Investigating the Impact of different drivers (pedagogies) of student centred learning in Indian Higher Educational Institutions

Author's Details:

1. **Dr. Rakesh Kumar Sharma**

Assistant Professor, School of Humanities and Social Sciences
Thapar Institute of Engineering & Technology (Deemed to be University), Patiala-India
Email: rakesh.kumar@thapar.edu
ORCID: 0000-0001-7656-6957

2. **Dr. Sheena Chhabra**

Assistant Professor (Contractual-II), School of Humanities and Social Sciences
Thapar Institute of Engineering & Technology (Deemed to be University), Patiala-India
Email: sheena.chhabra@thapar.edu

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Abstract:

With change in time, there has been a paradigm shift in the teaching pedagogy. The roles and responsibilities of both teachers and students have changed. Student centred learning is competency-based, real world relevant and can occur anytime and anywhere. Entwistle et al. (2000) opine that SCL approach enhances students' learning via their involvement in the large class. The paper aims to investigate the key drivers of student centred learning that enhance their learning during classroom interaction. The objective of implementation of this pedagogy is to enhance learning and involve the entire class including those students who are less serious in studies. Moreover, the intention is to improve teaching skills of instructor through students' feedback. The intervention is performed on final year students for the course Engineering Economics. The two statistical techniques (ANOVA and multiple regression) have been used for to analysis. The results of ANOVA technique reflect that the various pedagogies are significant drivers of SCL approach. Also, conducting group discussion and presentation and bifurcating large class in smaller groups lead to enhance students' learning and academic performance. The various pedagogies of SCL enhance students' learning and academic performance.

Keywords: Brainstorming, Case study, Flip class, Paradigm shift, Perception

1. Introduction:

We forget the things we listen, remember the things we see and understand the things where we are involved. Student centred learning is competency-based, real world relevant and can occur anytime and anywhere. The teachers and students with their peers create an environment to encourage rich learning process. With the change in culture, technology and mindset, there has been a paradigm shift in the teaching pedagogy leading to shifting perceptions of roles and responsibilities of both teachers and students. Student centred

learning (SCL) is becoming popular in academic institutions. The purpose behind this approach is to enhance the student learning through wide involvement of number of students in the large class (Entwistle *et al*., 2000).

Donnelly & Fitzmaurice (2005) re-iterate the importance of this shift. Baxter & Gray (2001) agree that for effective learning, it is necessary to switch to a model which requires active participation from students in the learning process. SCL has gained attention of many researchers and academicians. SCL is considered as flexible learning (Taylor, 2000), experiential learning (Burnard, 1999) or self-directed learning. Barr & Tagg (1995) believe that in SCL, the power has moved from the teacher to the student. Simon (1999) opines that a teacher should act as a guide and help the student in the process of maturation. This approach leads to continuous improvement in the system and gives ownership to the students to learn, make them responsible and achieve their goals (Lea *et al.*, 2003). Student centred approach allow students to control their learning as it gives them the responsibility through active participation instead of passively receiving the information (Slunt & Giancario, 2004). Cornelius & Gordon (2008) find that student centred learning offers flexibility in content delivery and study strategies, and the needs of individual student are accommodated. Boud & Feletti (1997) state that Problem-based learning, a method of SCL, persuades students to build up their learning goals, and act as a bridge to fill the gaps in their knowledge or understanding. The four main strategies in SCL have been identified: the first strategy is active learning (participation of the students) which will develop students' interest in the course/subject; the second is to make the students aware of what they are doing and why they are doing it which will motivate them to learn; the third is more interaction and involvement which will make them understand the concept; the final strategy is the focus on transferable skills which will make students' more confident (University of Glasgow, 2004). Brown (2008) observes that the goal of these innovative strategies is to produce "self-sufficient, self-governing and creative scholars who would appreciate and value the subject. Tyma (2009) observes that when a power to handle and manage the class is given to students even though the responsibility to monitor students retain with teacher, the performance of the students improves. Cantone (2001) find that the success rate in developing mathematical skills in students is high with cooperative methods involving peer interaction than by traditional teaching methods. Knight & Woods (2005) reveal that the student's learning and conceptual understanding is more when the lectures are interactive by participation of students and usage of problem solving techniques.

In student centred learning, the roles of teacher and student have changed, Weimer (2002) points out that the teacher outlook changes from the "sage on the stage" to the "guide on the side" who don't believe in providing students with knowledge but acts as a guide in their journey of intellectual development. These days, students are no longer considered as passive absorber of information rather the teacher only acts as a facilitator in the learning process (Tärnvik, 2007).

The current research tries to identify the impact of various pedagogies of SCL on vast majority of the students who would move beyond a type of learning which is superficial and focused on the development of exam-passing competencies as the ultimate goal. The various strategies used in this study are Brainstorming sessions, dividing large class into small

groups, flipped classroom etc. Lipponen (2002) examines that Collaborative learning and brainstorming enable students to absorb maximum information with high efficiency and in a meaningful way to accomplish their tasks. Weimer (2000) states explicitly that students learn by doing, and so involving them in the learning activities promotes learning. Johnson & Johnson (1998) discuss about Cooperative learning (CL) involving small groups of students who work together to enhance their learning. Lonka & Ahola (1995) analyse traditional and activating instruction in Helsinki and find that the activating group develops better study skills and understanding. The pedagogies such as problem and project based learning are an effective way to help students to gather subject knowledge and to develop the skills including critical thinking, problem solving, communication, management and collaboration (Bilgin *et al*., 2015; Du *et al*., 2013; He *et al*., 2017; Kolmos *et al*., 2008; Lehmann *et al*., 2008; Steinemann, 2003; Zhao *et al*., 2017).To further extent this study, it is necessary to review the previous researches to evaluate the impact of different pedagogies on students' outcome.

2. Review of Literature:

The prominence of student centred approach has invigorated the interest of many academicians in various teaching and learning perspectives. Attard *et al*., (2010) define SCL as a method that "allows students to shape their own learning paths and places upon them the responsibility to actively participate in making their educational process a meaningful one". The authors have closely studied the differences between traditional teaching methods and student centred approaches. It has been observed that the student/learner centred approaches are constructive as they emphasize on problem solving and critical thinking (Brown, Collins & Duguid, 1989). With SCL in practice, the concept of flipped classroom is becoming popular these days. The objective of the flipped classroom model is to modify the learning of new content and concepts by providing the content before class in the form of videos and spending the class time on discussions and applications of the provided material with deeper conceptual coverage, and peer interaction (Gajjar, 2013; Gojak, 2012; Sarawagi, 2013; Strayer, 2012; Tucker, 2012). The different group activities in SCL include think-pair-share, feedback, assessment technique, team matrix, three-step interview, role play, affinity grouping, critical debate, case study, peer evaluation and team presentations etc (Barkley, Cross & Major, 2005). These activities help students to enhance problem-solving skills, critical thinking and interpersonal skills. Unal & Unal (2017) investigate the various benefits of the flipped teaching method. They find that with flipped classroom teaching; students can move at their own pace, teachers can customize the course curriculum and the interaction time in the classroom can be used with more effectiveness and creativity. Fulton (2012) observes that there is a significant increase in the percentage of students (29% to 73.8%) passing the state test after flipping high school math classes in 2011. Consistently, Aronson & Arfstrom (2013) document that the students at the University of British Columbia in Vancouver, Canada with flipped course scored more than the students with tradition teaching method.

Attribution theorists consider that external control tends to reduce the personal investment and individual's responsibility for their learning which acts as a driver for SCL (Hannafin & Rieber, 1989). Since individuals have a little control over what is being taught and how it is being taught, they fail to assume responsibility for their learning. It is assumed that given the

opportunity to make their own choices, learners develop a greater responsibility for their learning. Duckworth (2009) is of the view that student centred learning makes the students more focused and improves their performance as teachers allow them to think at their own. Harel & Papert (1991) and Reigeluth (1996) believe that students are designers in SCL. Hannafini & Land (1997) opine that Student centred learning environments highlight that learners are constructors of knowledge, the context is important in understanding, and experience is vital for learning. According to constructivists, knowledge is not fixed or external; it is constructed individually. Experiencing an activity/event leads to understanding, thus, SCL emphasizes on experiences which act as a catalyst for constructing individual meaning (Piaget, 1952; Vygotsky, 1978). In SCL, learners interpret the content and generate meaningful knowledge depending upon their prior experiences (Biggs and Tang, 2011; Dewey, 1938). Student centred learning environments focus on the self-motivated nature of knowledge by providing means for developing, testing, and refining it. The knowledge can be constantly modified and refined through experiences and reflections (Linn & Muilenburg, 1996). Collins & O' Brien (2003) document that the properly implementation of SCL can motivate students to learn, retain and understand the subject with greater efficiency. This also develops a positive attitude towards the subject being taught. The student centred learning approach lead to increased participation, motivation and improved grades of the students (Hall & Saunders, 1997). Since every coin has two faces, with various pros of student centred learning, there exists some of the cons as well. As student centred learning, mainly focus on individual learning, it can be dangerous in the School system focus (Simon, 1999). Edwards (2001) also highlights the threats associated with student centred learning in adult education as this could lead to an individual's physical isolation from the peers. There has been emphasises on the importance of peer interaction in social learning (Cherry, 2019). The outset of being an independent learner may drive some of the sociability out of the learning process. Lea *et al*. (2003) examine that psychology students are being isolated from their peers in student centred approach.

The existing literature mainly focuses on students' performance and feedback on SCL. There is a need to conduct research that addresses instructors' understanding about practicing SCL that influence their instructional design for classroom interactions and the strategies they adopt.

3. Research Methods:

The study has been carried by implementing student centred pedagogies and think pair share approach in large class. The objective of the SCL approach is to enhance students learning and to improve teaching efficacy of the instructor.

This SCL pedagogies were used twice in the year 2017 (Even and odd Semester) of 4th Year students (mechanical engineering in even semester 2016-17 and Electrical Engineering students of odd Semester of 2017-18) for the course "Engineering Economics". This approach was implemented to enhance the student learning through wide involvement of number of students in the large class (Entwistle *et al.*, 2000). Earlier, the students were hesitant and there was less active participation from them. The basic intention of instructor was to involve wide range of students in different learning activities and to increase their

participation. Moreover, the intervention aims to get a new solution for existing problems. The wider involvement may generate more ideas resulting in innovative solution to existing problems.

The four different methods/ strategies were used to complete this intervention: First, an ice-breaking and brainstorming session was conducted in the large class. Second, the entire class of approx 90 students was divided into three different groups (20 to 22 students in each group) for the same (Bingham & Daniels, 1998). Then, the responses to one particular problem or topic from every group were invited and a coordinator from each group was appointed. The coordinators were asked to write the responses received from group members on white board. Then, the session was moderated and an important solution or answer for the particular problem was drawn. Third, case study discussion & a session for solving practical problem was conducted where the large class was divided into five small groups (Exley & Dennick, 2004). Fourth, flip classroom which was performed wherein the GD topics were provided immediately before the discussion and think pair share technique was applied for the conclusion (Bender, 2003).

During brainstorming sessions, the students were encouraged to give their ideas regarding particular topic or existing problems. The different pedagogies have been implemented after bifurcating large class in small groups consisting of 20 to 25 students. Brainstorming and ice breaking session, case study discussions and flip class concept were used in small groups. All the students of large class enthusiastically participated in small groups in SCL activities. These pedagogies were implemented to encourage and involve all the students including the ones who were less serious in studies. A self structured questionnaire covering the different aspects of student learning pedagogies was designed to get the feedback of SCL approach from students. This helped the instructor to improve his own teaching efficacy. The data collected through self structured questionnaire has been analysed using different statistical techniques. The various statistical techniques are used to investigate the key drivers (pedagogies) of student centred learning (SCL). At the first stage, analysis of variance (ANOVA) and post hoc are used by considering different pedagogies as endogenous variables. The students' interest towards SCL is used as categorical exogenous variable. Later, stepwise multiple regression is employed to investigate the impact of different SCL pedagogies on students performance and satisfaction level.

4. Hypotheses of the study:

H_1: The students have positive perception towards various pedagogies of SCL like brainstorming sessions, dividing large class into smaller groups, case study and flip class etc.

H_2: There is significant difference in the pedagogies as per interest of students or their perception towards them.

H_3: Conducting Brainstorming sessions significantly advances the student learning in the classroom.

H_4: Bifurcating large class in smaller groups significantly progresses the student learning in the classroom.

H_5: The use of flip class pedagogy significantly enhances the student learning in the

classroom.

H_6: Conducting case study sessions significantly improves the student learning in the classroom.

5. Data Analysis and Interpretation:

To analyse the various pedagogies of SCL and students' perception towards them which is measured through the extent to which these are liked and enjoyed by the students, descriptive statistics has been calculated shown in Table 1. It is observed that students who show high interest or liking towards SCL also like different pedagogies of it. Dividing a large class in smaller groups is appreciated by those students who prefer student centred learning. The mean value of dividing a large class in smaller groups is much higher in third category of students (i.e. students whose liking is high towards SCL). The results are consistent with Lea *et al.* (2003) who examined the perception of students in UK University and found that students had a positive view of SCL. Similarly, conducting brainstorming session, use of flip class and case study pedagogies are much preferred by students who have high liking towards SCL. The different SCL pedagogies as shown in table are less preferred by the students who have least interest in SCL approach. The results are consistent with Parisi (2009) who found that more than ninety percent of the participants agreed that SCL is employed to motivate the students in the classroom.

Tables

Table 1: Descriptive Statistics

Pedagogies of SCL	**Perception towards SCL (extent of liking)**	**Mean**	**SD**	**CV (%)**	**Low**	**High**
Dividing class in smaller groups	Low	2.86	0.900	31.47	2	4
	Medium	2.83	1.090	38.52	1	4
	High	3.68	1.081	29.38	1	5
	Total	3.38	1.133	33.52	1	5
Brainstorming	Low	3.57	0.787	22.04	2	4
	Medium	3.71	0.690	18.60	2	5
	High	4.14	0.903	21.81	1	5
	Total	3.98	0.862	21.66	1	5
Flip Class	Low	2.00	1.414	70.70	1	4
	Medium	2.96	1.122	37.91	1	5

	High	3.59	1.187	33.06	1	5
	Total	3.29	1.266	38.48	1	5
Case study	Low	4.00	0.816	20.40	3	5
	Medium	3.38	1.056	31.24	1	5
	High	4.09	0.845	20.66	1	5
	Total	3.88	0.951	24.51	1	5

(Source: Authors calculations with SPSS)

The homogeneity of variances of different endogenous variables is reported in table 2. In the case of analysis of variance (ANOVA), it is mandatory that there should be homogeneity of variances of all the variables used in study.

Table 2: Test of Homogeneity of Variances

Pedagogies of SCL	**Levene's Statistic**	**df1**	**df2**	**Sig.**
Dividing large class in groups	0.424	2	84	0.656
Brainstorming	0.204	2	84	0.816
GD and GP (Flip Class)	0.467	2	84	0.629
Case Study	1.801	2	83	0.172

(Source: Authors calculations with SPSS)

The acceptance of null hypothesis indicates that there is no significant difference in homogeneity of variance of endogenous variables. The different SCL pedagogies as used in present study are the endogenous variables for applying ANOVA. Since all the variables viz., dividing large class in groups, brainstorming sessions, flip class and case studies have associated p value of Levene's Statistic much higher than the significance level. It indicates the acceptance of null hypothesis and there is homogeneity.

Further, the various pedagogies are compared using ANOVA and the results are reported in table 3. These different pedagogies are considered as endogenous variables and students liking or interest as categorical exogenous variable.

Table 3: Analysis of Variance (ANOVA)

Pedagogies of SCL		Sum of Squares	Df	Mean Square	F	Sig.
Bifurcation of large class in small groups will enhance learning.	Between Groups	14.07	2	7.039	6.133	0.003*
	Within Groups	96.40	84	1.148		

	Total	110.48	86			
Brainstorming session as we conduct in class before starting any topic provide you new insight and enhance your understanding about the topic	Between Groups	4.42	2	2.212	3.121	0.049**
	Within Groups	59.53	84	0.709		
	Total	63.95	86			
Flip Class Pedagogy	Between Groups	19.30	2	9.652	6.841	0.002*
	Within Groups	118.51	84	1.411		
	Total	137.82	86			
Case Study	Between Groups	8.67	2	4.333	5.276	0.007*
	Within Groups	68.170	83	0.821		
	Total	76.83	85			

* The mean difference is significant at the 0.01 level.

**. The mean difference is significant at the 0.05 level.

***The mean difference is significant at the 0.10 level.

(Source: Authors calculations with SPSS)

Bifurcating large class in smaller group, solving case studies are found to be significant at 1% level (P value). The learning through flip class pedagogy is found to be highly significant, as the associated p value of it is much lesser than 0.05 and F statistics is quite high. The associated value of all these pedagogies is greater than 5.

Conducting brainstorming and ice breaking sessions in large class and creating three or more groups in large class for wide involvement of students are found significant to be significant pedagogies of SCL to enhance learning at 5% level of significance. The associated value of these pedagogies is greater than 3. These results reflect that different SCL pedagogies as used by instructor for wide involvement of student are liked by the students and they believe these can enhance their leanings. Parisi (2009) support the results of current study who found that the participants have a positive understanding of effect of SCL on their learning.

The results of Post Hoc analysis using LSD technique are reported in table 4. The post hoc test aims to check the difference within the different categories of exogenous variables and it is also known as multiple comparisons.

Table 4: Post Hoc Tests using LSD test (Multiple Comparisons)

Dependent Variable	**(I) SCL**	**(J) SCL**	**Mean Difference(I-J)**	**Std. Error**	**Sig.**
Dividing class into smaller groups	1	2	0.024	0.460	0.959
		3	-0.821	0.429	0.059***
	2	1	-0.024	0.460	0.959
		3	-.0845*	0.261	0.002*

	3	1	0.821	0.429	0.059***
		2	0.845*	0.261	0.002*
Brainstorming	1	2	-0.137	0.362	0.706
		3	-0.571	0.337	0.094***
	2	1	0.137	0.362	0.706
		3	-0.435*	0.205	0.037**
	3	1	0.571	0.337	0.094***
		2	0.435*	0.205	0.037**
Flip Class	1	2	-0.958	0.510	0.064***
		3	-1.589*	0.476	0.001*
	2	1	0.958	0.510	0.064***
		3	-0.631*	0.290	0.032**
	3	1	1.589*	0.476	0.001*
		2	0.631*	0.290	0.032**
Case Study	1	2	0.625	0.389	0.112
		3	-0.091	0.364	0.803
	2	1	-0.625	0.389	0.112
		3	-0.716*	0.222	0.002*
	3	1	0.091	0.364	0.803
		2	0.716*	0.222	0.002*

* The mean difference is significant at the 0.01 level.

**. The mean difference is significant at the 0.05 level.

***The mean difference is significant at the 0.10 level.

(Source: Authors calculations with SPSS)

In the present study, exogenous variable have three categories represented with numerical value 1 to 3, where 1 means student's lowest interest or liking to SCL and 3 means highest. The results reveal that there is significant difference for pedagogy of dividing large class into smaller groups between the students in first category (low interest) with third categories (high interest). Similarly, the opinion of students with moderate interest with high interest also differs significantly at 1% level (P value<0.01). The opinion of students with low interest and with high interest differs significantly at 10 % level. This shows that the students with high liking or interest towards SCL believe that bifurcation of class help them to enhance their learning in large class. Also, for brainstorming and ice breaking sessions, there are similar differences between three categories of students. There is no significant difference in the opinion of students with lowest interest and moderate interest regarding conducting brainstorming and ice breaking sessions in large class. But there is significant difference in the opinion of students with moderate interest and high interest at 5 % level (P value< 0.05). Similarly, the students' opinion about brainstorming significantly differs between the student with low and high interest at 10% level (P value < 0.05). There is a significant difference in the flip class pedagogy for large class between the three different categories of engineering

students according to their liking towards SCL approach. The results show that there is significant difference in opinion for flip class pedagogy between first and second categories, second and third and first and third. There is a significant difference in opinion between the students with low and high liking for SCL approach for flip class pedagogy (P value <0.01). The last pedagogy is conducting case study discussion in large class after bifurcating class in smaller groups. There is significant difference in the opinion of students with moderate likings and high likings for conducting case studies discussion in large class.

Further, stepwise multiple regression analysis is applied. The aim of regression analysis is to investigate the key SCL pedagogies enhancing student learning and satisfaction level. The different SCL pedagogies in regression models are used as exogenous variables and satisfaction level of students from these pedagogies is endogenous variable. The results are presented in table 5.

Table 5: Estimation using stepwise multiple regressions

Model 1			**Model 2**		
	(Constant)	Flip class	(Constant)	Flip class	Dividing class in smaller groups
Coefficients	1.947	0.186	1.665	0.147	0.122
T statistics	10.784	5.63	7.354	4.712	1.998
P Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)
Tolerance		1.000		0.867	0.867
VIF		1.000		1.153	1.153
R	0.5540		0.6580		
R Square	0.3069		0.4330		
Adj. R Square	0.2887		0.4109		
ANOVA	13.179 (0.000)		8.820 (0.000)		
Durbin Watson	1.702		1.702		

The two regression models are developed using stepwise multiple regression. In the first model, the flip class pedagogy is one of the significant variables at 1 % level. Since the associated p value of t statistics of flip class pedagogy is less than 0.01. The value of intercept is also found to be significant in first model at 1 % level of significance. But in the second model, there are two significant pedagogies (flip class and dividing large class in smaller groups). Flip class pedagogy is found to be significant at 1% level (p value <0.01) and dividing large class in smaller groups at 5% (p value<0.05) signifying that both of these pedagogies help students to enhance their class room learning.

The values of R square and adjusted R square in the first model are 0.3069 and 0.2887 respectively. R square represents the variance of endogenous variable as properly explained by different significant exogenous variables. In second model, R square is higher than first model. The R square of second model indicates that two significant variables explain 43.30% of endogenous variable.

The F statistics or ANOVA value is also found to be significant in both the models. The variance inflation factor (VIF) and tolerance value are the measures to check multicolinearity among exogenous variables. The tolerance value greater than 0.50 and VIF less than 3 indicates there is no problem of multicolinearity in exogenous variables. Since the tolerance value in both the models is higher than 0.50 and VIF less than 3. Thus, there is no multicolinearity in these two regression models. In nutshell, it is observed from the results of regression analysis that dividing large class in smaller groups and use of flip class pedagogies are most liked by the students. They believe that these pedagogies enhance their academic learning and performance.

The summary of various hypothesis (accepted or rejected) is provided in table 6.

Table 6: Summary of Acceptance and rejection of Hypotheses

S. No.	**Hypotheses**	**Accepted/Rejected**
1	H_1: The students have positive perception towards various pedagogies of SCL like brainstorming sessions, dividing large class into smaller groups, case study and flip class etc.	Accepted
2	H_2: There is significant difference in the pedagogies as per interest of students or their perception towards them.	Partially Accepted
3	H_3: Conducting Brainstorming sessions significantly advances the student learning in the classroom.	Rejected
4	H_4: Bifurcating large class in smaller groups significantly progresses the student learning in the classroom.	Accepted
5	H_5: The use of flip class pedagogy significantly enhances the student learning in the class room.	Accepted
6	H_6: Conducting case study sessions significantly improves the student learning in the class room.	Rejected

(Source: Authors Compilation)

6. Conclusion and Discussion:

The current study has been carried out after using certain SCL pedagogies in the large class of engineering students. The main objectives of the study are to investigate the level of interest for different SCL pedagogies used in the large class room and how these pedagogies support engineering students to enhance their class room learning. The different SCL pedagogies are used by the instructor in the large class of engineering students for a subject related to application of economic techniques in engineering discipline. Later, a feedback survey was carried out by the instructor and statistical techniques (ANOVA and regression analysis) were used to achieve the above stated objectives. Empirical findings of ANOVA reflect that bifurcation of large class in smaller groups, conducting brainstorming and use of flip class pedagogies are significantly liked by the engineering students. The results of Post-

Hoc analysis reveal that there is significant difference in different pedagogies according the different liking levels of the students. There is significant difference in SCL pedagogy viz., dividing large class into smaller groups and use of brainstorming sessions between the students who show high interest and low interest towards SCL pedagogy. Similarly there is also significant difference between the students have moderate and high interest towards SCL pedagogies. There is also significant difference towards use of Flip Class pedagogy across three different categories of students.

The findings of regression analysis show that use of flip class pedagogy and bifurcating large class in smaller groups significantly enhance student learning in class room. The use of flip class pedagogy gave high satisfaction level to engineering students. The probable reason could be the ownership. In flip class teaching, students have ownership and feel more responsible.

7. Implications:

The present research is conducted on the engineering students but the outcomes of this study will be beneficial across different academic disciplines. In the present time, the major challenging factor for instructor is to engage large class and enhance the learning of each and every student. An instructor always aims to enhance student learning in class room and his own teaching efficacy. To do so, an instructor prefers that every student should remain interactive in entire class session. The present study will have major implications to academic institution and teachers to enhance student learning using different SCL pedagogies and promote SCL approach in their teaching. Policymakers will also be benefitted from the outcomes of present study. The results of this research would help them to design and formulate syllabus curriculum and academic policy which promote different SCL pedagogies.

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