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ORIGINAL ARTICLE

Awareness, impact and hands-on experience of medical students about technology based practical at electrophysiology power lab.

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ABSTRACT… Objective: To assess the level of interest, the attitude and hands-on experience of PowerLab among the medical students of Karachi. **Study Design:** Cross-sectional study. **Setting:** Dow International Medical College, Dow University of Health Sciences. **Period:** September to November 2021. **Material & Methods:** Among 360 medical students investigated the awareness and perceptions of the PowerLab system. The data were entered and analyzed on Microsoft Excel version 2016. Statistical summaries and data analysis were made using Likert scales, percentages, and the Chi-squared test. **Results:** A total of 360 medical students participated in this study. Mean age was 20 years ± 1.4 years. Majority of students (53.6%) were from first professional year. Out of 360 students, 322 (89%) have heard of the PowerLab system. A statistically strong correlation (p-value ≤ 0.001) was found between the perceived level of adeptness of the teaching staff with the students' understanding of the PowerLab system. **Conclusion:** The study showed that students require more hands-on exposure when using PowerLab to develop a greater appreciation for the instrument. The results also suggested the importance of well-trained staff to ensure students receive a quality education that meets international standards.

Key words: Electrophysiology, Learning, Medical Students, Medical Education, PowerLab.

INTRODUCTION

Gross technological advancements within the past few years has vastly changed the trajectory of education in almost every field including medicine and health sciences.[1,2] Medical education has also swiftly shifted their focus on demonstrating competencies rather than just acquisition and regurgitation of knowledge.[3] To cultivate adept doctors and to improve their future prospects for better patient health care and management, technology must become the bedrock for medical education.[4] PowerLab is among one of the techniques which has brought revolutionary changes in medical education and allied health sciences.

The PowerLab system is a computer-based device primarily used in undergraduate medical education to relate different pathophysiological phenomena using hands-on practice for acquisition and interpretation of clinical data.[4] Electrophysiology is the one of the main subjects that comprises the use of the instrument, experimenting and investigating of human parameters such as temperature monitoring, blood pressure measurement, and live muscular and neuronal activity demonstration.[4,5] PowerLab has revolutionized the techniques of demonstrating and learning skills on old machines and apparatuses[5] thus gaining rapid prominence within the medical field, and eventually becoming a fundamental part of the medical curriculum.

Many reports studying the implementation of PowerLab affirmed the positive outcomes when pre-clinical students were given the opportunity to interact with the instruments within a supervised environment.[6,7] When students gained more independence to write their testable hypotheses and carry out their lab experiments alongside their peers, there was a greater understanding and appreciation for the instrument and for the

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subject itself.[7,8] The software also provides up to date lab experience which enhanced their clinical skills as they collected and processed data independently while assimilating their prior knowledge of medicine. Additionally, students demonstrated critical thinking during their lab sessions which promoted active participation and the inspiration for auxiliary learning.[8]

The results of previous studies highlighted that such interactive learning sessions were indeed beneficial for pre-clinical students when taught by a properly trained faculty; therefore, clinical skills lab was encouraged in their respective institutes in order to produce well - rounded medical professionals.[8,9] Furthermore, studies conducted locally have also revealed that the acquisition of clinical knowledge can be attained via clinical skills lab.

Nonetheless, there has been no specific study done on PowerLab and its impacts on pre–clinical medical students in Pakistan. Although it may be said that there are techniques, such as case-based learning and chart-stimulated recall that are more than two decades old that are still clinically relevant in medical education, it is unclear to say if the current version of PowerLab in medical schools can be included in this category. That is where this study comes into light. The objective of this study is to better understand how the use of PowerLab affects the students at medical schools in Karachi, Pakistan. PowerLab also requires trained personnel in order to fulfill the use of this device. This study will also try to get a picture of how well-trained the relevant personnel are in PowerLab handling by obtaining the students' feedback about their perspective and experience of PowerLab available at their institute.

MATERIAL & METHODS

This is a multi-centered retrospective cross-sectional study that was conducted at Dow University of Health Sciences from September to November 2021. The subjects included in this study were from all the professional years of Bachelor in Medicine and Bachelor in Surgery (MBBS) program (1 – 5 years) from Dow Medical College and Dow International Medical College affiliated with Dow University of Health Sciences. Sample size required for this study was calculated based on the response rate of 50% at a 95% confidence interval and a 5% margin of error. As per Open Epidemiology version 3.0[10], an estimated sample size of 357 was required. The study obtained data from 360 respondents after proper consent.

The inclusion criteria for this study included medical students from the first to final professional years of medical college who were well–aware of PowerLab and also have relevant hands-on experience. Students from a dental undergraduate program and other allied medical and health programs were included in our exclusion criteria.

The study is ethically registered at the institutional review board of Dow University of Health Sciences for ethical approval (IRB-2507/DUHS/Approval/2021/852). The participation of the students remained completely voluntary and anonymous throughout the course of the study. Consent was obtained physically or electronically via Google forms from each participant before the survey started.

The data collection used a self-administered proforma which was distributed to the medical students of Karachi. Prior to the distribution of the survey, a pilot study was conducted on 25 students to pretest the validity and consistency of the questionnaire. Pretesting the survey provided the opportunity to eradicate any vague or confusing elements and improve the proforma. The questionnaire was designed in four sections. The initial portion consisted of demographic details such as age, gender, nationality, enrollment year, and setup. The following sections were divided into questions that assessed the students about their awareness, their attitude, and hands-on experience with the PowerLab system. Once the sample size was achieved, the link to Google Forms was disabled from receiving further responses and the collected data was entered and analyzed on Microsoft Excel.

As for the statistical analysis, Microsoft Excel spreadsheet version 2016 for Windows was

used. Quantitative variables were expressed in frequency (n) with percentages (%) and mean with standard deviation. Chi-square tests were used to determine association between categorical variables. Level of significance would remain at 5% (p-value ≤ 0.05) at a 95% confidence interval. One of the sections of the questionnaire focused on the attitude of students toward the PowerLab sessions. This was done by a series of Likert Scale questions which ranged from 1 (strongly disagree) to 5 (strongly agree). The means and one-sample t-test were calculated for the Likert Scale responses assuming the data as interval data.

RESULTS

A total of 360 medical students participated in this study. The mean age of the students was 20 ± 1.4 years ranging from 17 to 26 years. Majority of students (53.6%) were from first professional year. Out of 360 students, 322 (89%) have heard of PowerLab system in medical education before. Among them, 167 (50.9%) claimed the source of information from classmates while 146 (44.5%) were informed via teacher or senior medical colleagues. A summary of the demographic's details may be found in Table-I.

While inquiring about their awareness of PowerLab system, 266 (95.3%) responded with physiology when they were asked about the domain of PowerLab application. About, 184 (59.2%) of students stated that they can independently run the PowerLab system, out of them, only 15 (5.2%) felt that they were also proficient in analysing the data from PowerLab as.

Compared to 162 (56.0%) of students who think that they slighty know about interpretation of data and results and 20 (7%) of students who does not know about data handling on PowerLab.

This series of questions about students' attitude towards PowerLab used a Likert Scale format. The highest means was observed in regards to meaningful impact on hands-on learning for medical students in pre-clinical years, (x = 4.000) and, it's important for medical students in pre-clinical years in terms of relevant technology, (x = 3.991). In comparison to this, when they were inquired about the resources available in PowerLab, the lowest (x = 3.072) was observed. Each response in Table-II had a p-value of less than 0.001 for a one-sample t-test assuming average population mean of 2.5.

S. No	Characteristics	n (%)
	Total	**360**
1	**Gender** Males Female	 131 (36.4) 229 (63.6)
2	**Current University** DOW International Medical College (Private) DOW University of Health Sciences (Public) Others	 235 (65.3) 117 (32.5) 11 (3.05)
3	**Professional Year** 1st 2nd 3rd 4th 5th	 193 (53.6) 72 (20) 88 (24.4) 6 (1.6) 1 (0.3)
4	**Heard of PowerLab before** Yes No	 324 (90.0) 36 (10.0)
5	**If "Yes", heard it from (source)** Class Teacher/Medical collogues Friends Other (Newspaper, social media, television, internet)	 166 (46.1) 146 (40.6) 7 (1.94) 41(11.4)
6	**Prior Experience with PowerLab** Yes No	 105 (29.2) 255 (70.8)

Table-I. Demographics of the student participants.

While inquiring about the hands on experience of PowerLab, only 11 (4.2%) of students reported that they have a weekly chance of hands-on experience on PowerLab sessions. Approximately, 161 (55.7%) of the students were less confident while running the software and 153 (52.8%) were able to run the system with assistance. Only 9 (3.3%) students stated that they were proficient in setting up different relevant equipments designed for each practicals.

When the students' attitude towards proficiency of the trained staff was compared with the usage

and understanding of PowerLab statistically significant dependence for the two responses (p-value ≤ 0.001) was found using chi-squared test. The result is shown in Figure-1.

Statistically significant association was found (p-value ≤ 0.001) when the extraction of basic concepts and their implementation in PowerLab was compared with the importance of new and relevant technology in pre-clinical years. The result is shown in Figure 2.

DISCUSSION

The effectiveness and importance of both hands-on and simulated practicals in the medical curriculum are well documented[11,12,13], as an emerging need for technological advancements.[1,14]

S. No	Response of students	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
1	PowerLab lab sessions were helpful for medical student	5.31	12.81	29.06	38.75	14.06	3.434
2	Recommendation to fellow student to attend PowerLab sessions as a way to enhance their understanding	6.88	10.63	25.00	35.63	21.88	3.550
4	The Staff were well trained and adept at usage of the PowerLab	5.00	9.38	27.81	37.81	20.00	3.584
6	PowerLab sessions enhanced the understanding of theoretical concepts	5.63	13.75	30.31	34.06	16.25	3.416
7	The resources available in PowerLab holds up to international standard	11.25	16.56	34.38	29.38	8.44	3.072
8	Helpful for medical students to get exposed to new and relevant technology in pre-clinical years	8.44	5.63	11.88	26.56	47.50	3.991
9	Understand of concepts taught in PowerLab sessions:	3.75	13.44	37.81	34.38	10.63	3.347
10	Ambience of powerlab was user friendly	4.69	9.38	31.88	39.38	14.69	3.500
11	Writing lab reports or other assignments would impact my final grade and enhance my hands on experience	6.25	7.5	28.13	38.75	19.38	3.575
13	Frequency of powerlab sessions per module should be increased	7.50	5.63	13.75	25.63	47.19	4.000

Table-II. Student responses for attitude-based questions regarding PowerLab. The p -values was ≤ 0.001 for each response in the table above.

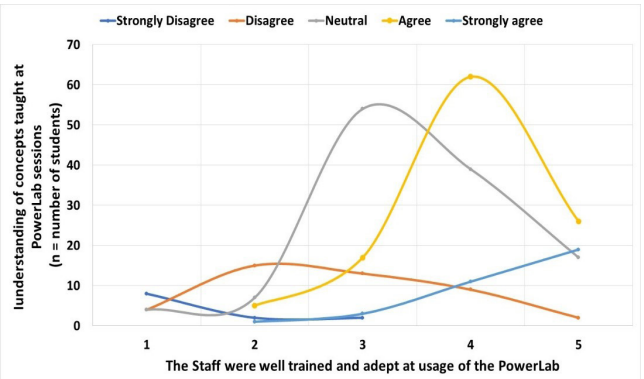

Figure 1. Scatterplot between students' attitude towards proficiency of the trained staff at the usage and understanding of the PowerLab (n = 320, p-value ≤0.001)

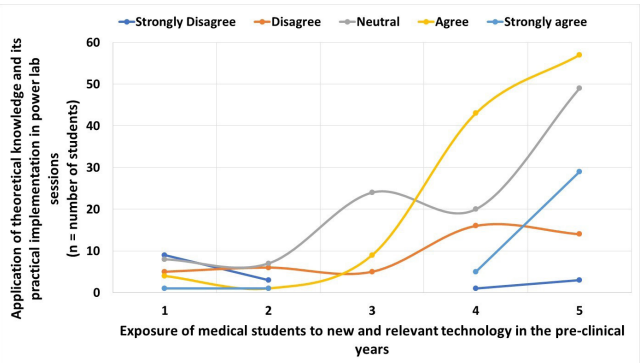

Figure-2. Scatterplot between extraction of knowledge and its implementation in PowerLab to the importance of new and relevant technology in their pre-clinical years (n=320, p-value ≤ 0.001).

This study aimed to bring new insight into how PowerLab affects the curriculum of medical institutes. The results indicate that students had a firm grasp on the knowledge of the PowerLab but were not comfortable in applying nor practising PowerLab.

Even though, many students did have prior hands-on experience in using the PowerLab system, many of the students were not confident in neither running nor setting up the required equipment. Furthermore, the results suggested that students agreed that PowerLab sessions were helpful in their medical education, but many disagreed that the material available held up to international standards. A similar study in 2017 had similar results as when the authors tested how to strengthen the capacity of health worker education in Zambia, PowerLab was deemed effective at teaching human physiology experiments to medical students.[15]

Regarding the subjective experience of medical students, the results revealed that the students had a better learning experience when the teaching staff were well–trained and adept at using the PowerLab system. This result is in line with other recent studies conducted at Isfahan University of Technology, Iran which revealed that the best approach of teaching was the student-centered along with teacher-centered methods which emphasizes the need for a well-trained teaching faculty.[16] The study also suggested that the teachers that improved their teaching skills and proficiency with time gave students more opportunities to correct their conceptions and ignite their interests in the subject. Evidence from this study coincided with the other Iranian study revealing that teachers that were able to exercise their accreditations and had proper PowerLab training had a mass of students with a clear understanding and positive outlook on the PowerLab system.

Moreover, students who were more interested in learning new and relevant technologies were also able to extract the knowledge from class and apply them to electrophysiology labs, indicating increased engagement from students. This result lines with recent studies on how student interests can increase student engagement and learning. A recent cohort done by Ella Kahu et al., reported how student interests impact student success. It was found that students that put more interest and effort in their courses had led to better grades.[17] Additionally, the relevance of the learning task was of profound importance as it directly impacted student interest. In light of these findings, it can be confidently stated that relevant technologies are key to promote the interest of pre-clinical medical students which in turn will lead to more engagement and learning. The results of this study also suggested that many students disagreed that the PowerLab available to them was of international standards, highlighting the importance of upgraded and updated versions which can better facilitate in their medical education. This would have an impact on how much interest the students would have in the Power lab and delay in updating the resources might decrease their level of engagement. It also explains why students were not confident in running nor analyzing data from PowerLab, despite having previous exposure to it. Overall, the result of this study is in line with previous literature and indicates the importance of new and relevant technology beyond the Power lab being available to set an interesting and engaging atmosphere for pre-clinical students.

The major challenge encountered was that students included in the study were primarily from one educational institute. For future in-depth comparisons, multi-center study equipped with PowerLab facility within different academic sessions should be conducted to evaluate the perception of medical students at a broader spectrum. Studies should also be conducted to assess the variables in increasing awareness and participation of students from the teachers' standpoint. This will allow for a two-way analysis of the effectiveness of PowerLab in the physiology labs.

Nonetheless, this study accomplishes the goal of understanding how PowerLab affects the medical curriculum of pre-clinical medical students. Previous literature has stressed the importance

of how important technology is to bring practise procedures to pre-clinical students without risk to patients[18,19,20] and this study also shows that the students believed that the PowerLab helped them in their medical education. The results have shown that the medical undergraduates understand PowerLab and despite exposure to it, the students were not comfortable in operating the equipment. Furthermore, a strong correlation between the perceived levels of adeptness of the teaching staff with the understanding of the PowerLab system was found, suggesting the importance of well-trained staff. Further studies such as training of concerned faculty members, their assessment before and after training and two-way feedback are needed to enhance the level of expertise and understanding of PowerLab in medical education.

CONCLUSION

This study aimed to analyze the level of awareness, their experience and students' understanding about the role of PowerLab as a technology based tool in medical education. In this scenario, our study highlights the importance of PowerLab trained staff that ensure quality teaching to medical students study, also students' get enough opportunities to get themselves handy on the PowerLab. However, further interventional studies and pre and post training studies among the faculty members are needed to highlight the domain where further workup is required.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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1	Tooba Noor	Developed the retionale of study prepared the questionnaire, wrote discussion and proof read the paper.	
2	Shabitul Aisha Khan	Prepared the frist draft of manuscript.	
3	Zaeem Ahmed Nizami	Helped in developing the methodology, data analysis and proofreading.