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Original Article



Impact of Integrated Vs. Traditional Curriculum Models on Long-Term Clinical Skills Retention

Sammer Fatima Jalal¹, Hassan Ayub², Farida Parveez¹, Sarah Amin³, Fatima Muhammad Khan⁴ and Sanodia Afridi⁵

¹Department of Medical Education, Frontier Medical and Dental College, Abbottabad, Pakistan

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*Corresponding Author:

Hassan Avub

Department of Dental Education, Bashir College of Dentistry, Islamabad, Pakistan

hassan.ayub490@gmail.com

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ABSTRACT

Integrating basic and clinical sciences has been promoted to enhance clinical reasoning and long-term retention in medical education. Objectives: To compare six-month retention of knowledge and interpretation-based clinical reasoning skills among undergraduate medical students taught through integrated versus traditional curriculum models. Methods: A quasiexperimental study was conducted among final-year medical students (Integrated curriculum: n=53; Traditional curriculum: n=48). Baseline and six-month follow-up assessments included multiple-choice questions (MCQs) for knowledge and interpretation tasks for clinical reasoning. Objective Structured Clinical Examination (OSCE) scores were also recorded. Independent samples t-tests were applied for normally distributed data and Mann-Whitney U tests for nonnormal data, based on Shapiro-Wilk normality results. Effect sizes and 95% confidence $intervals (Cls) were \ calculated. \ A \ p-value < 0.05 \ was \ considered \ statistically \ significant. \ \textbf{Results:}$ Baseline MCQ and interpretation scores were comparable between groups. At six months, knowledge retention (MCQ scores) declined in both groups without a significant between-group difference (p=0.074). Interpretation scores were higher in the integrated group (mean difference 0.48, 95% CI 0.11-0.85, p=0.012), representing a small but statistically significant advantage. OSCE performance was slightly better in the integrated group but did not reach statistical significance (p=0.083). Conclusions: The integrated curriculum was associated with a small but statistically significant advantage in preserving interpretation-based clinical reasoning over six months, despite similar knowledge and procedural skill retention. While the effect size is modest, these findings support the relevance of curriculum integration for $fostering \ higher-order\ reasoning, particularly\ when\ coupled\ with\ reinforcement\ strategies.$

INTRODUCTION

In recent years, medical education has undergone a global shift from discipline-based, teacher-centered models to more integrated, learner-centered approaches [1]. Integrated curricula aim to link basic sciences with clinical application, thereby fostering deeper understanding and longer retention of clinical skills. Studies conducted in the United States and Europe have demonstrated the effectiveness of integrated models in enhancing clinical reasoning, critical thinking, and long-term competence [2, 3]. International evidence further supports this trend. Paul

et al. reported improved cognitive retention in integrated settings [4], while Weimer et al. emphasized the role of spaced reinforcement within such curricula [5]. A systematic review by Alharbi et al. also concluded that integration enhances diagnostic accuracy and application of knowledge in real-life scenarios [6]. In contrast, traditional medical curricula, which separate basic sciences from clinical exposure, continue to be widely used in developing countries due to institutional inertia and resource limitations. In Pakistan, several public and private

²Department of Dental Education, Bashir College of Dentistry, Islamabad, Pakistan

³Department of Medical Education, National University of Science and Technology School of Health Sciences, Islamabad, Pakistan

⁴Department of Medical Education, Northwest School of Medicine, Peshawar, Pakistan

⁵Department of Obstetrics and Gynecology, Health Net Hospital, Peshawar, Pakistan

medical colleges still follow traditional models, raising questions about their adequacy in preparing students for modern clinical demands. While local studies, such as those by Alharbi *et al.* and Fatima *et al.* have explored knowledge acquisition under traditional formats, few have examined long-term retention of clinical skills or directly compared integrated and traditional models over time [6, 7].

This lack of evidence poses a challenge for educators and policymakers striving to reform curriculum design in Pakistan. With limited studies evaluating retention of core competencies such as OSCE performance and interpretation ability, especially after clinical rotations, there remains a critical gap in understanding how curriculum structure influences long-term outcomes. This study aimed to compare the impact of integrated versus traditional curriculum models on the retention of clinical knowledge and skills over a six-month interval.

METHODS

This was a prospective quasi-experimental study designed to compare the long-term retention of clinical skills among medical students taught through integrated versus traditional curriculum models. The quasi-experimental design was chosen because students were already enrolled in pre-assigned curricula at their institutions; random allocation was not feasible due to administrative constraints and ethical considerations. This non-random assignment introduces a potential risk of selection bias; however, baseline equivalence for demographics, prior clinical exposure, and self-reported confidence was assessed to minimize the impact of possible confounders on internal validity. The study was conducted from March 2024 to August 2024 at Health Net Hospital, Peshawar, in collaboration with affiliated medical colleges implementing both curriculum models. Formal approval was obtained from the Ethics Review Committee of Health Net Hospital, Peshawar (Reference No. 3088/HNH/HR). Written informed consent was obtained from all participants. Sample size was calculated using G*Power version 3.1 for an independent samples t-test, with an expected moderate effect size (d = 0.5), α = 0.05, and power $(1 - \beta) = 0.80$. The effect size assumption was based on findings from comparable published studies examining curriculum-based differences in clinical skill retention, which reported effect sizes in the moderate range. The minimum sample required per group was 48; to account for potential attrition, 101 final-year MBBS students were enrolled, 53 from the integrated curriculum and 48 from the traditional curriculum. A purposive sampling method was used, focusing on students who had completed their clinical rotations exclusively under one curriculum type. This approach improved feasibility but carries the risk of sampling bias, which may limit the generalizability of findings to other settings. The study included final-year MBBS students who had documented exposure to either the integrated or traditional curriculum, had completed both baseline and six-month follow-up assessments, and had provided written informed consent. Students were excluded if they had incomplete academic records, failed to attend the follow-up assessment, were enrolled in hybrid curriculum models, or had participated in supplemental clinical workshops within three months before the baseline assessment. Knowledge retention was assessed using a validated 20-item multiple-choice question (MCQ) test mapped to core clinical competencies. Clinical skills performance was measured through an Objective Structured Clinical Examination (OSCE) using standardized checklists, with two faculty assessors independently rating each station. Although complete blinding to group allocation was not feasible due to scheduling constraints, assessors were not informed of the study hypothesis to minimize potential assessment bias. Interpretation ability was evaluated through structured scenario-based questions scored by trained faculty, while self-rated confidence was measured at baseline using a 10-point Likert scale to assess perceived clinical competence. Baseline assessments (MCQ, OSCE, and interpretation) were conducted at the end of the students' final clinical training block. Identical assessments were repeated six months later without any interim reinforcement, allowing measurement of natural skill decay or retention. Data were anonymized using unique participant codes. Content validity of assessment tools was established via expert panel review. Internal consistency was confirmed with Cronbach's α = 0.82 for the MCQ test and α = 0.85 for the OSCE checklists. Inter-rater reliability for OSCE scoring was high (intra-class correlation coefficient = 0.89), indicating consistent scoring between assessors. Data were analyzed using IBM SPSS Statistics, version 26.0. Continuous variables were summarized as mean ± standard deviation (SD) when normally distributed and as median with interquartile range (IQR) when non-normally distributed. Categorical variables were presented as frequencies and percentages. The Shapiro-Wilk test was used to assess normality for each continuous variable, and the choice between parametric and non-parametric tests was explicitly based on these results and the distributional characteristics of the data. Between-group comparisons were performed using independent samples t-tests for normally distributed variables and Mann-Whitney U tests for non-normal variables (e.g., six-month MCQ scores). For Mann-Whitney U tests, Hodges-Lehmann median differences with 95% confidence intervals (CIs) were reported to provide an estimate of effect size. Within-

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group comparisons were conducted using paired samples t-tests for normally distributed outcomes and Wilcoxon signed-rank tests for non-normal data. Chi-square tests were used to assess associations between categorical variables. Effect sizes were calculated for statistically significant results, and exact p-values were reported, with p<0.05 considered statistically significant.

RESULTS

Baseline demographic characteristics were similar between the integrated and traditional curriculum groups. The proportion of female students was 47.2% in the

integrated group and 43.8% in the traditional group (p=0.730). Distribution by academic year did not differ significantly (p=0.231), and prior clinical exposure was slightly more common in the traditional group (72.9%) compared to the integrated group (62.3%), but without statistical significance (p=0.254). Mean age was almost identical between groups (23.07 \pm 2.10 vs. 23.17 \pm 1.24 years; p=0.772), and self-reported confidence scores were comparable (6.97 \pm 1.09 vs. 7.28 \pm 1.45; p = 0.222). These findings confirm that the groups were demographically balanced at the study outset, Table 1.

Table 1: Comparison of Participant Demographics and Background Variables Between Curriculum Groups (n=101)

Variables	Category	Integrated (n=53)	Traditional (n=48)	Test Statistic	df	p-value	95% CI (Difference)
0 1	Female	25 (47.2%)	21(43.8%)	. 2 0 110	1	0.730	-
Gender	Male	28 (52.8%)	27(56.2%)	$x^2 = 0.119$			
Year of Study	3 rd Year	28 (52.8%)	31(64.6%)	2 1 / 70	1	1 0.231	_
real of Study	4 th Year	25 (47.2%)	17 (35.4%)	$x^2 = 1.432$			
Prior Clinical Exposure	Yes	33 (62.3%)	35 (72.9%)	x ² = 1.299 1		0.254	
	No	20 (37.7%)	13 (27.1%)	X-= 1.299	'	0.204	_
Age (Years)	Mean ± SD	23.07 ± 2.10	23.17 ± 1.24	t = -0.290 (Welch's test)	85.82	0.772	-0.77 to 0.58
Self-Reported Confidence	Mean ± SD	6.97 ± 1.09	7.28 ± 1.45	t = -1.230 (Welch's test)	86.58	0.222	-0.83 to 0.18

At baseline, MCQ knowledge scores were slightly higher in the integrated group than in the traditional group $(6.44 \pm 1.22 \text{ vs.} 6.15 \pm 1.14; p=0.222)$. At six months, median scores were 5.91(IQR=5.04-6.31) in the integrated group and 5.26(IQR=4.64-6.14) in the traditional group. This difference was not statistically significant (Mann-Whitney U = 1008.5, Z = -1.792, p=0.074; Hodges-Lehmann median difference = 0.42, 95% CI: -0.03 to 0.88). Both groups experienced similar declines in knowledge over time, with no significant difference in change scores (p=0.976), Table 2.

Table 2: Knowledge Retention Outcomes by Curriculum Group

Variables	Integrated (n=53)	Traditional (n=48)	Test Statistic / U	df/U	p- value	95% CI (Diff.)	Median (IQR) Integrated	Median (IQR) Traditional	HL Δ (95% CI)
Baseline MCQ Score	6.44 ± 1.22	6.15 ± 1.14	t = 1.228	98.87	0.222	-0.18 to 0.75	_	_	_
MCQ Score at 6 Months	5.75 ± 0.85	5.45 ± 1.19	Mann-Whitney U=1008.5	_	0.074	_	5.91 (5.04- 6.31)	5.26 (4.6 4-6.14)	0.42 (-0.0 3, 0.88)
Change Score (6mo-base)	-0.69 ± 1.62	-0.70 ± 1.78	t = 0.030	95.37	0.976	-0.66 to 0.68	_	_	_

Baseline OSCE scores were slightly higher in the integrated group but not significantly different (7.70 \pm 1.26 vs. 7.46 \pm 1.34; p=0.363). At six months, OSCE scores again favored the integrated group (7.47 \pm 1.02 vs. 7.09 \pm 1.19; p=0.084), though the difference was not statistically significant. Interpretation skills were nearly identical at baseline, but at six months, the integrated group scored significantly higher (6.75 \pm 1.21 vs. 6.28 \pm 0.99; p = 0.036, indicating better preservation of clinical reasoning, Table 3.

Table 3: Comparison of OSCE and Interpretation Scores Between Integrated and Traditional Curriculum Groups

Outcome Measures	Group	Mean ± SD	95% CI (Lower-Upper)	p-value
OSCE Baseline	Integrated	7.70 ± 1.26	7.35 - 8.04	0.363
Score	Traditional	7.46 ± 1.34	7.07 - 7.85	0.565

OSCE at 6	Integrated	7.47 ± 1.02	7.19 - 7.76	0.084	
Months	Traditional	7.09 ± 1.19	6.74 - 7.43	0.064	
Interpretation Baseline	Integrated	7.20 ± 0.96	6.94 - 7.47	0.991	
	Traditional	7.21 ± 1.04	6.90 - 7.51	0.991	
Interpretation	Integrated	6.75 ± 1.21	6.42 – 7.09	0.076	
at 6 Mo	Traditional	6.28 ± 0.99	5.99 - 6.57	0.036	

In the integrated group, OSCE scores decreased slightly over six months, but the change was not statistically significant (mean difference = 0.22 ± 1.58 ; p=0.305). Interpretation scores showed a greater decline (mean difference = 0.45 ± 1.66), with a p-value of 0.052, suggesting a possible reduction in performance without reinforcement, Table 4.

Table 4: Within-Group Change in OSCE and Interpretation Scores in Integrated Curriculum (n=53)

Outcome Comparison	Mean ± SD	95% CI (Lower-Upper)	p-value
OSCE Baseline vs. 6 Months	0.22 ± 1.58	-0.21 - 0.66	0.305
Interpretation Baseline vs. 6 Months	0.45 ± 1.66	-0.003 - 0.91	0.052

This 3D clustered column chart illustrates the mean interpretation scores achieved by students at 6 months, comparing the integrated curriculum group (6.75 \pm 1.21) to the traditional group (6.28 \pm 0.99). Error bars (represented as stacked SDs) indicate variability within each group. The graph demonstrates that participants in the integrated curriculum achieved slightly higher mean interpretation scores at the 6-month follow-up compared to those in the traditional curriculum. The difference in mean scores was statistically significant (p=0.036). Although both groups exhibited variability in performance, the integrated group not only outperformed the traditional group in terms of average score but also had slightly greater score dispersion, as indicated by a higher standard deviation (1.21 vs. 0.99). This suggests that while the integrated approach was more effective on average, individual performance varied more widely, Figure 1.

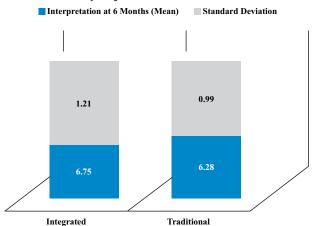


Figure 1: Comparison of Mean Interpretation Scores at 6 Months with Standard Deviation Between Integrated and Traditional Curriculum Groups

DISCUSSION

This study aimed to evaluate the long-term retention of clinical skills among undergraduate medical students taught through integrated versus traditional curriculum models. While knowledge retention (MCQ scores) declined modestly in both groups over six months, the integrated group demonstrated a small but statistically significant advantage in interpretation scores, which reflect higher-order clinical reasoning. Given the modest magnitude of this difference, the result should be interpreted cautiously, acknowledging statistical significance but also its practical limitations. The baseline comparability of both

groups in terms of demographics and confidence levels adds strength to the internal validity of this quasiexperimental design. However, the quasi-experimental nature and purposive sampling limit causal inferences and generalizability, a limitation common to curriculum comparison studies. The lack of significant group differences in knowledge retention at six months aligns with studies by Veer et al. and Ji et al. both of which emphasized that factual knowledge deteriorates over time unless actively reinforced [8, 9]. In contrast, interpretation skills were better preserved in the integrated curriculum group. This finding, although modest in effect size, supports previous work by Jujo et al. who advocated that integrated teaching encourages deeper cognitive processing and long-term clinical reasoning development [10]. Similarly, McMains et al. and Al-Badri et al. argued that integrated approaches improve the meaningful application of knowledge rather than just factual recall [11, 12]. The OSCE scores, although slightly better in the integrated group, did not reach statistical significance, which was consistent with Rafig-uz-Zaman et al. and Shahrezaei et al. who found that improvements in procedural skills often require repeated, hands-on reinforcement over time, regardless of curriculum format [13, 14]. The modest within-group decline in interpretation scores over time (p=0.052) without refresher training mirrors the trend reported by Shahrezaei et al. where skills decayed even in high-performing students unless periodic reinforcement was applied [14]. This supports Yin et al. that deliberate practice and spaced learning are critical for long-term retention [15]. Our results also align with Offiah et al. who found that integrated curricula facilitate the transfer of knowledge into clinical reasoning by blending basic sciences with clinical contexts [16]. Likewise, a systematic review by Albert et al. concluded that students under integrated curricula were better at diagnostic interpretation and clinical application [17]. Moreover, a multicenter longitudinal analysis by Chaou et al. showed that students from integrated programs sustained higher performance in licensing exams and clinical competencies [18]. These findings collectively suggest that while the integrated curriculum's advantage in interpretation scores is statistically significant, it should be viewed as one component of broader curriculum reform efforts rather than a sole determinant of long-term clinical competence. Despite these advantages, the lack of significant withingroup improvement or maintenance in OSCE scores over time signals a potential weakness in experiential consolidation, as emphasized by Natesan et al. and Menard et al. [19, 20]. Future curriculum reforms should, therefore, pair integration with structured, repeated practical exposure to sustain psychomotor and procedural skills alongside reasoning ability.

CONCLUSIONS

It was concluded that integrated curriculum models were associated with a small but statistically significant advantage in preserving interpretation-based clinical skills over a 6-month interval, despite similar trends in knowledge retention and OSCE performance. While the effect size is modest, the finding remains relevant for curriculum reform, especially in resource-constrained and transitioning medical education systems. The results reinforce global calls for curriculum integration in medical education and emphasize the need for targeted reinforcement strategies to optimize long-term clinical competence.

Authors Contribution

Conceptualization: SFJ Methodology: HA, SA¹

Formal analysis: SFJ, HA, FP, SA¹FMK, SA²

Writing review and editing: SFJ, HA, FP, SA¹, FMK, Sa²

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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