professor respondents and student respondents in terms of functionality, instructional applicability, usability, durability and safety and maintainability. The given scale was used to interpret the weighted mean scores for the assessment of the different evaluation criteria of the developed activity and experiment table: 4.20-5.00: Very Much Functional /Agree/Usable/Durable/Safe and Maintainable; 3.40-4.19: Much Functional/Agree/Usable/Durable/Safe and Maintainable; 2.60-3.39: Moderately Functional/Agree/ Usable/Durable/Safe and Maintainable); 1.80-2.59: Less Functional/ Agree/ Usable/ Durable/ Safe and Maintainable); 1.00-1.79: Not Functional/Agree/Usable/ Durable/ Safe and Maintainable).

RESULTS AND DISCUSSION

The study has two major activities, the development of the actual activity and experiment table and its evaluation.

The Development Phase

Among the factors considered were availability of materials, the construction costs, available craftsman, space it will occupy, sizes relative to the end-users, special features and specific functions. Prior to the actual construction of the DPP activity and experiment table, preliminary sketches were prepared. Brainstorming was extensively used by the researchers on how Drafting and Physics will be combined resulting to DPP table

Complete working drawing was performed including various features and functions. The signature construction of the DPP table was made. The table was exhaustively explored that covers all basic grounds that need to be covered in order for the student and professor users fully understand its operation.

It was subjected to series of critiquing from master carpenters, experts in Drafting and Physics subjects, Drafting and Physics student teachers from other school and graduates. All comments and suggestions were considered in the revision and redesigning of the table for further improvement.

The total cost of the developed DPP table is estimated at a total amount of Eight Thousand Five Hundred pesos (PhP 8,500.00). The existing equipment has a total combined amount of Twelve Thousand pesos (PhP 12,000.00).

The DPP activity and experiment table when not in use occupies nearly one (1) square meter only and if two tables are in use simultaneously can occupy two (2) square meters.

Table 1. Evaluation of the Respondents on the Developed DPP Activity and Experiment Table and the Existing Equipment in Terms of the Different Criteria

Criteria	Students				Professors			
	DPP		Existing		DPP		Existing	
	Mean	VI	Mean	VI	Mean	VI	Mean	VI
Functionality	4.71	VMF	3.40	MF	4.70	VMF	3.38	MF
Instructional Applicability	4.55	VMA	3.88	MA	4.68	VMA	3.28	MoA
Usability	4.71	VMU	3.74	MU	4.74	VMU	3.42	MU
Durability	4.67	VMD	3.58	MD	4.63	VMD	3.22	MoD
Safety and Maintainability	4.60	VMSM	3.36	MoSM	4.52	VMSM	3.44	MSM
Grand Mean	**4.65**	**VMA***	**3.60**	**MoA***	**4.65**	**VMA***	**3.35**	**MoA***

While the existing equipment, if utilized at the same time or even not in use occupy four (4) square meters. Therefore, the developed activity and experiment table can save space where space saved may be used for students' room/laboratory mobility or more number of students in a class may be accommodated.

Table 1 presents the composite table on the computed mean and standard deviation on the evaluation of the two groups of respondents on the developed DPP activity and experiment table and the existing equipment in terms of the different criteria.

It could be reflected from the table that the students' perception for DPP activity and experiment table ranked first are shared by "functionality" and "usability" with 4.71 average weighted mean and interpreted as "very much functional" and "very much usable", respectively. While professors evaluated "usability" as ranked first with 4.74 average weighted mean and interpreted as "very much usable". In general, the grand mean for both groups of respondents shared the same at 4.65 and interpreted as "very much acceptable" meaning that condition and provision of the DPP activity and experiment table is excellent and the standard functions meets quality.

It implies that the students and professors are expecting developed DPP activity and experiment table can provide possible solution to the scarcity of Drafting furniture and Physics apparatus to sustain quality instruction. Furthermore, provide additional space for students' mobility and/or accommodate more students in a class.

On the other hand, students' evaluation of the existing equipment revealed that "instructional applicability" ranked first and "safety and maintainable" ranked last with 3.88 and 3.36 average weighted mean and interpreted as "much applicable" and "moderately safe and maintainable", respectively. On the part of the professors ranked first is "safety and maintainability" and "durability" is in the last rank with average weighted mean of 3.44 and 3.22 and interpreted as "much safe and maintainable" and moderately durable", respectively.

In general, obtained grand mean for students' evaluation is 3.60 while among the professors is 3.35 both verbally interpreted as "moderately acceptable". It means that both respondents believe that condition or provision is adequate and meets the normal function of the existing equipment when used separately or simultaneously.

As shown in table 2, evaluation of the student respondents on the DPP activity and experiment table as compared to the existing equipment differ significantly with respect to functionality, usability, durability and safety and maintainability with computed t-value of 3.275,3.540, 3.114 and 3.543 which are more than the tabular t-value of 2.000 at 0.05 level of significance.

Table 2. Evaluation of the Student Respondents Using the DPP Activity and Experiment Table as Compared to the Existing Equipment in Terms of the Different Criteria

Criteria	DPP	Existing	df	t	Ho	VI
Functionality	4.71	3.40	59	3.275	R	S
Instructional Applicability	4.55	3.88	59	1.914	A	NS
Usability	4.71	3.78	59	3.540	R	S
Durability	4.67	3.58	59	3.114	R	S
Safety and Maintainability	4.60	3.36	59	3.543	R	S

On the other hand, with respect to the instructional applicability, students" evaluation of the DPP table against existing equipment does not differ significantly with computed t-value of 1.914 which is less than the tabular t-value of 2.000 at 0.05 level of significance. Thus, accepts the null hypothesis.

It is safe to say that the DPP table and existing equipment both applicable to facilitate instruction to the fullest. It can also be noted that when it comes to multiple functions due to different features, the developed table has an edge. Newness of the project and compact in size instituted a new look and attraction for student respondents' high evaluation of the DPP table over the existing equipment. Furthermore, the stainless steel parts and the casters guarantee strength and durability.

Table 3. Evaluation of the Professor Respondents Using the DPP Activity and Experiment Table as Compared to the Existing Equipment

Criteria	DPP	Existing	df	t	Ho	VI
Functionality	4.70	3.38	15	2.129	A	NS
Instructional Applicability	4.68	3.28	15	2.295	R	S
Usability	4.74	3.42	15	2.111	A	NS
Durability	4.63	3.22	15	2.389	R	S
Safety and Maintainability	4.52	3.44	15	1.800	A	NS

The table reflects that the perception of the professor respondents on the evaluation of DPP activity and experiment table as compared to the existing equipment differ significantly with respect to instructional applicability and durability with computed t-value of 2.295 and 2.389 which are more than the tabular t-value of 2.131 at 0.05 level of significance. These reject the null hypothesis.

On the other hand, with respect to functionality, usability and safety and maintainability, professors' evaluation does not differ significantly with computed t-value of 2.129, 2.111 and 1.800 which are less than the tabular t-value of 2.131 at 0.05 level of significance, respectively. Thus accepts the null hypothesis.

The result implies that significant difference existed on the evaluation of the professors on the developed table and the existing equipment. The disparities on the evaluation might mean that the developed DPP table is better due to its multiple features and purposes that only occupies limited space aside from the usual functions of the respective existing devices and occupies a larger space. This supports the ideas of Zakaria [7] that the factors affecting students' performance and professors' effective delivery of instruction, in one way or the other depend on the quality of instructional materials, devices and facilities.

As displayed in table 4, no significant differences were found among evaluation of the two groups of respondents in terms of different criteria except on instructional applicability, using the DPP activity and experiment table with the computed t-value of 0.010, 0.091, 0.108 and 0.250 which are less than the tabular t-value of 1.980 at 0.05 level of significance. Hence, the null hypothesis is accepted. On the other hand, significant difference was found among evaluation of the student and professor respondents in terms of instructional applicability with the computed t-value of 2.082 which is greater than the tabular t-value of 1.980 at 0.05 level of significance. Thus, rejects the null hypothesis.

This implies that the evaluation of the two groups of respondents with respect to instructional applicability has significant difference. Difference on how they viewed conditions of the DPP activity and experiment table particularly its actual utilization, manipulations of the features and direct operation.

As displayed in the table, no significant differences were found among evaluation of the two groups of respondents in terms of different criteria except on instructional applicability, using the DPP activity and experiment table with the computed t-value of0.010, 0.091, 0.108 and 0.250 which are less than the tabular t-value of 1.980 at 0.05 level of significance. Hence, the null hypothesis is accepted.

On the other hand, significant difference was found among evaluation of the student and professor respondents in terms of instructional applicability with the computed t- value of 2.082 which is greater than the tabular t-value. Thus, rejects the null hypothesis.

Table 4. Computed t-values on the Evaluation of the Two Groups of Respondents in Using the DPP Activity and Experiment Table in Terms of the Different Criteria

Criteria	Students		Professors							
	Mean	SD	Mean	SD	M Diff	df	t	f	Ho	VI
Functionality	4.71	0.51	4.70	0.56	0.01	74	0.010	1.908	A	NS
Instructional Applicability	4.55	0.57	4.68	0.60	0.13	74	2.082	1.908	R	S
Usability	4.71	0.50	4.74	0.64	0.03	74	0.091	1.908	A	NS
Durability	4.67	0.59	4.63	0.64	0.04	74	0.108	1.908	A	NS
Safety and Maintainability	4.60	0.58	4.52	0.80	0.08	74	0.250	1.908	A	NS

Table 5. Computed t-values on the Evaluation of the Two Groups of Respondents in Using the Existing Equipment in Terms of the Different Criteria

Criteria	Students		Professors							
	Mean	SD	Mean	SD	M Diff	df	t	f	Ho	VI
Functionality	3.30	1.17	3.38	1.19	0.02	74	0.158	1.908	A	NS
Instructional Applicability	3.88	0.83	3.28	1.03	0.60	74	1.500	1.908	A	NS
Usability	3.74	1.01	3.42	0.98	0.32	74	0.711	1.908	A	NS
Durability	3.58	0.91	3.22	1.00	0.36	74	0.818	1.908	A	NS
Safety & Maintainability	3.36	1.00	3.44	1.09	0.08	74	0.205	1.908	A	NS

This implies that the evaluation of the two groups of respondents with respect to instructional applicability has significant difference. Difference on how they viewed conditions of the DPP activity and experiment table particularly its actual utilization, manipulations of the features and direct operation.

The table depicts that no significant differences exist on the evaluation of the existing equipment by the student and professor respondents in all of the criteria with obtained t-value more than the tabular t-value of 1.980 at 0.05 level of significance.

This implies that both groups of respondents believe that the existing equipment though utilized to in its intended use, there are other provisions and/or features needed to improve where the developed DPP table offers.

CONCLUSION AND RECOMMENDATION

This study involved the development of an instructional device for teaching and learning Drafting Technology and Physics subjects specifically in drawing plates and performing experiments. The methods utilized in this study were developmental research method and the experimental research method. The development phase included the initial design of the activity and experiment table, the prototyping, critiquing, design modification and final construction of the actual table/ device. The evaluation phase involved the actual use of the activity and experimental table by the student respondents and the assessment made by the students and professors.

The main objective of the study is to develop and evaluate by Drafting and Physics professors and students an activity and experiment table with several features and functions that intensify the teaching-learning process in science and technology. The study highlighted the following findings: the evaluation of the student- and professor – respondents on the developed DPP table is very much acceptable with the same grand mean of 4.65; the two groups of respondents are likewise evaluated the existing equipment as moderately acceptable; the evaluation of students using the DPP table as compared to the existing equipment in terms of functionality has no significant difference while professor respondents evaluated otherwise together with the durability criteria; and, no significant difference were obtained from the evaluation of the two groups of respondents using the existing equipment and developed DPP table except on instructional applicability. The DPP activity and experiment table attained very high and better evaluation as compared to existing equipment as evaluated by the student and professor respondents. The developed DPP table is acceptable for use as instructional device and facility in teaching and learning Drafting/Drawing and Physics.

In connection with the results revealed from the present study the following recommendations are hereby offered: Utilization of the developed table is strongly recommended in Industrial Technology and Engineering Courses. Adding more features and intensifying electrical/electronic parts leading to automation may be conducted to make the device state-of-the-art. Construction of chair/s to match the activity and experiment table. Evaluation of the developed table may be conducted using experts, professors and students from other school/university. Evaluation on the effectiveness of the developed table may be conducted using other respondents in other colleges/campuses. Apply patent for utility model in the Philippine Intellectual Property Office (PhilIPO). Further study is also strongly recommended using other factors and other evaluation criteria such as aesthetics, ingenuity, economy, viability, reliability, impact and contribution, Earth-friendly, novelty and commercialization.

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APPENDIX

Pictures of the Developed DPP Activity and Experiment Table