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Original Article

Effectiveness of Traditional Lecture-Based Learning and Flipped Classroom Learning in Teaching Dermatology among Undergraduate Medical Students of Bangladesh

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Abstract

Background: In recent years, transition towards competency-based education, has been one of the most major shifts in medical education. From traditional lecture-based teaching-learning to problem-based teaching-learning (PBL), flipped classroom learning (FCL) and team-based teaching-learning (TBL) are the methods increasingly being employed in medical education. For promoting active learning by improving teaching efficiency is the most valuable and effective approach, which requires students to actively participate in the class, engage with learning materials and collaborate with the peers This study aimed to evaluating the effectiveness and acceptability of Traditional Lecture-Based Learning (TLBL) and Flipped Classroom Learning (FCL) in dermatology among undergraduate medical students of Bangladesh. **Methods:** This quasi experimental study was performed among 118 undergraduate medical final year students from three non-government medical colleges in Cumilla district of Bangladesh, who were selected using convenience sampling method. The study was conducted from July 2023 to June 2024. To assess effectiveness three topics Acne, Psoriasis and Alopecia were chosen and two teaching methods Traditional Lecture-Based Learning (TLBL) and Flipped Classroom Learning (FCL) were adopted. Pre-test and Post-test of each session were conducted and self-administered structured questionnaire were used to get level of performance and satisfaction respectively. **Results:** Study revealed that the overall satisfactions about the attainment of 'learning objectives', 'learning ability and interest', 'team/group work ability', 'clinical ability' and on the 'teaching method' by TLBL were 43.2%, 37.4%, 25.6%, 37.4% and 44.2 % respectively; These satisfactions were increased as 75%, 77.4%, 74.4%, 77.8% and 75.8% respectively by FCL. The gross satisfaction in percentage with TLBL was 37.6% and was increased to 76% with FCL. All these differences were statistically significant between the two groups as a whole (Independent t test, P=0.000). The mean post-class test scores compared to the mean pre-class test scores showed that students' learning increased 85.83% by FCL (P=0.000) and decreased 4.22% by TLBL (P=0.6980).**Conclusion:** The null hypothesis of the of the present quasi experimental design was, 'Traditional lecture-based leaning (TLBL) and Flipped classroom learning (FCL) are equally effective in teaching dermatology to undergraduate medical students of Bangladesh'. Based on the findings of the present study we can reject the null hypothesis and accept the alternate hypothesis 'Flipped classroom learning and Traditional lecture-based leaning are not equally effective; Flipped classroom learning is better than Traditional lecture-based learning in teaching dermatology to undergraduate medical students of Bangladesh.'. FCL can be complementary with TLBL if these are judiciously used and included with wider research in the teaching methods of medical education of Bangladesh.

Keywords: *Traditional-Lecture Based Learning (TLBL), Flipped Classroom learning (FCL), Medical Education, Dermatology.*

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Introduction

Rapidly changing healthcare needs of population worldwide challenges medical education in keeping pace. Traditional curricula, inadequate resources, poor quality assurance and accreditation practices results in the production of under equipped graduates. To effectively address and mitigate the health problems of the twenty-first century, more efficient, and effective paradigms in public health and medical education are necessary.[1,2] Health professional institutes have to play pivotal role in developing evidence-based curricula, implementing new technology, and promoting new programs. Principal stakeholders must take an active role to bring about the necessary changes in medical education and public health. Now a days, shift towards competency-based curriculum, the use of newer technology, the raising demand on interprofessional education and addressing social determinants of public health related issues in medical education are major challenges.[3]

In recent years, transition towards competency-based education, has been one of the most major shifts in medical education. An extensive evolutionary process has been occurred in medical education for so many years. From traditional lecture-based teaching-learning to problem-based teaching-learning (PBL), case-based learning, flipped classroom teaching-learning (FCL) and team-based teaching-learning (TBL) are the methods increasingly being employed in medical education. For promoting active learning by improving teaching efficiency is the most valuable and effective approach, which requires students to actively participate in the class, engage with learning materials and collaborate with the peers.[4] Active learning has been shown to be effective as it engages the students in the learning process. It facilitates more interaction between students and teachers and frequent useful feedback from the faculties. It also leads to more collaboration and interaction between the students and may gain extraordinary learning experience.[5]

Recently, the flipped classroom method draws much attention in medical education. A flipped classroom is an instructional strategy and a type of blended learning. It aims to increase student engagement and learning by having pupils' complete readings at home through online by provided videoed lecture and texts and work on problem solving activities during class. It engages students to obtain background knowledge at home prior to an interactive class meeting and reserves the class time for discussion about real problems, facilitated by faculties in which students do not need didactic lecture like traditional lecture-based classroom learning. Previous studies show that the flipped classroom approaches can provide

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pupils with more flexibility for self-learning, helps to promote students' interest in studying and retention of knowledge.[6,7]

A flipped classroom learning (FCL) is a type of active learning in which reversal of traditional lecture as the form of study at home followed by discussion and feedback. It means the students have to observe videoed lecture and or study reference texts through internet on their smart phones or laptops at home. The students can pause and rewind the difficult concept as many times as they want. It helps students to study core concept of a lecture before the class, so that students can use time of class effectively to apply and discuss those core concepts with their instructors.[8]

Overall usefulness of the flipped classroom method in medical education being debated even till now. There is a debate in the literature that if a flipped classroom is conducted very poorly and when summative assessment is not done, students do not go through prior homework, it will not be effective. Therefore, it is Very much important to evaluate the effectiveness of the flipped classroom learning that is applied to a new setting. Thus, this study was conducted with the objective of evaluating the effectiveness and acceptability of the flipped classroom learning in teaching dermatology among undergraduate medical students in Bangladesh.

The most common method of teaching is lecture-based instruction. In this method, primary transmitters of knowledge are teachers whereas students are the receivers. Lecture-based learning is more or less efficient but it involves less engagement of the students. Medical students need to acquire a large extent of knowledge and that knowledge must be retained by students for long-term use. This long-term retention of knowledge can be facilitated by employing methods of active learning that ensure extensive involvement by the students; team-based and flipped classroom learning strategies fall in the category of active and effective learning.[9]

Flipped classroom learning is emerging rapidly and need to be tested so that the effectiveness of this learning strategy could be determined and implemented to improve the quality of education. In this light of the above-mentioned facts, the researcher in this study assessed the effectiveness of flipped classroom learning in teaching dermatology among undergraduate medical students in Bangladesh.

Methods

This quasi experimental study was conducted from 1st July 2023 to 30th June 2024 among undergraduate final year medical students of dermatology course from three non-government medical colleges at Cumilla district of Bangladesh. The null hypothesis of the quasi experimental design was, 'Traditional lecture-based leaning (TLBL) and Flipped classroom learning (FCL) are equally effective in teaching dermatology to undergraduate medical students of Bangladesh' and alternate hypothesis was 'Flipped classroom learning and Traditional lecture-based leaning are not equally effective; Flipped classroom learning is better than Traditional lecture-based learning in teaching dermatology to undergraduate medical students of Bangladesh.' Convenience sampling technique was adopted to collect data with the reason for students with similar academic background could be included by random sampling in the study. Inclusion criteria were undergraduate final year M.B.B.S. students who participated in the dermatology classes and were willing to participate in the study. Exclusion criteria

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were those students who did not answer perception and satisfaction questionnaire and pre-class and post-class MCQ test questions. Calculated sample size was 16 in each group. Attempted to collect data from not less than 30 students in each group of selected medical colleges during intervention to ensure normality assumption of data. The total sample size was 118. Three different categories of instruments were used in this study. A self-administered structured questionnaire was used to collect data regarding the perception and satisfaction of traditional classroom learning and flipped classroom learning for final year students, constructed under 5 points Likert`s scale was used for data collection. The appropriate values for the Likert`s scale were: strongly disagree = 1, disagree = 2, neither disagree nor agree = 3, agree = 4 and strongly agree = 5. A pre-class MCQ test questions with 10 items with total 10 marks was used for assessing the students' preliminary knowledge before conducting the teaching methods-based learning. Out of 10 items, all were recall type questions. A post-class MCQ test questions with 10 items with total 10 marks was used for assessing the students' knowledge after conducting the teaching methods-based learning. Out of 10 items, 4 items were problem oriented and 6 items were recall type questions. The questions of pre-class test were not repeated in the post class test. The instrument was pretested in medical colleges other than the study area. Selected medical colleges were approached through a request letter issued by Director, Centre for Medical Education describing the purpose of the study and seeking co-operation to conduct the study. The researcher visited the respective medical colleges, introduced himself and explained the title and objectives of the study and finalized date and time for data collection. Initially the students of the dermatology department of the selected medical colleges were briefed about FCL in one session. The students gave their prior permission before the study was conducted. Traditional Lecture-Based Learning (TLBL) on the topic was conducted through PowerPoint presentation. For Flipped Classroom Learning (FCL) flipped video and texts were delivered before the day of flipped session through WhatsApp to the students with the assistance of class monitor and students were asked to study the supplied content at home according to learning objectives. On the next day before the session difficult points or parts were provided to class monitor by the students, then peer to peer and student-teacher discussion was carried out on those difficult points or parts. Before conducting all the preselected session, students were assessed through pre-class MCQ test questions of respective topics. Researcher himself conducted the sessions with preselected teaching technique and students participated in the preselected categories of session and teachers of dermatology department also participated in the sessions as observer. During data collection from students the researcher provided some introduction to the students related to the study. The students were briefed all about the questionnaire. Any question raised during data collection was clarified by the researcher. After the session the student performances were assessed using the post-class MCQ test questions along with the questionnaire regarding their perception and satisfaction of the respective session. Topics for the session were acne, psoriasis and alopecia. In each medical college, first teaching method was traditional lecture based, then flipped classroom teaching methods with selected topics respectively.

The data obtained by the questionnaire were checked and edited immediately after data collection manually. Then this was entered into computer Software Program

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SPSS version 27.0.1. The computerized data was again checked and edited. Data was analyzed as per the specific objectives of the study. The statistical tool commonly was used to analyze survey data and compare multiple groups' perceptions and performance scores was Independent t tests. In order to get a comprehensive insight from students' perception on different teaching methods researcher developed following matrix of students' satisfaction level:

Highly Unsatisfactory	Unsatisfactory	Moderately Unsatisfactory	Moderately Satisfactory	Satisfactory	Highly Satisfactory
Below 40%	41%-50%	51% to 60%	61%-70%	71%-80%	81% and above

Result

Table 1: Comparison of mean level students' satisfaction on different issues related to their attainment of leaning objectives by TLBL and FCL

Question	Method of teaching (n)	Percentage of level of agreement with corresponding score					Score Mean (SD)	t, (df), P-value
		SD=1	D=2	NDNA=3	A=4	SA=5		
Meets my learning requirement of the syllabus	TLBL (n=110)	8 (7.27%)	25 (22.73%)	44 (40%)	33 (30%)	0 (0%)	2.93 (0.91)	-10.25 (172.15) 0.000*
	FCL (n=108)	1 (0.93%)	1 (0.93%)	8 (7.41%)	91 (84.26%)	7 (6.48%)	3.94 (0.51)	
I grasped the key points and difficulties	TLBL (n=110)	7 (6.36%)	37 (33.64%)	58 (52.73%)	8 (7.2%)	0 (0%)	2.61 (0.72)	-11.63 (217) 0.000*
	FCL (n=109)	1 (0.92%)	2 (1.83%)	34 (31.19%)	59 (54.13%)	13 (11.93%)	3.74 (0.73)	
This method covered wide content areas	TLBL (n=110)	9 (8.18%)	32 (29.09%)	25 (22.73%)	43 (39.09%)	1 (0.91%)	2.95 (1.03)	-6.43 (191.81) 0.000*
	FCL (n=109)	1 (0.92%)	2 (1.83%)	34 (31.19%)	62 (56.88%)	10 (9.17%)	3.72 (0.7)	
Makes me more efficient in achieving my goals and knowledge	TLBL (n=110)	9 (8.18%)	45 (40.91%)	44 (40%)	12 (10.91%)	0 (0%)	2.54 (0.8)	-11.13 (216) 0.000*
	FCL (n=108)	1 (0.93%)	1 (0.93%)	42 (38.89%)	48 (44.44%)	16 (14.81%)	3.71 (0.76)	
My knowledge related to the topics has been strengthened by discussion	TLBL (n=109)	36 (33.03%)	59 (54.13%)	11 (10.09%)	3 (2.75%)	0 (0%)	1.83 (0.72)	-19.01 (216) 0.000*
	FCL (n=109)	1 (0.92%)	1 (0.92%)	41 (37.61%)	50 (45.87%)	16 (14.68%)	3.72 (0.76)	
I got maximum scope of clinical problem solving and the application of knowledge	TLBL (n=109)	57 (52.29%)	51 (46.79%)	1 (0.92%)	0 (0%)	0 (0%)	1.49 (0.52)	-28.26 (215) 0.000*
	FCL (n=108)	1 (0.93%)	0 (0%)	32 (29.63%)	63 (58.33%)	12 (11.11%)	3.79 (0.67)	
I got scope of team discussion and the understanding of knowledge	TLBL (n=110)	76 (69.09%)	29 (26.36%)	4 (3.64%)	1 (0.91%)	0 (0%)	1.36 (0.6)	-26.90 (216) 0.000*
	FCL (n=108)	1 (0.93%)	1 (0.93%)	37 (34.26%)	60 (55.56%)	9 (8.33%)	3.69 (0.68)	
I spent more time on pre-class preparation	TLBL (n=110)	60 (54.55%)	43 (39.09%)	5 (4.55%)	1 (0.91%)	1 (0.91%)	1.55 (0.71)	-22.27 (217) 0.000*
	FCL (n=109)	1 (0.92%)	1 (0.92%)	41 (37.61%)	55 (50.46%)	11 (10.09%)	3.68 (0.71)	
Overall	TLBL (n=878)	262 (29.84%)	321 (36.56%)	192 (21.87%)	101 (11.5%)	2 (0.23%)	2.16 (0.47)	-25.234 (217) 0.000*
	FCL (n=868)	8 (0.92%)	9 (1.04%)	269 (30.99%)	488 (56.22%)	94 (10.83%)	3.75 (0.47)	

TLBL = Traditional lecture-based learning, FCL= Flipped Classroom Learning, SD= Strongly Disagree, D=Disagree, NANDA= Neither Disagree nor Agree, A=Agree & SA=

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*Strongly Agree. *Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and the difference for the FCL was highly significant (P-value=0.000).*

Table 1 presents the students' level of satisfaction with the attainment of learning objectives, as measured on a 5-point Likert scale. The mean scores for satisfaction with Traditional Lecture-Based Learning (TLBL) ranged from 1.55 to 2.95, translating to a satisfaction rate of 31% to 58.6%. In contrast, satisfaction with Flipped Classroom Learning (FCL) ranged from 3.68 to 3.94, corresponding to a satisfaction rate of 73.6% to 78.8%. The overall mean scores were 2.16 for TLBL and 3.75 for FCL, indicating an overall satisfaction level on different issues related to their attainment of leaning objectives 43.2% by TLBL and 75% by FCL providing highly significant differences (P-value <0.001).

Table 2: Comparison of mean level students' satisfaction on different issues related to their learning ability and interest by TLBL and FCL

Question	Method of teaching (n)	Percentage of level of agreement with corresponding score					Score Mean (SD)	t, (df), P-value
		SD=1	D=2	NDNA=3	A=4	SA=5		
Helps to improve my ability to expression	TLBL (n=110)	66 (60%)	40 (36.36%)	2 (1.82%)	2 (1.82%)	0 (0%)	1.45 (0.63)	-31.17 (212.30) 0.000*
	FCL (n=110)	1 (0.91%)	0 (0%)	15 (13.64%)	86 (78.18%)	8 (7.27%)	3.91 (0.53)	
Improves my thinking ability	TLBL (n=110)	25 (22.73%)	71 (64.55%)	12 (10.91%)	2 (1.82%)	0 (0%)	1.94 (0.71)	-19.74 (218) 0.000*
	FCL (n=110)	1 (0.91%)	0 (0%)	33 (30%)	60 (54.55%)	16 (14.55%)	3.82 (0.71)	
More effective utilization and controllable of time to learning	TLBL (n=110)	55 (50%)	44 (40%)	10 (9.09%)	1 (0.91%)	0 (0%)	1.61 (0.69)	-25.33 (217.11) 0.000*
	FCL (n=110)	0 (0%)	0 (0%)	29 (26.36%)	63 (57.27%)	18 (16.36%)	3.90 (0.65)	
Improves my ability to self-learning	TLBL (n=109)	48 (44.04%)	48 (44.04%)	12 (11.01%)	1 (0.92%)	0 (0%)	1.69 (0.7)	-23.36 (217) 0.000*
	FCL (n=110)	0 (0%)	1 (0.91%)	31 (28.18%)	63 (57.27%)	15 (13.64%)	3.84 (0.66)	
Stimulates my interest in dermatology	TLBL (n=110)	25 (22.73%)	37 (33.64%)	40 (36.36%)	6 (5.45%)	2 (1.82%)	2.30 (0.94)	-13.76 (205.44) 0.000*
	FCL (n=109)	0 (0%)	2 (1.83%)	31 (28.44%)	55 (50.46%)	21 (19.27%)	3.87 (0.73)	
Makes me more willing to spend time on dermatology learning	TLBL (n=110)	27 (24.55%)	37 (33.64%)	39 (35.45%)	7 (6.36%)	0 (0%)	2.24 (0.9)	-14.81 (208.51) 0.000*
	FCL (n=110)	0 (0%)	1 (0.91%)	34 (30.91%)	54 (49.09%)	21 (19.09%)	3.86 (0.72)	
Overall	TLBL (n=659)	246 (37.33%)	277 (42.03%)	115 (17.45%)	19 (2.88%)	2 (0.3%)	1.87 (0.52)	-31.27 (218) 0.000*
	FCL (n=659)	2 (0.3%)	4 (0.61%)	173 (26.25%)	381 (57.81%)	99 (15.02%)	3.87 (0.43)	

*TLBL = Traditional lecture-based learning, FCL= Flipped Classroom Learning, SD= Strongly Disagree, D=Disagree, NANDA= Neither Disagree nor Agree, A=Agree & SA= Strongly Agree. *Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and the difference for the FCL was highly significant (P-value=0.000).*

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Table 2 illustrates the students' level of satisfaction with the attainment of learning ability and interest, based on a 5-point Likert scale. The mean satisfaction scores for Traditional Lecture-Based Learning (TLBL) ranged from 1.45 to 2.30, indicating a satisfaction rate of 29% to 46%. For Flipped Classroom Learning (FCL), the mean scores ranged from 3.82 to 3.91, corresponding to a satisfaction rate of 76.4% to 78.2%. The overall mean scores were 1.87 for TLBL and 3.87 for FCL, reflecting an overall satisfaction level on different issues related to their learning ability and interest 37.4% by TLBL and 77.4% by FCL providing highly significant differences (P-value <0.001).

Table 3: Comparison of mean level students' satisfaction on different issues related to their team/group work ability by TLBL and FCL

Question	Method of teaching (n)	Percentage of level of agreement with corresponding score					Score Mean (SD)	t, (df), P-value
		SD=1	D=2	NDNA=3	A=4	SA=5		
Improves our group/team collaboration ability	TLBL (n=110)	70 (63.64%)	40 (36.36%)	0 (0%)	0 (0%)	0 (0%)	1.36 (0.48)	-28.50 (219) 0.000*
	FCL (n=111)	3 (2.7%)	3 (2.7%)	17 (15.32%)	76 (68.47%)	12 (10.81%)	3.82 (0.77)	
Provides scope of discussion among most of the members of our class	TLBL (n=110)	69 (62.73%)	40 (36.36%)	1 (0.91%)	0 (0%)	0 (0%)	1.38 (0.51)	-22.86 (172.09) 0.000*
	FCL (n=110)	3 (2.73%)	6 (5.45%)	36 (32.73%)	49 (44.55%)	16 (14.55%)	3.63 (0.9)	
Provides scope of emerging many different opinions	TLBL (n=110)	78 (70.91%)	29 (26.36%)	3 (2.73%)	0 (0%)	0 (0%)	1.32 (0.52)	-26.75 (188.57) 0 .000*
	FCL (n=110)	1 (0.91%)	7 (6.36%)	25 (22.73%)	63 (57.27%)	14 (12.73%)	3.75 (0.79)	
Provides scope of accepting different views by others	TLBL (n=110)	83 (75.45%)	26 (23.64%)	1 (0.91%)	0 (0%)	0 (0%)	1.25 (0.46)	-25.623 (163.43) 0.000*
	FCL (n=110)	1 (0.91%)	9 (8.18%)	32 (29.09%)	49 (44.55%)	19 (17.27%)	3.69 (0.89)	
Every member has an opportunity to express opinions	TLBL (n=109)	86 (78.9%)	21 (19.27%)	2 (1.83%)	0 (0%)	0 (0%)	1.23 (0.46)	-27.04 (171.34) 0.000*
	FCL (n=111)	1 (0.9%)	8 (7.21%)	30 (27.03%)	55 (49.55%)	17 (15.32%)	3.71 (0.85)	
Everyone is focusing on the discussion as team/group work	TLBL (n=110)	97 (88.18%)	13 (11.82%)	0 (0%)	0 (0%)	0 (0%)	1.12 (0.32)	-29.83 (140.71) 0.000*
	FCL (n=111)	1 (0.9%)	6 (5.41%)	36 (32.43%)	47 (42.34%)	21 (18.92%)	3.73 (0.86)	
Overall	TLBL (n=659)	483 (73.29%)	169 (25.64%)	7 (1.06%)	0 (0%)	0 (0%)	1.28 (0.31)	-35.40 (155.75) 0.000*
	FCL (n=663)	10 (1.51%)	39 (5.88%)	176 (26.55%)	339 (51.13%)	99 (14.93%)	3.72 (0.43)	

*TLBL = Traditional lecture-based learning, FCL= Flipped Classroom Learning, SD= Strongly Disagree, D=Disagree, NANDA= Neither Disagree nor Agree, A=Agree & SA= Strongly Agree. *Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and the difference for the FCL was highly significant (P-value=0.000).*

Table 3 presents the students' level of satisfaction with their attainment of team/group work abilities, as measured by a 5-point Likert scale. The mean

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satisfaction scores for Traditional Lecture-Based Learning (TLBL) ranged from 1.12 to 1.38, corresponding to a satisfaction rate of 22.4% to 27.6%. For Flipped Classroom Learning (FCL), the mean scores ranged from 3.63 to 3.82, indicating a satisfaction rate of 72.6% to 76.4%. The overall mean scores were 1.28 for TLBL and 3.72 for FCL, reflecting an overall satisfaction level on different issues related to their team/group work ability 25.6% by TLBL and 74.4% by FCL.

Table 4: Comparison of mean level students' satisfaction on different issues related to their clinical ability by TLBL and FCL

Question	Method of teaching (n)	Percentage of level of agreement with corresponding score					Score Mean (SD)	t, (df), P-value
		SD=1	D=2	NDNA=3	A=4	SA=5		
Improves my clinical reasoning thinking	TLBL (n=110)	51 (46.36%)	45 (40.91%)	9 (8.18%)	5 (4.55%)	0 (0%)	1.71 (0.81)	-24.79 (193.45) 0.000*
	FCL (n=111)	1 (0.9%)	0 (0%)	10 (9.01%)	85 (76.58%)	15 (13.51%)	4.02 (0.56)	
Makes me know more of the topic	TLBL (n=109)	26 (23.85%)	60 (55.05%)	17 (15.6%)	6 (5.5%)	0 (0%)	2.03 (0.79)	-17.00 (218) 0.000*
	FCL (n=111)	1 (0.9%)	1 (0.9%)	36 (32.43%)	50 (45.05%)	23 (20.72%)	3.84 (0.79)	
Makes me more impressed with the topic	TLBL (n=110)	24 (21.82%)	58 (52.73%)	25 (22.73%)	3 (2.73%)	0 (0%)	2.06 (0.75)	-18.62 (219) 0.000*
	FCL (n=111)	0 (0%)	0 (0%)	35 (31.53%)	58 (52.25%)	18 (16.22%)	3.85 (0.68)	
Improves my ability on how to treat patients	TLBL (n=110)	56 (50.91%)	40 (36.36%)	10 (9.09%)	2 (1.82%)	2 (1.82%)	1.67 (0.86)	-20.76 (207.53) 0.000*
	FCL (n=111)	0 (0%)	1 (0.9%)	33 (29.73%)	60 (54.05%)	17 (15.32%)	3.84 (0.68)	
Overall	TLBL (n=439)	157 (35.76%)	203 (46.24%)	61 (13.9%)	16 (3.64%)	2 (0.46%)	1.87 (0.61)	-27.55 (219) 0.000*
	FCL (n=444)	2 (0.45%)	2 (0.45%)	114 (25.68%)	253 (56.98%)	73 (16.44%)	3.89 (0.47)	

*TLBL = Traditional lecture-based learning, FCL= Flipped Classroom Learning, SD= Strongly Disagree, D=Disagree, NANDA= Neither Disagree nor Agree, A=Agree & SA= Strongly Agree. *Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and the difference for the FCL was highly significant (P-value=0.000).*

Table 4 illustrates the students' satisfaction with the attainment of their clinical abilities, measured on a 5-point Likert scale. The mean satisfaction scores for Traditional Lecture-Based Learning (TLBL) ranged from 1.67 to 2.06, corresponding to a satisfaction rate of 33.4% to 41.2%. In contrast, the Flipped Classroom Learning (FCL) method had mean scores ranging from 3.84 to 4.02, reflecting a satisfaction rate of 76.8% to 80.4%. The overall mean scores were 1.87 for TLBL and 3.89 for FCL, indicating overall satisfaction levels on different issues related to their clinical ability 37.4% by TLBL and 77.8% by FCL providing highly significant differences (P-value <0.001).

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Table 5: Comparison of mean level students' satisfaction on different issues related to teaching methods by TLBL and FCL

Question	Method of teaching (n)	Percentage of level of agreement with corresponding score					Score Mean (SD)	t, (df), P-value
		SD=1	D=2	NDNA=3	A=4	SA=5		
I have no resistance to this teaching method	TLBL (n=110)	9 (8.18%)	60 (54.55%)	34 (30.91%)	7 (6.36%)	0 (0%)	2.35 (0.72)	-19.11 (194.84) 0.000*
	FCL (n=110)	0 (0%)	0 (0%)	16 (14.55%)	82 (74.55%)	12 (10.91%)	3.96 (0.51)	
This teaching method is expected to be carried out in more topics	TLBL (n=110)	13 (11.82%)	61 (55.45%)	31 (28.18%)	5 (4.55%)	0 (0%)	2.25 (0.72)	-14.63 (218) 0.000*
	FCL (n=110)	0 (0%)	2 (1.82%)	46 (41.82%)	50 (45.45%)	12 (10.91%)	3.65 (0.7)	
This teaching method is an effective teaching method	TLBL (n=110)	31 (28.18%)	54 (49.09%)	18 (16.36%)	7 (6.36%)	0 (0%)	2.01 (0.84)	-16.31 (218) 0.000*
	FCL (n=110)	0 (0%)	2 (1.82%)	41 (37.27%)	50 (45.45%)	17 (15.45%)	3.75 (0.73)	
Overall	TLBL n=330)	53 (16.06%)	175 (53.03%)	83 (25.15%)	19 (5.76%)	0 (0%)	2.21 (0.61)	-21.12 (218) 0.000*
	FCL (n=330)	0 (0%)	4 (1.21%)	103 (31.21%)	182 (55.15%)	41 (12.42%)	3.79 (0.5)	

*TLBL = Traditional lecture-based learning, FCL= Flipped Classroom Learning, SD= Strongly Disagree, D=Disagree, NANDA= Neither Disagree nor Agree, A=Agree & SA= Strongly Agree. *Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and the difference for the FCL was highly significant (P-value=0.000).*

Table 5 presents the students' satisfaction with the teaching method, as measured on a 5-point Likert scale. The mean satisfaction scores for Traditional Lecture-Based Learning (TLBL) ranged from 2.01 to 2.35, equating to a satisfaction rate of 40.2% to 47%. For the Flipped Classroom Learning (FCL) method, the mean scores ranged from 3.65 to 3.96, corresponding to a satisfaction rate of 73% to 79.2%. The overall mean scores were 2.21 for TLBL and 3.79 for FCL, indicating overall satisfaction levels on different issues related to teaching methods 44.2% by TLBL and 75.8% by FCL providing highly significant differences (P-value <0.001).

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Table no 6: Distribution students attended in pre-class test and post-class test, and comparison of mean score by TLBL and FCL using Independent t test

Teaching method	Type of test	Descriptive statistics			Inferential statistics				
		n	Mean	Std. Dev.	F	Sig.	T	df	Sig. (2-tailed)
TLBL	Pre-class test	112	3.79	3.340	8.487	0.004	0.388**	218.25	0.698
	Post-class test	111	3.63	2.957					
FCL	Pre-class test	114	2.54	2.573	22.745	0.000	-5.627**	220.1	0.000*
	Post-class test	118	4.72	3.307					

*TLBL = Traditional lecture-based learning & FCL= Flipped classroom learning. **Independent sample t test showed two groups (TLBL vs. FCL) were statistically differ from each other and * the difference for the FCL was highly significant (P-value = 0.000).*

Table 6 displays the mean student scores before and after the implementation of two different teaching methods. The data indicates that the pre-class test scores for TLBL and FCL were not identical, exhibited difference of 1.25. However, post-class test scores show a significant improvement with FCL compared to TLBL. The increase in scores after applying FCL was markedly higher (from 2.54 to 4.72, an increase of 2.18 points or 85.83%) compared to the decrease observed with TLBL (from 3.79 to 3.63, a decrease of 0.16 points or 4.22%). An independent t-test confirmed that the difference was statistically significant for FCL, with P-values of 0.000.

Discussion

In this quasi experimental study, researcher amasses the perception of students participated in the teaching learning sessions from different point of view including fulfilling learning objectives, attainment of learning ability and interest, enhancing team work ability, improving clinical ability, and their acceptance of these methods on 5-point Likert scales. This research was conducted among 118 students of three non-government medical colleges located in Cumilla district of Bangladesh. Among participants, number of female (58.90%) participants were more than the male (41.10%); this is due to large number of female students are getting admission compared to the male students in the medical colleges of Bangladesh.

It was observed that students' level of satisfaction about the attainment of learning objectives (table-1) by TLBL were ranged from 31 to 58.6% and FCL were ranged from 73.6 to 78.8%, which indicates the satisfaction about the issues related to the attainment of learning objectives were highly unsatisfactory to moderately unsatisfactory for TLBL and satisfactory for FCL respectively and the overall mean scores were 2.16 for TLBL and 3.75 for FCL providing highly significant differences (p-value <0.001). A study was conducted on 150 MBBS Phase-I medical students in Chirayu Medical College and Hospital, Bhopal, Madhya Pradesh, India by Jaiswal et al. reported the similar finding that 78.68% of students responded against that traditional lecture was not interactive

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and couldn`t fulfil their learning objectives.[10] Jategaonkar et al. an observational study, conducted among 100 final year undergraduate medical students and teachers in pediatrics' at the Mahatma Gandhi Institute of Medical Sciences Sevagram, Maharastra, India, observed that a significant portion of students (82%) found the pre-class materials for the FCL sessions were relevant and useful for attaining desired learning objectives, and they dedicated considerable time to pre-class activities which leads better understanding about the lesson taught.[11]

Students' level of satisfaction about the attainment of learning ability and interest (table-2) by TLBL were ranged from 29 to 46% and FCL were ranged from 76.4 to 78.2% which indicates the satisfaction about the issues related to the attainment of learning ability and interest were highly unsatisfactory to unsatisfactory for TLBL and satisfactory for FCL respectively and the overall mean scores were 1.87 for TLBL and 3.87 for FCL providing highly significant differences (p-value <0.001). Jaiswal et al. also found that 88.52% students perceived TLBL classroom did not develop their interest about the topic and 72.13% of those believed it was not helpful for improving their communication skills.[10] Nichat et al. undertook a systematic review of published article between 2018 and 2023 approximately to different teaching learning method, in which their meta-analysis outcome from nineteen articles included from comprehensive screening of initially identified seven hundred twenty-six articles on teaching-learning approaches found that FCL allows students to engage in learning through several projects, activities and discussions which enhance their enthusiasm and aptitude for achieving their learning objectives.[12] Also, in the study of Jategaonkar et al. uncovered a fascinating trend after completing all sessions, students expressed profound enthusiasm for the topic, heightened attention levels, deeper comprehension, and a more engaged learning experience, with a remarkable 70% crediting the FCL approach for igniting their interest and fostering active learning.[11]

It was observed that students' level of satisfaction about the attainment of their team/group work ability (table-3) by TLBL were ranged from 22.4 to 27.6% and FCL were ranged from 72.6 to 76.4%, which indicates the satisfaction about the issues related to the attainment of their team/group work ability were highly unsatisfactory for TLBL and satisfactory for FCL respectively and the overall mean scores were 1.28 for TLBL and 3.72 for FCL providing highly significant differences (p-value <0.001). Likewise, the event was more negative in Jaiswal et al. study where only 8.18% participants of the study believe that TLBL increase their active involvement in the class[10]. Nichat et al. discovered that the FCL method not only boosts student engagement but also fosters peer-to-peer interaction, deeper and more profound understanding of the subject matter.[12]

Students' level of satisfaction about the attainment of their clinical ability (table-4) by TLBL were ranged from 33.4 to 41.2% and FCL were ranged from 76.8 to 80.4%, which indicates the satisfaction about the issues related to the attainment of their clinical ability were highly unsatisfactory to unsatisfactory for TLBL and satisfactory for FCL and the overall mean scores were 1.87 for TLBL and 3.89 for FCL providing highly significant differences (p-value <0.001). Among 268 students participated in a cross-sectional study by Ali et al. one-fourth of the students believed that traditional classroom boosted their analytical and problem-solving skills.[13] Nichat et al. also observed, from all nine articles relating to FCL out of nineteen

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included in the review, that along with learning flexibility, FCL method improves students' ability to think beyond traditional way and equips them with sophisticated clinical ability.[12]

Students' level of satisfaction about the teaching method (table-5) by TLBL were ranged from 40.2 to 47% and were ranged from 73 to 79.2%, which indicates the satisfaction about the issues related to the teaching method were unsatisfactory for TLBL and satisfactory for FCL and the overall mean scores were 2.21 for TLBL and 3.79 for FCL providing highly significant differences (p-value <0.001). Only 3.27% participants of Jaiswal et al. study wanted to attend TLBL class in future while comparing with the class based on small group discussion.[10] Jategaonkar et al. revealed that students praised the flipped classroom (FCL) as a significantly enhanced learning experience, three-quarter (75%) of them advocated for its routine integration with traditional teaching methods to cover diverse topics in the medical curriculum.[11]A survey conducted by Rotellar et al. involving 64 pharmacy students presented that they preferred the flipped learning approach over the traditional lecture format in a pharmaceutics course[14]. Therefore, we can assume that FCL will be comparatively beneficial option for the students of dermatology as well as other disciplines of MBBS course

It is evident from the table 6 that students' baseline test scores were nearly identical for TLBL and FCL, ranging only around 8% of total score, indicating consistent initial proficiency but students' achievement level, comparing between pre-class test and post-class test scores, did not improve for the TLBL class, rather decreased to some extent. Mean scores decreased from 3.79 to 3.63 (a decrease of 0.16 points or 4.22%). Since, questions for the post-class test included few questions that require problem-solving skills to answer correctly, students participated in TLBL class failed to secure desired scores in the post-class test, implying low or absent of problem-solving skills attained by the students participated in TLBL classes. However, for FCL classes, students' achievement level astonishingly improved, considering difference between pre-class test and post-class test scores. The increase in mean scores after applying FCL was markedly higher (from 2.54 to 4.72, an increase of 2.18 points or 85.83%). This suggests that FCL was notably more effective in enhancing problem-solving skills, as TLBL students struggled with problem-oriented questions in the post-test. The independent sample t-test confirmed these differences as statistically significant for both methods (P=0.000). Similar findings have been reported in the literature, where FCL has been associated with improved problem-solving skills and higher post-intervention scores compared to traditional methods.[15,16]. In contrast, TLBL often shows limitations in fostering deep problem-solving skills, as evidenced by lower gains in similar studies.[17] Hurtubise et al. found that teachers also recognized FCL's potential to foster competency-based education through active student participation and peer interactions, aligning with the findings of this study.[18]

Therefore, as far the studies revealed, flipped classroom learning (FCL) consistently outperformed traditional lecture-based learning (TLBL) in student performance regardless of geography and discipline they belong to, as there was significant difference in performance between in either way.

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Conclusion

The null hypothesis of the quantitative section of the present quasi experimental design was, 'Traditional lecture-based leaning (TLBL) and Flipped classroom learning (FCL) are equally effective in teaching dermatology to undergraduate medical students of Bangladesh'. This quantitative data revealed that gross satisfaction in percentage on the different teaching methods was lowest with TLBL (37.6%) and higher with FCL (76%) and the differences were always statistically highly significant (P=0.000). Comparing the pre-class test scores with the post-class test scores it was found that better advancement of students' performance occurs with FCL (85.8%) but students' performance decrease with TLBL (-4.2%); these changes were statistically significant for FCL (P=0.000); but was insignificant for TLBL (P=0.698). Hence, we can reject the null hypothesis and accept the alternate hypothesis 'Flipped classroom learning and Traditional lecture-based leaning are not equally effective; Flipped classroom learning is better than Traditional lecture-based learning in teaching dermatology to undergraduate medical students of Bangladesh.' FCL can be complementary with TLBL if these are included with wider research in the teaching methods of medical education of Bangladesh. Hence it can be concluded that the FCL and TLBL can be complementary to each other if they are judiciously used.

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