



UNVEILING THE IMPACT: BLENDED LEARNING USING ICT ENABLED PEDAGOGICAL INTERVENTION IN BIOMEDICAL INSTRUMENTATION EDUCATION FOR ALLIED HEALTHCARE PROFESSIONALS

Biomedical Engineering

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ABSTRACT

Blended learning, incorporating pedagogical interventions provided by Information and Communication Technology (ICT), revolutionises education, especially in allied healthcare[1]. This study investigates the effects of this on allied healthcare professionals studying biomedical instruments. Professionals specializing in cardiac care, clinical lab, imaging sciences, operation theatre & anaesthesia, respiratory therapy, and dialysis technology completed pre-and post-tests. Statistical studies, including t-tests, assessed the intervention's effectiveness. The findings showed substantial gains in each specialization, demonstrating the effectiveness of blended learning with ICT help in knowledge acquisition.

KEYWORDS

Blended Learning, Information and Communication Technology (ICT), Allied Health Professionals, Biomedical Instrumentation

INTRODUCTION

Education is a field that utilizes information and communication technology [2]. E-learning is a broad word for using electronic technologies, mostly Internet technology, to provide a range of possibilities for improving performance and understanding [3]. Furthermore, as mobile device access has improved, more students are utilizing them to look for information [4], [5], [6]. Moreover, they will diagnose, treat, and make decisions with cutting-edge technology tools in their future employment [7]. In addition to having varied learning styles, today's students are more comfortable with technology.

Quick access to information provides educators with an excellent opportunity to innovate in the classroom and meet the needs of the modern curriculum [8]. One option that fits the student's schedule is using video lectures made available online via a local area network or the Internet [9]. Students gain from video lectures since they can learn quickly and at leisure [10]. They can also investigate complex ideas and take more notes by pausing, fast-forwarding, or rewinding [11], [12]. Students have the potential to revolutionize medical education by utilizing information technology.

Biomedical instrumentation is critical in modern healthcare, requiring specialists with up-to-date knowledge and abilities [13], [14]. Blended learning combines didactic instruction with online resources. It is a promising style to effective education delivery [15]. ICT-enabled pedagogical interventions improve this method by harnessing technology to enhance learning results [16]. This study looks into the effectiveness of blended learning with an ICT-enabled pedagogical intervention in Biomedical Instrumentation Education for Allied Healthcare Professionals.

Methodology

The study-involved professionals from diverse specializations, including cardiac care, clinical lab, imaging sciences, operation theatre & anesthesia, respiratory therapy, and dialysis technology. Participants were allied healthcare professionals from Symbiosis Institute of Health Sciences (SIHS). The Google Form questionnaire was circulated among the study population through email. In phase 1, a pretest was conducted, in which the evaluation of knowledge was assessed. After this ICT-enabled pedagogical interventions was done, where the students were trained through learning videos, simulation based training and didactic classroom presentation sessions. In phase 2, a posttest was conducted to evaluate whether knowledge gained through ICT-enabled pedagogical interventions increases more with additional resources. Pre and post-test assessments were conducted to gauge knowledge acquisition before and after the intervention. Students undergoing biomedical instrumentation training were included in the study. Statistical analyses, including t-tests, were employed to evaluate the significance of improvements within each specialization.

RESULTS

The pre and post-test results revealed substantial enhancements in knowledge across all specializations. T-test analyses indicated significant improvements ($p < 0.05$) in each specialization, affirming

the efficacy of the blended learning approach. For instance, in cardiac care, the mean knowledge total increased from 11.20 to 18.10 ($p = 0.0018$), while in dialysis technology, it rose from 5.33 to 18.17 ($p < 0.0001$). Similar trends were observed in other specializations.

Table No.1 : Knowledge Level Of Allied Healthcare Professional Students In Focused Group Study With Pedagogical Teaching Interventions.

S. No	Level of knowledge	Pretest			Posttest			p-value	t Value
		Mean	Std. Deviation	Error	Mean	Std. Deviation	Error		
1.	Cardiac Care Technology	11.2	5.63	1.78	18.10	1.91	0.60	0.0018	3.66
2.	Respiratory Therapy	8.44	5.36	1.79	16.44	2.07	0.69	0.0007	4.17
3.	Imaging Sciences	12.45	4.95	1.49	17.18	1.94	0.58	0.0079	2.95
4.	Clinical laboratory	7.17	3.66	1.49	16.83	2.64	1.08	0.0004	5.25
5.	Dialysis Technology	5.33	2.5	1.02	18.17	4.02	1.64	0.0001	6.63
6.	OT & Anesthesia	7.31	5.82	1.61	17.69	2.43	0.67	0.0001	5.93
7.	Assisted Reproduction Technology & Embryology	5.27	5.16	1.56	17.36	2.91	0.88	0.0001	6.77

Table no 1, gives the statistical t-test analysis values of the focused group study conducted on specializations of allied health professionals studying at symbiosis institute of health sciences.

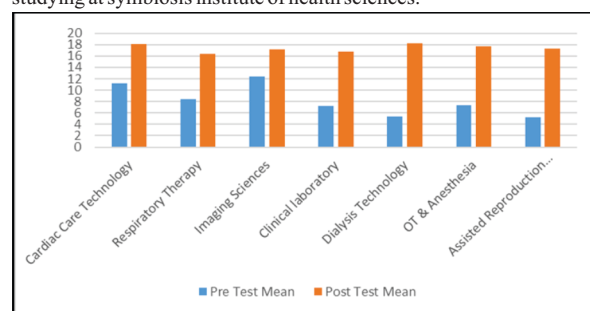


Figure No 2: Focused Group Study Means Values Of Each Specialization Of The Allied Health Professionals Training Program

The study findings provide valuable insights into the perspectives and experiences of various stakeholders, offering a basis for improvements in biomedical instrumentation education and training programs. The significant associations between academic program/qualification and age/qualification suggest there is specific qualifications required for

certain academic programs and age groups. The gender and academic program variables association indicates potential disparities in admission/enrollment for the program entailing gender equity in education. The independence of gender and qualification, as well as age and gender, suggests that gender may not have a direct impact on qualification attainment or age, indicating areas for further investigation into potential influencing factors.

Table No. 3: Factor Analysis To Understand The Association Of The Variables Under Study.

Variable 1	Variable 2	p-value	Implications
Training Experience	Self-Confidence	0.467	p-value is less than 0.05 and positive implying a positive association between training experience and Self-confidence
Training Experience	Self-Capability	-0.098	A non-significant & negative p-value means simply having good training experience will not impact Self-Capability & competence gaining amongst the health professionals
Self-Confidence	Self-Capability	-0.274	Negative non-significant p-value indicating Self-confidence does not have any impact/effect on Self-capability of the study participants

Overall from the factor analysis one can conclude that merely having a good training experience and self confidence will not develop self capacity & competencies amongst the Allied Health Professionals. Training Effectiveness: The lack of significant associations between training experience and self-confidence/self-capability implies that simply undergoing training may not directly translate into increased confidence or perceived capability. This suggests a need for training programs to focus not only on imparting knowledge and skills but also on boosting participants' confidence and self-perceived capability. The weak negative correlation between self-confidence and self-capability indicates complexity of individual perceptions. It suggests that individuals assess their confidence and capability in a different way. This implies more attention is required addressing personal factors and beliefs while designing the training programs. While the current analysis does not find significant relationships between the self-confidence, self-capability & experience variables, it is important to explore other factors that could influence participants self-confidence and self-capability. Understanding these aspects can help in developing a personalized training module to meet the learners expectations.

In summary, the data reveals the multifaceted nature of training experiences and self-perceptions, emphasizing the importance of objective and subjective based self-assessments to evaluate training effectiveness.

DISCUSSION

The findings emphasize the transformation brought by blended learning with ICT-enabled pedagogical interventions in teaching biomedical instrumentation. The noticeable enhancements in knowledge highlight the effectiveness of this approach in meeting the need of diverse healthcare learners. Integration of technology will enhance accessibility & create engaging and stimulating learning experiences.

The results emphasizes the effectiveness of blended learning with ICT intervention can enhance Biomedical Instrumentation Education for healthcare professionals. These findings aligned with previous research demonstrate the advantages of integrating technology into education.

This research reveals that combining traditional and digital learning methods can enhance learning outcomes by offering flexibility, interaction and access to an array of educational resources materials. Similarly, using ICT tools will improve engagement and knowledge retention among learners in biomedical instrumentation.

Further exploration into the lasting impact of blended learning and optimized educational strategies will warrant progressed education for allied healthcare professionals.

CONCLUSION

Blended teaching augmented with ICT technology has emerged as a powerful tool for advancing Biomedical Instrumentation Education among allied healthcare professionals. The study illustrates its effectiveness in enabling learners to acquire knowledge and develop skills across specialties. This highlights the significance of adopting innovative educational methods to address the evolving demands of the healthcare industry.

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