ORIGINAL ARTICLE

EFFECTIVENESS OF YOUTUBE AS AN EDUCATIONAL TOOL FOR TEACHING ORTHODONTICS TO UNDERGRADUATE DENTAL STUDENTS

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Background: The advent of modern technology has dramatically influenced the availability of resources for students to learn and gain knowledge as well as improve their skills. **Methods:** Over six months, a randomized control trial (pretest-post-test design) was conducted at Khyber College of Dentistry, Peshawar. The aim was to compare the traditional method with YouTube learning to enhance students' diagnostic skills in lateral cephalometry and benefit the local dental community. **Results:** Seventy-four participants took part, with an average age of approximately 23 years having 35.1% male and 64.9% female participants. The control group's pre-test mean score was 5.54, significantly increasing to 13.62 in the post-test. The experimental group's pre-test mean score was 4.08, significantly rising to 15.29 in the post-test. The experimental group outperformed the control group in the post-test, with mean scores of 15.29 and 13.62, respectively. Participants showed overall satisfaction with course content, materials, instructor knowledge, and YouTube learning, though opinions on class location and equipment varied, with some expressing less satisfaction in this aspect. **Conclusions:** This current study signifies the use of YouTube as a teaching tool. YouTube based learning had a superior efficacy to traditional based learning for instruction of cephalometric landmarks identification.

Keywords: Teaching tool; Orthodontics; Medical Education; E-Learning; YouTube.

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INTRODUCTION

Effective education is vital for academic success, with recent technological advances transforming learning globally, including dental education.[1] E-learning, especially through platforms like YouTube, has become a significant alternative to traditional methods.[2,3]

The COVID-19 pandemic has accelerated the adoption of e-learning in dentistry.[4] YouTube has emerged as a practical resource for dental students, offering insights into clinical practices and surgical techniques.[5,6]

Lateral cephalometric imaging plays a crucial role in orthodontics and orthognathic surgery, aiding in the identification of dental abnormalities.[7,8] However, interpreting cephalograms poses challenges that advanced technologies, such as 3D visuals and videos, could address.[9]

Dental students face difficulties in mastering cephalometric interpretation through conventional lectures.[1] The study explores the potential of YouTube-based learning to enhance instruction for cephalometric landmarks tracing, addressing a gap in current research.[10]

This study aims to compare the effectiveness of traditional learning and YouTube-based learning in cephalometric landmark identification and related analyses. The goal is to contribute to improved lateral cephalometry diagnosis, benefiting local dental education.

MATERIAL AND METHODS

The research was conducted at the Orthodontic Department of Khyber College of Dentistry in Peshawar and spanned six months from approval. It utilized a Randomized Controlled Trial with a pretest-posttest design, sanctioned during the 134th meeting of the KMU AS&RB on May 25, 2023 (Ref No: DIR/KMU-AS&RB/EY/002028). By using openepi, the total sample size was 74 (37 in each group) by using the mean of Point (Or) of the Traditional learning group 6.65±6.24 and 3.67±1.64 in the Smartphone-based mobile learning by keeping a 95% confidence interval with 80% power of the test.[1]

One hundred final-year students were divided into two groups using systematic random sampling based on performance in their third professional examination. The 3rd Professional BDS examination marks for the entire batch were graded from highest to lowest, and a comprehensive list was created. To evenly distribute students of similar abilities into two groups, all even serial numbers were assigned to Group I, and all odd serial numbers were assigned to Group II.

Data collection commenced post-approvals, with validated pre/post-tests and YouTube videos link. Participants were ensured confidentiality, provided informed written consent, and randomly assigned to two groups, each exposed to specific teaching methods. Both groups were exposed to a pretest of 20 MCQs. Group 1 was taught cephalometric tracing topics by the traditional method with direct observation and practice in the demonstration room, while Group 2 used a YouTube video for the same topics of 10–15 minutes for learning and practice, supervised by the same Trainee Medical Officer. Both groups had a three-day session of one and a half hours, followed by a post-test (20 MCQ's) on the fourth day. Students feedback evaluation was conducted on a five-point Likert scale. (Figure 1)

Data analysis was performed using SPSS version 24, presenting results through tables and graphs Numeric data like age and score of the participant in each group were computed as a mean and standard deviation. Categorical data like gender was described as frequency and percentages. Paired sample T-test was applied to compare each group's pre and post-intervention scores. An Independent Sample T-test was used to compare post-intervention scores between both groups. Data was stratified for age and gender to see effect modification using a paired sample T-test. The level of significance was $p \leq 0.05$.

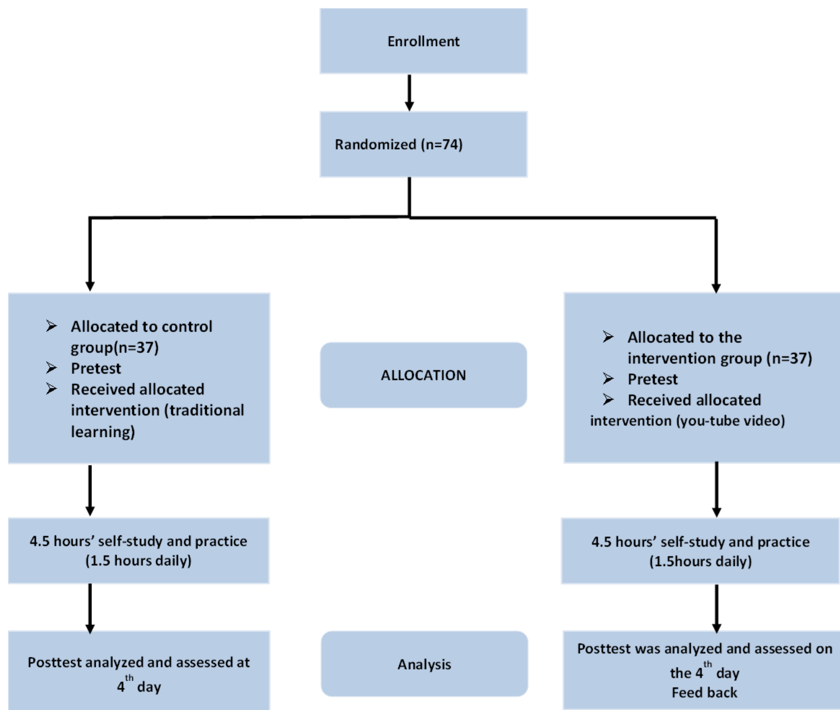

Figure-1: Consort flowchart

RESULTS

Among 74 participants, the average age was approximately 23 years, showing little variation (figure 2). Gender distribution indicated n = 26 (35.1%) male and n=48 (64.9%) female participants (figure 3).

In the control group, the mean pre-test score of 5.54 increased significantly to 13.62 post-intervention through traditional teaching, with a highly significant t-value of -11.43 (p=0.001). A weak negative correlation (r = -0.124) suggested that higher pre-test scores were associated with slightly lower post-test scores. Cohen's d-effect size of 2.79 indicated a substantial impact.

For the experimental group, the mean pre-test score of 4.08 rose significantly to 15.29 post-intervention, with a highly significant t-value of -25.27 (p=0.001). A very weak negative correlation (r = -0.049) suggested a slight tendency for higher pre-test scores to be associated with slightly lower post-test scores. The large Cohen's d effect size of 6.03 highlighted a significant impact, with the intervention having a greater influence on the experimental group than the control group.

Both groups showed significant post-test score improvements post-intervention, with the experimental group demonstrating a larger effect size, indicating a greater impact of the intervention on their results. (Table 1)

Generally positive feedback on course content, materials, instructor, communication, and YouTube learning.

Varied opinions on class location and equipment, with some participants expressed less satisfaction. (Table 3)

The experimental Group outperformed the Control Group on post-test (mean scores: Control = 13.62, Experimental = 15.29) (Table-2). Lower standard deviation in the Experimental Group suggests higher consistency in post-test scores. A significant difference between groups was confirmed by t-value (-2.45) and *p*-value (0.017), with a moderate effect size (Cohen's d = 0.56). (Table-2)

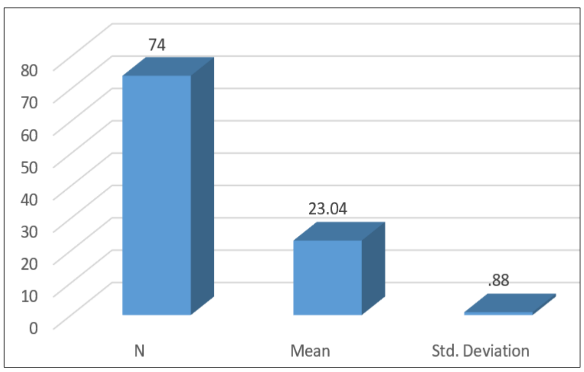

Figure-2: Age of Participants

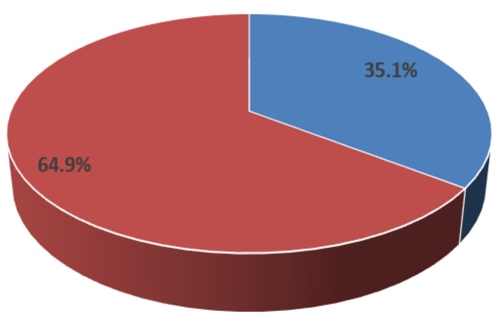

Figure-3: Gender distribution

Table-1: Mean comparison of pre-test and post-test on control group and experimental group

	Pre-test		Post-test					
Variables	**M**	**SD**	**M**	**SD**	**T**	**p**	**r**	**Cohen's d**
Control Group	5.54	1.96	13.62	3.58	-11.43	.000	-.124	2.79
Experimental Group	4.08	1.58	15.29	2.10	-25.27	.000	-.049	6.03

Table-2: Mean comparison of control and experimental groups on post-test score

	Control Group		Experimental Group				
Variables	**M**	**SD**	**M**	**SD**	**t**	***p***	**Cohen's d**
Post-test Score	13.62	3.58	15.29	2.10	-2.45	.017	.56

Table-1: Item means of feedback evaluation

	N	**Mean & SD**
Course content met your needs	34	4.23±.43
Course material and educational resources	34	4.26±.44
Class location and equipment	34	2.32±1.12
Knowledge of the subject matter	34	4.50±.50
Communicated the course material effectively	34	4.52±.50
YouTube learning is interesting and engages our attention throughout	34	4.47±.50
The YouTube video duration was just right	34	4.52±.50

DISCUSSION

The study aimed to assess the effectiveness of teaching cognitive skills using traditional and YouTube learning methods for orthodontic students. Results indicated a positive impact of YouTube teaching compared to the control group, confirming the effectiveness of YouTube as a complementary teaching tool. The study's inclusion of participants with a mean age of 23 years adds demographic diversity, enhancing the study's generalizability. In contrast to the current study, Abdelaziz et al used blended learning and investigated the effect of blended learning on new nursing students' outcomes in nursing subjects at Ain Shams University. The study recruited younger students (second-year nursing students), and the average age of students in the study group using traditional lectures was 18.27, while the mean age of students in the control group using e-learning was 18.4.[11]

In comparison to previous research Reime et al. emphasized that in the e-learning group, younger students outperformed older students across the age range of 22–57 years.[12] The current study's inclusion of participants with a mean age of 23 years highlights a specific age group, allowing for focused insights into e-learning approaches for young adults. This focus contrasts with studies that did not discuss age as a factor influencing learning gain. Although the age range was narrow, the emphasis on this specific demographic provides valuable understanding of e-learning strategies tailored to young adults

The study found no significant gender differences in learning gain, differing from other studies revealing gender-based variations. In contrast to this study, Reime et al. conducted research where students were provided with learning objectives and divided into two groups: one using an e-learning program and the other attending 48 three-hour-long lectures. Their study also revealed a gender-based distribution, with women scoring higher than men.[12] Elham Soltanmehr *et al*. conducted a similar study, comparing the effect of virtual and traditional education on the theoretical knowledge and reporting skills of dental students in the radiographic interpretation of bony lesions of the jaw by evaluating 39 dental students who had not received any instruction in the radiographic interpretation of bony lesions of the jaw. There were 7 males (35%) and 13 females (65%) in the virtual learning group, and 5 males (26.3%) and 14 females (73.7%) in the traditional learning group. In terms of sex, the difference between the two groups was insignificant (p>0.05).[13]

As the current study aimed to assess the effectiveness of an intervention by comparing pre- and post-test performances in control and experimental groups. Traditional teaching significantly improved control group outcomes while the YouTube video intervention led to a rise in experimental group. Baseline knowledge showed no significant difference between groups, and overall, the intervention had a marginal impact on learning gain, with no statistical difference between groups.

Comparisons with similar studies, such as O'Leary & Janson (2010), highlighted the unique focus on e-learning in their study. The intervention had a meaningful impact on post-test scores, emphasizing its practical importance and significant positive changes, supported by a moderate effect size (Cohen's d).[14]

Additional literature, including Mitchell *et al*. and Basoglu & Akdemir, corroborated the positive effects of continuous electronic access and educational applications on student performance, aligning with the current findings. Smartphone applications were found to be optimally effective for learning enhancement, as reported by Fernandez-Lao *et al*., Fozdar & Kumar, and Hartnell-Young & Heym. Leasure et al. indicated that electronic learning is 19% more effective than traditional learning.[15]

Strength and limitations:

The study's strengths include using a randomized control group design to reduce bias and enhance validity, pretest and posttest assessments for robust measurement, focus on undergraduate dental students for real-world applicability, standardized YouTube content to control confounding variables, quantitative data for clear analysis, and evaluation of video quality to ensure information reliability.

The study's limitations include a small sample size (74), which may limit statistical power and generalizability; a short timeframe for pretest and post-test assessments, hindering understanding of long-term impacts; restriction to a single institution, limiting broader applicability; inability to confirm YouTube as the sole source of improvement due to potential confounding factors; and focus on short-term results without exploring long-term consequences of using YouTube as a learning aid.

Recommendations:

To strengthen the study's findings, expand the sample size to include more diverse students and incorporate follow-up assessments for long-term impact. Add qualitative analysis through focus groups and surveys to understand student perceptions. Use learning analytics to tailor content and conduct comparative analyses with other teaching methods. Include feedback from educators to refine and maximize YouTube's educational impact.

CONCLUSION

In conclusion, the experimental group showed a greater increase in post-test scores than the control group, highlighting the effectiveness of YouTube as a teaching tool. YouTube based learning had a superior efficacy to traditional based learning for instruction of cephalometric landmarks identification.

AUTHORS' CONTRIBUTION

SSS conceived and designed the study, analysed and interpreted the data, and wrote the manuscript. BJ helped in designing the study and writing the manuscript, did review and final approval of the manuscript. HA did statistical analysis & editing of the manuscript and is responsible for the integrity of the research. NI, WE & SA helped in data collection and manuscript writing.

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