

A Comparative Study of Two Blended Learning Strategies: Team-Based Learning and Directed Self Learning During COVID-19 in Pakistan

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ABSTRACT

Objective: This study aimed to compare two blended instructional approaches: Online plus Team-Based Learning (TBL) versus Online plus Directed Self Learning (DSL) by evaluating students' post-test assessment scores and their responses on a feedback questionnaire during the COVID-19 in Pakistan.

Materials and Methods: Fifty first-year dental students participated in a quasi-experimental comparative study using a non-probability convenient sampling technique. During the pandemic lockdown, all students received online lectures on anatomy followed by an on-campus pre-test. Two interventional learning approaches TBL & DSL, were used to blend with online lectures followed by a post-test. A feedback questionnaire was given to students and responses were compared. Data were analyzed by using SPSS version 23, with a significant p -value of ≤ 0.05 .

Results: The comparison of post-test assessment scores of the TBL group (12.38 ± 2.55) and DSL group (10.70 ± 2.67) revealed a statistically significant difference ($p=0.047$). Most responses by the TBL group were statistically significant: motivation towards learning ($p<0.01$), analysis of learning through feedback ($p<0.001$), preference for collaborative work ($p<0.001$) and assessment of blended instruction ($p<0.001$).

Conclusion: Blended TBL proved to be more effective than the blended DSL approach in improving students' test scores in anatomy. The majority of students preferred TBL as a learning approach that motivated them to learn anatomy, promoted collaborative work, and enhanced cognitive and decision-making skills through immediate feedback. Furthermore, students recommended TBL to supplement online lectures and should be offered more frequently in the curriculum.

Keywords: Blended Learning, Team-Based Learning, Directed Self Learning, Test Scores, COVID-19

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INTRODUCTION

The contagion COVID-19 Pandemic has significantly disrupted society, the global educational system, including medical education, and caused enormous economic losses in underprivileged countries like Pakistan.¹ Educational institutions are forced to shift from face-to-face instruction to online mode—a stopgap measure also referred to as an “Emergency Remote Teaching” (ERT) where the rapid approach might affect the quality of courses delivered once the emergency subsided.²

In Pakistan most higher education institutes are not sufficiently equipped to execute online programs smoothly; some of the challenges faced by students and faculty include concerns with internet connectivity, retaining student engagement, online examinations, difficulties comprehending the particular dynamics of online education, lack of faculty training and institutional support.¹ Moreover, the stress of the pandemic had a negative impact on student's academic performance, hence it was difficult to hold students accountable during online assessments.³

To address these challenges blended learning (BL) emerges as an appropriate model which helps by bringing content delivery online and supplementing it with face-to-face (F2F) environments that foster student interaction, stimulate critical thinking, create settings for collaborative work and promote an active attitude towards the learning process.⁴ BL approach with tailored instructional techniques has the potential to enhance student engagement either in or out of the classroom.⁵

Since institutional readiness for online teaching required financial and administrative resources, therefore our main focus was on F2F, student-centred, collaborative teaching strategies. One approach is Directed Self-Learning (DSL) which incorporates the principles of self-directed learning (SDL) where students are provided with integrated learning objectives and some guidance on the process that proved to be more beneficial, especially in the early years of medical education.⁶ SDL is a 21st-century skill to motivate and actively engage learners; techniques used to improve SDL skills include clear instructions, well-organized learning materials, clarity in goals and self-designed tasks.⁷

Another popular approach is Team-based learning (TBL) which has been a thriving, active instructional technique, first developed and verified in the 1970s by Dr. Larry Michaelsen for use in business schools. TBL has become a very popular method in medical education in recent years as this can be applied to both large groups of more than 100 students and small classes of less than 25 students.⁸ TBL provides students with opportunities to apply conceptual knowledge through a sequence of activities that include individual work, teamwork and immediate feedback that foster collaborative, problem-solving decision-making skills, and life-long learning skills in learners.⁸ While examining the geographic distribution of TBL trends, United States remained the hub of TBL research and implementation whereas in Asia, Singapore is the leader hence, scholars suggested more research is required to understand TBL implementation in the non-English speaking contexts.⁹

There is a paucity of literature on DSL, however, some work has been done on Integrated learning in medical education: are our students ready?⁶ Directed self-regulated learning,¹⁰ Directed self-learning,¹¹ and SDL-related DSL sessions.¹² Mostly TBL has been compared with traditional lectures,¹³ Problem-based learning (PBL),¹⁴ and small group discussions (SGD),¹⁵ However, there was hardly any study that compared TBL with interactive DSL in literature. Hence, more work is required on TBL, DSL and blended instructional strategies in undergraduate medical education in Pakistan.

The purpose of our study was to strengthen online teaching in times of sudden shift to online classes by using the tenets of on-campus instructional approaches. Our objective was to compare TBL and DSL blended instructional approaches.

MATERIALS AND METHODS

Fifty 1st year dental students participated in a quasi-experimental comparative study. The duration of the study was 6 months (March 2021 to August 2021). Students were divided into two groups TBL (n=25) and DSL group (n=25) by using a non-probability convenient sampling technique. Students willing to participate were included while students who were not willing or absent were excluded from the present study. The written informed consent forms were signed by all students. Ethical approval was taken from the

Institutional Review Board & Ethics Committee at Shifa Tameer e Millat University, Islamabad, Pakistan with IRB #188-21. Special permission was taken from the Ethical Committee of Rawal Institute of Health Sciences, Islamabad to conduct a study in the Anatomy Department.

RIHS is implementing a hybrid integrated system-based curriculum which is divided into three blocks; each block consists of two modules in 1st year BDS. Large group interactive sessions, SGD, SDL, DSL and PBL are the main medium of instruction. Routinely during DSL sessions, students do self-study in the presence of a facilitator without any interactive activity. However, in the present study, TBL and interactive DSL were introduced for the first time in college as active learning strategies blended with online lectures. To sensitize the facilitators and students, a pilot TBL & DLS session was conducted. Students' queries were addressed, and they were encouraged to participate in the study. The present research was conducted in three phases shown schematically in Figure 1.

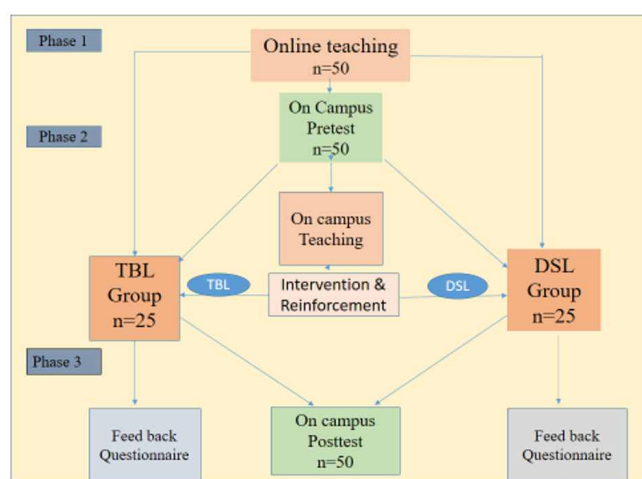


Figure 1: Flow chart of the research methodology

In Phase I, fifty 1st year dental students were given online lectures on General Anatomy, Embryology, and Histology for three weeks (8 hours) during lockdown, owing to the COVID-19 pandemic, following the training programme of Module 2, Block 1. Students were then notified about the on-campus Anatomy test (Pretest) one week before the opening of the campus. Course content, learning resources, and specific learning objectives (LOs) were provided to students through WhatsApp groups. During Phase II, a combined pre-test of both groups was conducted on

campus and results were displayed. Online instruction was then blended with on-campus TBL & DSL instructional approaches. All students were given the same course content, learning resources (pre-reading material), and LOs as given for online lectures a week before the beginning of sessions.

For the blended interactive DSL session, students were motivated to self-study one week before as they had to deliver presentations during the session. Students were given the choice to deliver presentations on a whiteboard or laptop and multimedia. The time duration for DSL was 3 hours. At the start of the DSL session, the facilitator divided the students into five small groups comprising five students each and topics were randomly assigned. Each group member was assigned one SLO on which the student has to make a small presentation of 3-5 minutes, independently. (Preparation time=30 minutes). Fifteen minutes were allocated for group discussion before the presentation. The facilitator was available throughout the group discussions. Students delivered presentations in the remaining two hours and fifteen minutes. After the completion of each presentation, difficult points were clarified and feedback was given.

The Blended TBL session was conducted according to Larry Michelson's model following its fundamental design components.⁸ TBL group was divided into five diverse teams (A-E) based on block-I result, geographic distribution and gender. At least one male member was allotted to each team. Before TBL students were allowed to self-study the prereading material for one week. On the day of TBL, students took an in-class MCQ-based individual readiness assurance test (IRAT, 10 minutes), followed by the same test in groups (GRAT, 10 minutes). Each IRAT & GRAT comprised 10 MCQs (Type A). During the GRAT, the learning environment was changed. Students were asked to arrange themselves in groups to facilitate discussion. This took additional 10 minutes. Each student was given a chance to defend their choice of answer on each MCQ and develop a consensus with teammates. The final answer was given on a scratch card by using a coin. Next immediate feedback (30 minutes) was given by comparing IRAT & GRAT results. Students felt very joyful as their scores increased in group work. This was followed by an explanatory session (30 minutes) during which the misconceptions of the students were clarified.

Students were encouraged for appeals however, there were no appeals filed by any student. The last activity was of Team application exercise (60 minutes) comprised of two clinical problem-based scenarios, displayed on multimedia, each one followed by 3-4 MCQs. All the teams were encouraged to simultaneously report the response for each MCQ using placards. At the end of the session, a peer evaluation form was given for formative feedback and individual accountability (30 minutes).

All students then gave a combined post-test. Results of TBL & DSL groups compiled and displayed promptly on notice boards. Pre & post-tests (20 marks each) were comprised of 20 Multiple choice questions (Type A) addressing the three cognitive domains. A blueprint of assessment was prepared according to the Table of Specifications (TOS), validated by the senior faculty of the anatomy department and finally reviewed and approved by the Department of Medical Education (DME) through calculation of the internal reliability coefficient. The pretest assessment was taken of 43 students whereas the post-test assessment was taken of 40 students. The Cronbach's Alpha in the pretest assessment was 0.954 whereas, in the post-test assessment was 0.941. Both assessments showed excellent reliability.

During Phase III, a validated feedback questionnaire was given at the end of TBL and DSL sessions for the comparison of responses. The questionnaire comprised fifteen statements divided into 5 themes (Table 3). Following the pilot study, validation was done through Principle component analysis using factorization. The Cronbach's Alpha of the questionnaire was 0.71. Data were analyzed by using SPSS version 23. Descriptive and inferential statistics were employed. The normality of data was checked by the Shapiro test. Qualitative

variables were analyzed in the form of frequencies, percentages and graphs.

RESULTS

In this study, a total of 50 dental students in the first year were enrolled equally to receive initially online lectures for 8 hours and then received either TBL or DSL instruction. Of 50 students, 43 students completed their pretest and 40 students completed their post-test. 11 (22%) were males and 39 (78%) were females. The absent students from both the Pre and Post-tests were removed for result analysis. Owing to the absent participants, in the pretest, 6 students were excluded from the TBL group and 1 from DSL; whereas in the post-test 4 students were excluded from TBL and 6 from DSL. An Independent t-test was conducted for the comparison of TBL and DSL groups. The p -value ≤ 0.05 was considered significant.

Before intervention with TBL & DSL, a baseline pretest was taken following online lectures. Statistically, no significant difference was found between the pretest groups as $p=0.954$ (Table 1). However, when Post-test assessment scores were compared between TBL and DSL groups, a statistically significant difference ($p=0.047$) was seen (Table 2).

Students' feedback response was taken by comparing two blended learning strategies TBL & DSL (Table 3). From the TBL group 22 students and DSL group, 20 students submitted their responses. Students of both groups were satisfied with the learning resources ($p=0.26$). Acknowledged that the given preparation time was worthwhile for the amount of learning that occurred in class ($p=0.86$). A significant difference ($p=0.008$) was found between the TBL group (100%) and the DSL group (70%) on the statement that learning objectives helped them to organize their learning.

Table 1: Comparison of pre-test assessment scores of TBL and DSL Groups

Parameters	TBL (n=19)	DSL (n=24)	<i>p</i> -value
	Mean \pm SD		
TBL and DSL	8.36 \pm 3.26	8.30 \pm 3.81	0.954

Table 2: Comparison of post-test assessment scores of blended TBL and DSL Groups

Parameters	TBL (n=21)	DSL (n=19)	<i>p</i> -value
	Mean \pm SD		
TBL and DSL	12.38 \pm 2.55	10.70 \pm 2.67	0.047

Table 3: Comparison of average feedback findings between blended TBL and DSL groups

Themes		Questionnaire statements	TBL Mean ± SD	DSL Mean ± SD	p-value
1 Assessment of Learning Material	1.	Learning resources given to us for self study before instructional mode were beneficial to my learning.	4.48 ± 0.59	4.25 ± 0.71	0.26
	2.	Learning objectives given before instructional mode helped me to organize my learning.	4.52 ± 0.73	3.90 ± 0.71	0.008
	3.	The preparation time for instructional mode was worthwhile considering the learning that took place in class.	4.26 ± 0.86	4.30 ± 0.57	0.86
2 Acceptance of learning strategy	4.	I learned useful additional information during the instructional session.	4.78 ± 0.42	4.30 ± 0.65	0.006
	5.	This instructional mode improved my motivation to learn.	4.61 ± 0.58	4.05 ± 0.82	0.01
	6.	I was satisfied with the faculty's response to my queries.	4.52 ± 0.66	4.20 ± 0.76	0.14
	7.	I enjoyed the instructional activities.	4.61 ± 0.58	4.20 ± 0.95	0.09
	8.	The Instructional mode assisted me to analyze my learning through feedback.	4.52 ± 0.66	3.70 ± 1.12	<0.001
	9.	This instructional mode should be offered more frequently in the curriculum	4.61 ± 1.0	3.75 ± 1.02	<0.001
3 Assessment of characteristics of group work	10.	I preferred to study individually rather than discuss in groups.	1.91 ± 1.1	3.75 ± 1.05	<0.001
	11.	The ability to collaborate with my peers was necessary if I have to be successful as a student.	4.43 ± 0.84	3.55 ± 1.0	<0.001
4 Assessment of the usefulness of a strategy	12.	This instructional mode was not useful, because the same topic was covered in an online lecture	1.52 ± 1.0	2.20 ± 0.95	0.02
5 Assessment of Blended instruction	13.	Instructional mode helped me to get to a higher level of knowledge than I expected at the end of the online lecture.	4.53 ± 0.90	2.20 ± 0.95	<0.001
	14.	I think online lectures were sufficient to get good test scores	1.89 ± 1.0	3.75 ± 1.0	<0.001
	15.	This instructional approach should be used to reinforce online Lectures	4.47 ± 1.0	3.60 ± 1.04	0.01

As far as acceptance of the learning strategy (Theme 2) was concerned, a significant difference ($p=0.006$) was seen as students gained additional useful information during TBL as compared to DSL. When the motivation of students was assessed; the majority were in favour of TBL ($p=0.01$) Students from both groups enjoyed all instructional activities ($p=0.09$) and were satisfied with faculty responses to their queries (0.14). When students were asked whether the feedback helped them to analyze their learning, the majority agreed in the TBL

group ($p<0.001$). Most students (95.4%) agreed that TBL should be offered more frequently in the curriculum ($p<0.001$).

When characteristics of group work were assessed (Theme-3) majority of TBL participants (86.3%) disagreed, with the concept that they prefer to study individually as compared to group discussions, whereas among the DSL participants only 20% disagreed, 25% remained neutral and 55% agreed ($p<0.001$). Almost all

participants from the TBL group (99.9%) agreed that the ability to collaborate with peers is necessary to become a successful student while only 80% agreed from the DSL group ($p < 0.001$).

A significant difference ($p < 0.02$) was found when students were asked about the usefulness of instructional mode (Theme 4) through a distractor, "This instructional mode is not useful because the same topic was covered in an online lecture". Most students from the TBL group (95.44%) and only 70% from the DSL group disagreed with the statement.

On inquiry upon assessment of blended instruction (Theme 5), students' response was more in favour of TBL. A significant difference ($p < 0.001$) was found when asked about whether the instructional mode helped them to achieve a greater level of knowledge than expected at the end of the online lecture, 81.6% from the TBL group and only 55% agreed from the DSL group. In response to the statement that online lectures were sufficient to get good test scores, most students from the TBL group disagreed ($p < 0.001$). The majority of students agreed that TBL should supplement online lectures whereas mixed responses were submitted by the DSL group ($p < 0.01$).

DISCUSSION

Following online classes, a Pretest assessment was taken to establish baseline scores and to rule out any differences between the TBL & DSL groups ($p = 0.954$, Table 1). Students' pretest assessment results revealed that students' test scores were low following online classes (Table 1). Our findings were similar to a study which reported learning outcomes were downgraded by 5 to 10 points on a cumulative final exam for students who took the pure online segment as opposed to those in the F2F or blended formats.¹⁶

Until now, there has been no direct comparison of blended TBL & DSL as active learning approaches in the literature. We did not compare pretest assessment scores with post-test scores as students were given online lectures in times of stressful environment of Covid 19 lockdown.¹⁷ Our data revealed that mean post-assessment scores improved after intervention with TBL & DSL (Table 1 & 2). Nevertheless, TBL proved more rewarding to students as post-assessment scores in the TBL group improved significantly ($p = 0.047$) (Table 2). Hameed et al (2017) analyzed the impact of TBL

supplementation on exam scores and reported that augmenting pedagogic lectures with TBL can improve student's learning, proficiency and exam scores.¹⁸ In this study, instead of traditional lectures we supplemented online lectures with TBL and DSL, and we found supplementation with TBL was more rewarding for students. In another research, however, there was no significant difference in exam scores and grades seen between TBL and non-TBL groups.¹⁹

Students of both groups were satisfied equally with learning resources and preparation time as there was no significant difference between groups. However, a significant p -value (0.008) indicated that learning objectives were more helpful to the TBL group. This could be because the TBL group applied all LOs immediately on MCQ-based tests in IRAT, GRAT and application exercises and got immediate feedback on their scores by which they could assess their preparation, whereas the DSL group had to utilize only one LO for making a presentation. Our TBL findings were consistent with earlier research on TBL that learning objectives should be concrete for effective learning.²⁰ Present research findings were in agreement with Burgees et al. (2016) who implemented TBL design in 1st-year medical students and concluded that many parts of the TBL process were favoured by students, notably incentive to perform the pre-reading and increased participation in the process.⁸

Students of both groups equally enjoyed all instructional activities ($p = 0.09$) and were satisfied with the faculty's response to their queries ($p = 0.14$). This might be because the facilitators of both groups generated peer discussions and resolved students' queries. Our study was in accordance with other studies that stated TBL activities were enjoyable and engaging.²⁰ Similarly SDL sessions were described in another study as being simple, efficient, and joyful.²¹ In the current study, DSL was designed to promote learners' active engagement and self-directed learning; the facilitator role was of a guide in solving student queries, encouraging group discussions, and providing feedback after the presentations. Our study was in accordance with research in which DSL presentations facilitated by teachers helped the students to organize their understanding of the topic, and enhance their self-regulation and communication skills.¹² Present study was in agreement with the research that highlighted the

significant improvement in academic performance of undergraduate medical students with Modified DSL particularly in the early years of undergraduate medical education.²²

The majority of students agreed in the TBL group that feedback helped students to analyze their learning as compared to the DSL group ($p<0.001$). The scratch cards used during GRAT immediately provide consensus-building discussion and performance feedback, increasing students' decision-making skills. Our study supports the research that immediate feedback, allowed students to assess their preparation and understanding by improving their cognitive, analytical and decision-making abilities.²³ TBL should be offered more frequently in the curriculum ($p<0.001$) was backed by many researchers who verified that TBL is a highly organized student-centred, small-group interactive technique that improved students' learning and should be utilized in the anatomy curriculum.²⁴

During the TBL process groups were converted into heterogeneous teams, while also holding peers accountable. TBL technique encouraged students to study regularly while also benefiting from active teaching and peer learning. The preference for collaborative work was seen in the TBL group ($p<0.001$), which was consistent with previous studies.^{24,25} Although Group discussions were held in DSL also, there wasn't any peer accountability hence, more emphasis was seen on individual work. This was consistent with the study on modified DSL sessions where students' actively participated but their observation on satisfaction and usefulness towards achievement of skills was not encouraging.⁶

The present research found TBL, a useful approach ($p<0.02$) that helps the student to achieve a greater level of knowledge than online lectures ($p<0.001$.) This study was consistent with earlier findings that TBL was an effective strategy as it enhances students' cognitive and metacognitive skills.²⁶ The study of anatomy and its subsequent application demands the students to retrieve a large amount of factual information, which was difficult for students to accomplish by online teaching alone, hence in the present study, the majority of students were in favour of the TBL instructional approach to reinforce online lectures instead of DSL ($p<0.01$). Our research supports the findings that blending online courses with interactive F2F teaching

sessions improved learner achievements and satisfaction levels in contrast to the traditional anatomy curriculum for dental students.¹²

The limitation of our study was the small sample size which may not be representative of all undergraduate dental students. Also due to time constraints, busy 1st-year dental curriculum and situations of lockdown, we were unable to conduct more TBL & DSL sessions during the module.

We recommend future research on TBL & DSL be carried out on a large sample size. In addition, more studies are required in the implementation of TBL & DSL in Pakistan during online and F2F teaching sessions to improve students' academic performance and learning outcomes in undergraduate medical & dental curricula.

CONCLUSION

Both the blended approaches TBL and DSL, increased students' test scores in anatomy than online methodology alone, but blended TBL outperformed blended DSL ($p=0.047$). Also, a well-designed DSL that incorporates the principles of SDL will be a useful strategy in institutes where resources are limited. Students from both groups felt that the learning material and preparation time given for self-study was worthwhile and beneficial to their learning. Also, students enjoyed all the instructional activities and felt satisfied with the faculty's responses to their queries. However, the majority of students found the TBL approach more engaging than DSL as this approach improved their motivation towards learning anatomy, promoted collaborative work, and enhanced cognitive and decision-making skills. Most students felt that TBL should be utilized to supplement online lectures and should be offered more frequently in the curriculum.

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DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

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AUTHORS CONTRIBUTION

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