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Sukkur IBA University Journal of Educational Sciences and Technologies publishes and encourages the submission of on the cutting edge research in the field of Educational sciences and technologies

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- Science Education
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- Educational Technologies
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- Technical and Vocational Education
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- History of Education, Science and Technology

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- Development of Learning Environment
- Discourse Analysis
- Diversity and Learning
- Diversity and Teaching
- Education and Society
- Educational Management
- Educational Research
- E-Learning and Knowledge Management
- Augmented and Virtual Reality Based Education
- Technical and Vocational Education
- Educational Technologies
- Gamification and Simulation Based Education
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- Research Design and Methods
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- Pedagogy and Skill development
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- Sustainability of Teacher Education
- Sports and Education
- Teaching and learning
- Teaching of specific skills
- Theories and practice in Education
- Theories and practice in Educational Research
- Time Management and Skill development
- Time Management and Students Performance
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- Educational Philosophy
- Teacher Education
- Educational leadership
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- Early childhood education
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- Humanities of Social Sciences
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- Language and Pedagogy and policy
- Educational Technologies
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- School Teacher and Community
- Educational Society
- Foundations of Education
- Sports and Health Sciences
- Technical and Vocational Education

Patron's Message

Sukkur IBA University has been imparting quality education with its core values i.e. merit, quality, and excellence since its inception. SIBA University has achieved numerous milestones in a very short span of time that hardly any other university has achieved in the history of Pakistan. SIBA University established its Department of Education (DoE) in 2012 to improve, enhance and maintain the quality of education by producing professionally trained teachers, experts, professionals, and researchers.

The Vision of the DoE is to become a reputed teacher education department, which practices international standards of teaching, research, and training with the aim to produce world-class teachers and educational managers. The broad goals of DoE are to develop innovative, effective, and inspiring educational models for school improvement, educational leadership and management, curriculum design and assessment, and implementation in Pakistani educational contexts and classroom settings to get maximum benefits through the economic growth and development of the country. The prime purposes of DoE are to build the capacity of teachers and educational institutions to enhance teachers' and teacher educators' professional attitudes, and to elevate their status and self-esteem through fostering a sense of professionalism, knowledge, skills, competencies, critical thinking, scientific behavior, and decision making.

In this connection, the SIBAU Journal of Educational Sciences and Technologies (SJEST) provides a platform for educational professionals, researchers, students, etc. to share their research work with the global community for further progress, and development. The Journal is multidisciplinary and serves wide areas of educational sciences and technologies, particularly, promoting research that is essential for the enhancement of quality of education. SJEST aimed to achieve an international reputation and high-impact research journal in the near future.

Prof. Dr. Asif Ali Shaikh
Vice Chancellor and Patron
SJEST Sukkur IBA University

Editorial

Dear Readers,

It's a matter of great pleasure to bring you volume III, issue I of **Sukkur IBA University Journal of Educational Sciences and Technologies (SJEST),** a multidisciplinary and interdisciplinary journal. **SJEST** has an institutional association with the **Department of Education**, **Sukkur IBA University,** which believes in the quality of education and research. and the opening of this journal is an outcome of a strong research orientation. In addition, the **SJEST** provides a valuable platform for national and international researchers to publish their research articles in order to disseminate their findings to the largest audience globally in order to bring scientific and authentic solutions to problems.

This issue went through the initial review by the managing team, and double-blind peer-reviewed articles, which address the key issues in the field of educational sciences, and technologies i.e. integration of distributed generators and shunt capacitor; teachers' scaffolding and the Project-Based Learning; vocabulary learning through WhatsApp's SMS; enhancement of the achievement of secondary students' school classroom rules; project-based learning among private and public institutes; and strategic leadership styles of Head Teachers and the performance of secondary schools. The researched topics and the areas provide good reading materials supported by different research findings based on the primary and secondary data to all readers to understand the phenomena scientifically. The findings of the published papers will be helpful in learning different points of views and directions about the different phenomena, which are a good addition to the body of existing literature.

On the behalf of the **SJEST**, I welcome the submissions for the upcoming issues of the journal and looking forward to receive your valuable feedback for the betterment of the journal.

Thanks

Dr. Zafarullah Sahito
Editor-in-Chief
SJEST

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Contents

Vote of Thanks

We are really thankful to the members of editorial and advisory board for their valuable time, suggestions and initiatives made possible to publish this issue.

We are specially thanking to the following reviewers who spent their time and energies to review the papers in time to publish the Second volume, Second issue of SJEST.

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1. Introduction
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Integration of Distributed Generators and Shunt Capacitor Banks to Minimize Power Loss and Enhance Voltage Stability Index

Faraz Ahmed[1], Aamir Ali[1], M. U. Keerio[1]
[1] Quaid-e-Awam University of Engineering Science and Technology Nawabshah, Sindh, Pakistan
Email: farazbhurt@gmail.com, aamirali.bhatti@quest.edu.pk,
Corresponding author's email: usmankeerio@quest.edu.pk

Abstract
A substantial quantity of real power loss is accounted for the distribution system due to its radial nature. Efficient and secure operation of a distribution system, it is necessary to minimize the active power loss and the system's voltage stability index (VSI). Power loss and VSI in the distribution system can be minimized with the optimal integration of distributed generation (DG), shunt capacitor banks (SCB), and optimal feeder reconfiguration. In this regard, this paper presents a constraint composite differential evolution (C^2oDE) algorithm for the optimal siting and sizing of DG and SCB along with network reconfiguration. Moreover, the proposed algorithm is combined with the two representative constraint handling techniques (feasibility rule and epsilon constraint method) to find a feasible solution. The proposed approach aims to achieve technical benefits such as minimization of active power loss, voltage deviation (VD), and voltage stability index (VSI). During the optimization process, these technical benefits are considered objective functions. Various six study cases are formulated to measure the performance of a proposed method. Simulation is carried out on IEEE standard 33 and 69-bus radial networks. The simulation results show that the proposed method and the feasibility rule constraint technique is effective and superior compared to the other recent applied optimization methods. Also, simulation results of case 6 (b), where the power factor of DG is controlled, give the best performance and minimum values of all the objective functions compared to all the other cases.

Keywords: ***Distributed generation, Shunt capacitor bank, Distribution system, Composite differential evolution, constraint handling techniques***

1. Introduction

The power system is comprised of generation, transmission, distribution, and utilization. The distribution system is the portion between the power transmission network and utilization. The distribution system is designed as the weakly meshed scheme (comprised of tie and sectionalizing switches), but its operation is radial. Due to the radial nature of the distribution system, a large portion of active power loss appears (Akbar et al., 2022). In the literature, one of the techniques is network reconfiguration has been used to minimize power loss (Ali et al., 2023). Interchanging of tie and sectionalizing switches is called network reconfiguration. Tie switches are generally opened, and sectional switches are closed. Recently, some metaheuristic techniques are used for optimal network reconfiguration. These includes runner-root algorithm (RRA) (T. T. Nguyen, Nguyen, Truong, Nguyen, & Phung, 2017), modified bacterial foraging optimization (MBFO)

(Naveen, Sathish Kumar, & Rajalakshmi, 2015), parallel genetic membrane computing (PGMC) (Lei, Wu, Shi, & Shi, 2015), modified particle swarm optimization (MPSO) (Flaih, Xiangning, Dawoud, & Mohammed, 2016) and cuckoo search algorithm (CSA) (T. Nguyen & Truong, 2015).

Moreover, integrating appropriate distributed generation position and capacity can give several technical, environmental, and economic benefits. Recently numerous techniques have been studied to find the proper location and degree of various DGs categories (like a solar photovoltaic, wind turbine, diesel generator etc.). In (Meena, Swarnkar, Gupta, & Niazi, 2015), Taguchi method (TM) was used for the optimal site and size of DG allocation to show its effectiveness considering the 33-bus test system. In (Injeti & Kumar, 2011) genetic algorithm (GA) was proposed for the optimal capacity and allocation of DG in distribution system considering real power loss minimization. Hybrid GA-PSO was presented in the reference (Moradi & Abedini, 2012) considering the objective function of power loss, VD, and VSI. Authors in (Saravanamutthukumaran & Kumarappan, 2012) considered the various voltage-dependent load model for the optimal DG and capacity using the multiobjective optimization technique. Ant lion optimizer (ALO) (Palanisamy & Muthusamy, 2021) and hybrid ALO and fuzzy logic controller in (Samala & Mercy Rosalina, 2021) are applied to find the optimal site and size of DG. Non-dominated based multiobjective modified krill herd (MKH) algorithm (Davodi, Esapour, Zare, & Rostami, 2015) was considered for optimal DG allocation.

Like DGs, shunt capacitor banks (SCBs) are also used to minimize power loss and improve voltage profile. SCBs should also be effectively and efficiently allocated in the distribution system. Integration of SCBs added locally reactive power in the system to improve load-bus voltage and reduce power losses. It also reduces the costs of reactive power from the substations. In the literature, numerous optimization techniques have been presented for the optimal allocation of SCBs. That are PSO (Prakash & Sydulu, 2007), hybrid PSO and crow search algorithm (CSA) (Askarzadeh, 2016), differential evolution (DE) (Neelima & Subramanyam, 2011), hybrid DE and pattern search (PS) called DE-PS (El-fergany, 2013), teaching learning-based optimization (TLBO) (Sultana & Roy, 2014) and direct search algorithm (DSA) (Raju, Murthy, & Ravindra, 2012),. Moreover, the distribution system's operation and the loss minimization can be effectively achieved by considering simultaneous DGs and SCBs allocation. Therefore, hybrid integrations of DGs and SCBs can significantly minimize the distribution network losses and enhance system performance. In the literature, various number of optimization techniques has been used for the optimal allocation of simultaneous DGs and SCBs. Recently, some metaheuristic algorithms that includes harmony search algorithm (HSA) (Rao, Ravindra, Satish, & Narasimham, 2013), bacterial foraging optimization (BFO) (Mohamed Imran & Kowsalya, 2014), water cycle algorithm (WCA) (El-Ela, El-Sehiemy, & Abbas, 2018), a multi objective evolutionary algorithm based on decomposition (MOEA/D) (Partha P Biswas, Mallipeddi, Suganthan, & Amaratunga, 2017), enhanced sine cosine algorithm (ESCA) (Saeidi, Niknam, Aghaei, & Zare, 2019), intersect mutation differential evolution (IMDE) (Khodabakhshian, Andishgar, & Systems, 2016) and backtracking search algorithm (BSA) (Fadel, Kilic, & Taskin, 2017) have been used for finding

the DG and SCBs allocation. Fireworks algorithm (FWA) (Mohamed Imran, Kowsalya, & Kothari, 2014), adaptive cuckoo search algorithm (ACSA) (T. T. Nguyen, Truong, & Phung, 2016) and uniform voltage distribution based constructive reconfiguration (UVDA) in (Bayat, Bagheri, & Noroozian, 2016) have been used to find the simultaneous optimal reconfiguration and DG allocation. However, to our understanding, few researchers conduct ideal network reconfiguration in conjunction with optimal sizing and positioning of DGs and SCs that includes GA (Saonerkar & Bagde, 2014), linear population size reduction success history-based parameter adaption technique of DE (L-SHADE) LSHADE (P. P. Biswas, Suganthan, & Amaratunga, 2018) minimization of power loss as the objective function.

This paper proposes the constraint composite differential evolution (C2oDE) (Wang, Li, Li, & Wang, 2018) algorithm integrated with the most widely used constraint handling techniques in the optimization era for optimal reconfiguration and DGs SCBs allocation. The proposed integrated optimization technique is intended to achieve the following advantages.

1. Maximum penetration of DGs and SCBs improves the distribution system's technical problems such as minimization of power loss and VD and improving VSI.
2. Integration of uncontrollable power factor (PF) of DG (unity PF) and controllable PF of DG (operating between 0.8 and 1 lagging) considered for the flexible distribution system operation.
3. Six study cases of single and weighted sum multi-objective functions are formulated to find the optimal reconfiguration, DGs, and SCBs allocations considering IEEE 33 and 69-bus systems.

The remaining portion of the paper is prepared as; load flow, objective functions and constraints are discussed in section 2, whereas section 3 provides the structure of the proposed optimization method. Test systems, case studies, and parameters of C^2oDE are discussed in section 4, while sections 5 and 6 present the simulation results and conclusion.

2. Problem Formulation

Simultaneous DG and SCB allocation, along with reconfiguration, are constrained optimization problems (COPs). Generally, the objective function (OF) of COP subject to inequality $g_j(\vec{x}_i)$ and equality $h_j(\vec{x}_i)$ constraints can be described as:

$$\begin{aligned} &\min_{\vec{x}_i} f(\vec{x}_i),\ \vec{x}_i \in S,\ L_i \le x_i \le U_i\ \ \forall\, i = 1,2,\dots,D \\ &\text{Subject to}\quad g_j(\vec{x}_i) \le 0, j = 1,\dots,l \\ &\qquad\qquad h_j(\vec{x}_i) = 0, j = l+1,\dots,m \end{aligned} \tag{1}$$

Whereas, $\vec{x}_i$ is the decision vector, D is the number of dimensions in decision vector, S is the entire search space where L and U are the bounds, l and m are the number inequality and equality

constraints. For the computation of objective function, equality and inequality constraints consider the typical configuration of a radial distribution network and the injection of DG and SCB is given in Fig. 1.

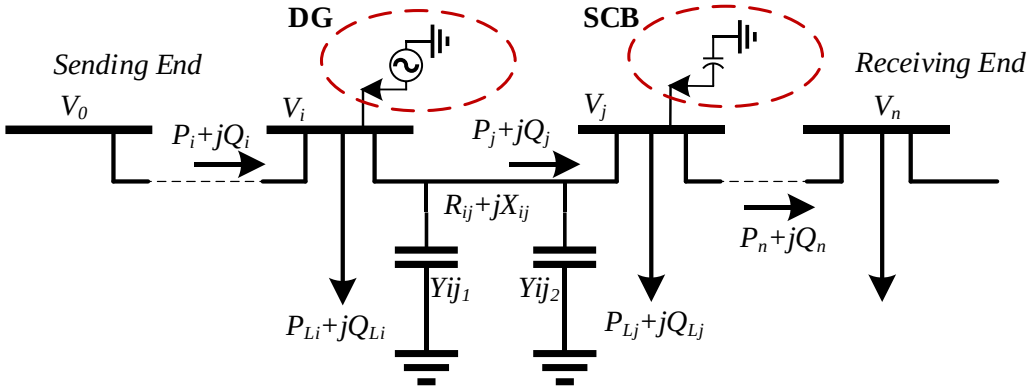

Fig. 1. One line of typical radial feeder

This study aims to determine the best capacity and position of both DGs and SCBs to minimize power loss and voltage deviation with maximization of VSI. For the computation of objective functions, it is first to calculate the magnitude of voltage and its angle at each bus using direct search based forward-backward sweep load flow technique; for detail, see reference (Jen-Hao, 2003). In this paper, DG and SCB are considered negative PQ loads at power factor between 0.8 and 1 and the bus at which DG unit is connected that bus is categorized as PQ bus. If the DG is added to the bus i and having output power P_{DG} then the load at that bus changes from P_{di} to $(P_{di}-P_{DG})$. Likewise, if SCB of reactive power Q_C is added to j^{th} bus in the distribution system, it alters the reactive load Q_{dj} to $(Q_{dj}-Q_C)$. During the optimization process, the proposed algorithm checks all possible places with all feasible sizes of both DGs and SCBs to find the appropriate grouping that reduces active power loss and VD while maximum VSI. Three objective functions (OF), such as power loss, VD, and VSI are considered in this work. In the first OF, real power loss (f_1) is minimized that can be expressed as (P. P. Biswas et al., 2018):

$$f_1(x) = min\left(\sum R_{ij}.\frac{P_i^2+Q_i^2}{|V_i|^2}\right) \qquad (2)$$

Whereas, P_i and Q_i show the active and reactive power injection at bus i as shown in "Fig.1". In the second technical objective function (f_2) voltage deviation index is considered in which a better voltage profile is preserved and given as (Mohamed Imran et al., 2014)

$$f_2(x) = min \sum_{i=1}^{N} \left(\frac{vi - v_i^{spcc}}{v_i^{max} - v_i^{min}} \right)^2 \quad (3)$$

Whereas VSI is the third objective function (f_3), which is one of the most significant indicators for secure operation. VSI between bus i and j can be expressed as (Mohamed Imran et al., 2014):

$$VSI_j = V_i^4 - 4 \times \left(P_{Lj,eff} R_{ij} + Q_{Lj,eff} X_{ij} \right) \times V_i^2 - 4 \times (P_{Lj,eff} X_{ij} - Q_{Lj,eff} R_{ij})^2 (4)$$

Where, $P_{Lj,eff}$ and $Q_{Lj,eff}$ are the effective real and reactive load demand fed through bus j, R_{ij} and X_{ij} are the line resistance and inductive reactance, respectively linking between bus i and j. During operation, a bus with the lowest value of VSI, among all others, needs to be maximized to enhance the entire network's voltage level. Therefore, for the maximization of VSI, a third objective function is given as:

$$f_3(x) = max\left(1/min\left(VSI_{ij}\right)\right) \ \forall \ i,j \quad (5)$$

Equality constraints: Power balance constraints are satisfied during the load flow and is described as:

$$\sum_{i=1}^{NG} P\, G_i = P_L + P_{Loss} \quad (6)$$

$$\sum_{i=1}^{NG} Q\, G_i = Q_L + Q_{Loss} \quad (7)$$

Inequality constraints: The bus voltage, branch flow during reconfiguration, and active/reactive power generated from the DGs along with DG power factor (PF) and installed capacitor limit should not increase beyond the permissible limit of the distribution network and given as:

$$V_i^{min} \le |V_i| \le V_i^{max} \quad (8)$$

$$I_{ij} \le I_{ij(\max)} \quad (9)$$

$$\sum_{i=1}^{N_{DG}} P_{DG,i} \le P_{DG}^{max} \quad (10)$$

$$\sum_{i=1}^{N_{DG}} Q_{DG,i} \le Q_{DG}^{max} \quad (11)$$

$$\sum_{i=1}^{N_C} Q_{C,i} \le Q_C^{max} \quad (12)$$

$$PF_i^{min} \le PF_i \le PF_i^{max} \quad (13)$$

Where, V_i^{min} and V_i^{max} are the minimum and maximum allowable voltage limits for any bus i, I_{ij} is the branch current. P_{DG}^{max} and Q_C^{max} are the maximum ratings of DG and SCB respectively, N_{DG} and N_c are the number of DGs and SCBs.

3. Proposed optimization algorithm

Optimal reconfiguration combined with optimum capacity and position of both DGs and SCBs allocation problem is constrained optimization problem (COP). Since in the past two decades, evolutionary algorithms (EAs) have involved noticeable attention in resolving practical constrained optimization problems efficiently. Differential evolution (DE) is a popular EA. It has numerous attractive advantages for finding the feasible solution to COP because of simple implementation, includes few control parameters and achieves top rank in many computations. In the literature, numerous DE variants have been applied to find constrained type engineering problems. In this work, constrained composite DE (C^2oDE) global optimizer (Wang et al., 2018) is proposed and added with two different representative constraint techniques to find the balance between constraints and objective functions. In the next sub-sections, the proposed constraint handling techniques (CHTs) and the C^2oDE optimization framework are introduced.

4.1 C^2oDE algorithm

In the C^2oDE algorithm, differential vectors are used for the generation of offspring. Fundamentally, there are four stages in the proposed algorithm. In the first stage, randomly generation of an initial population $\vec{x}_i^t (i \in \{1 \dots NP\})$ in the range of lower and upper bound of search space. After that, in the second stage, mutation operators are used for the generation of mutant vector $\vec{v}_i^t (i \in \{1 \dots NP\})$, in this stage, three types of mutation operators were used:

1) current-to-rand/l

$$\vec{v}_i^t = \vec{x}_i^t + F \cdot (\vec{x}_{r1}^t - \vec{x}_i^t) + F \cdot (\vec{x}_{r2}^t - \vec{x}_{r3}^t) \qquad (14)$$

2) Modified rand-to-best/l

$$\vec{v}_i^t = \vec{x}_{r1}^t + F \cdot (\vec{x}_b^t - \vec{x}_{r2}^t) + F \cdot (\vec{x}_{r3}^t - \vec{x}_{r4}^t) \qquad (15)$$

3) current-to-best/l

$$\vec{v}_i^t = \vec{x}_i^t + F \cdot (\vec{x}_b^t - \vec{x}_i^t) + F \cdot (\vec{x}_{r1}^t - \vec{x}_{r2}^t) \qquad (16)$$

Where, $\vec{x}_{r1}^t$ to $\vec{x}_{r4}^t$ are the mutually different decision vectors randomly selected from 1 to *NP* individuals, $\vec{x}_b^t$ shows the best solution of current generation *t*. Each mutation vector has distinct features for example mutation vector given in Eq. (14) can explore the entire search space and hence increase the diversity however, in Eq. (15) and (16) are accelerating the convergence to get information from the best individual. In the third step trial vector $\vec{u}_i^t$ is generated using a binomial crossover operator between each pair of $\vec{v}_i^t$ and $\vec{x}_i^t$, It can be noticed from Fig. 2 that, for each target vector, three offsprings are generated with distinct advantages of exploration and exploitation using trail vector generation strategy and pool of parameters.

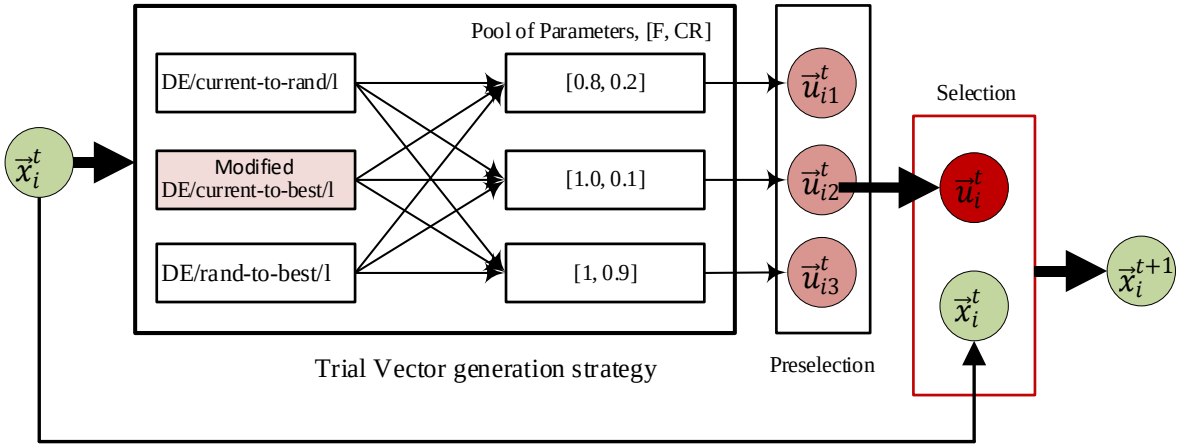

Fig. 2. Framework of proposed C^{2}oDE algorithm (Wang et al., 2018)

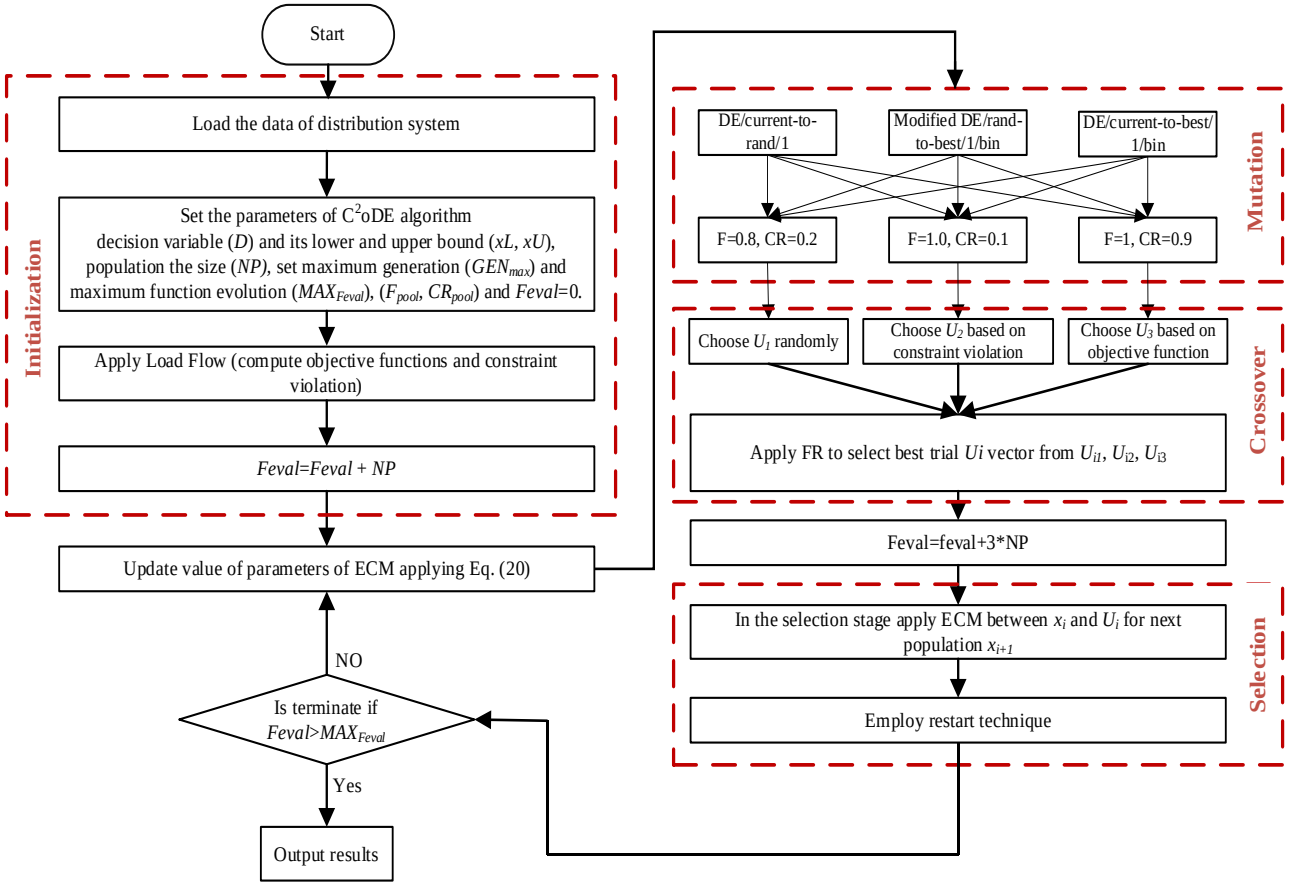

Fig. 3. Flow chart for the implementation of C^{2}oDE

Furthermore, the feasibility rule (FR) and ε constrained method (ECM) are implemented with the proposed algorithm at phase of preselection and selection to select feasible solutions for the next generation. Both the constraint techniques can be defined by considering the equality and inequality constraints as shown in Eq. (1), and then to compute the overall constraint violation as:

$$G_j(\vec{x}) = \begin{cases} max\ \left(0, g_j(\vec{x})\right)\ 1 \le j \le l \\ max\ \left(0, \left|h_j(\vec{x})\right|\right)\ \ l+1 \le j \le m \end{cases} \quad (18)$$

$$G(\vec{x}) = \sum_{j=1}^{m} G_j\ (\vec{x}) \quad (19)$$

In FR two members of trail vector are randomly selected (say $\vec{u}_i$ and $\vec{u}_j$) and compare them as follows:

i. If both $\vec{u}_i$ and $\vec{u}_j$ are feasible, select the one which has a minimum objective function value.
ii. If both $\vec{u}_i$ and $\vec{u}_j$ are infeasible, select the one which has minimum constraint violation.
iii. If $\vec{u}_i$ is feasible and $\vec{u}_j$ is an infeasible, always select feasible one

In ECM, let it be assumed that $\vec{u}_i$ is superior to $\vec{x}_i$ at the selection stage if and only if the following conditions are satisfied:

$$\begin{cases} f(\vec{u}_i) < f(\vec{x}_i), if\ G(\vec{u}_i) < \mathcal{E}\ and\ G(\vec{x}_i) < \mathcal{E} \\ f(\vec{u}_i) < f(\vec{x}_i), if\ G(\vec{u}_i) = G(\vec{x}_i) \\ G(\vec{u}_i) < G(\vec{x}_i) \end{cases} \quad (20)$$

Whereas, parameter $\mathcal{E} = \mathcal{E}_o(1 - \mathrm{t/T})^{cp}$, if the ratio between current and maximum generation (t/T) is less than 50%, otherwise 0. However, $\mathcal{E}_o$ is the initial threshold, and in the starting it is equal to the maximum constraint violation. The parameter cp can be calculated as:

$$cp = -\frac{log\ \varepsilon_0 + \lambda}{log\ (1-p)} \quad (21)$$

Where λ is set to 6, and p controls the exploitation of objective function. The flow diagram of C^2oDE is given in Fig. 3.

4. Test Systems, Case studies, and Parameters of Algorithm

In this paper, IEEE standard 33 and 69-bus test systems are used for finding the appropriate allocation of DG and SCB along with reconfiguration. The total complex power demand of the proposed methods is 3715+j2300 kVA and 3802+j2694 kVA, respectively. The proposed distribution network's line and load data are given in (Biswas et al., 2018), and the base configuration is as shown in Fig. 4 and 5. Before and after network reconfiguration, sectionalizing

and tie switches must be the same in number. Both the networks have five loops shown in Fig. 4 and 5. There must be an open switch in the entire loop, and all the buses are connected with the root bus (sub-station/slack bus) to ensure radial constraint. Optimal combination of tie and sectionalizing switches, the proposed algorithm conducts inspections of all such possible combinations. The developed basic loops of both the study systems are shown in Table 1.

In case 1 to 4 maximum rating of DG injection is 2 MW in 33-bus test network and 2.25 MW in 69-bus system, whereas; SCB rating is limited to less than the demand MVAr rating (Biswas et al., 2017). Moreover, to increase DGs' penetration (only in cases 5 and 6), the maximum rating of DGs and SCBs is less than active and reactive power demand. The parameters of C^2oDE algorithm are shown in Table 2.

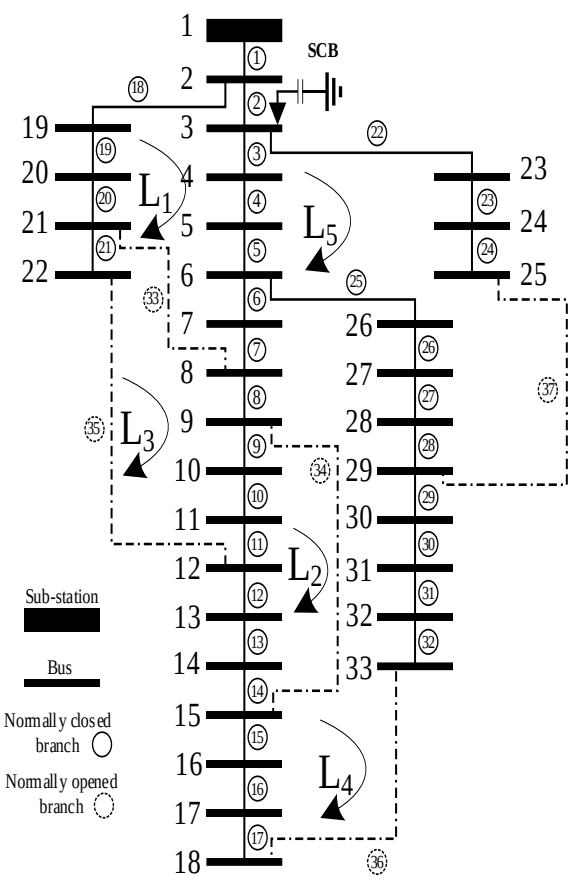

Fig. 4. Base configuration of 33-bus

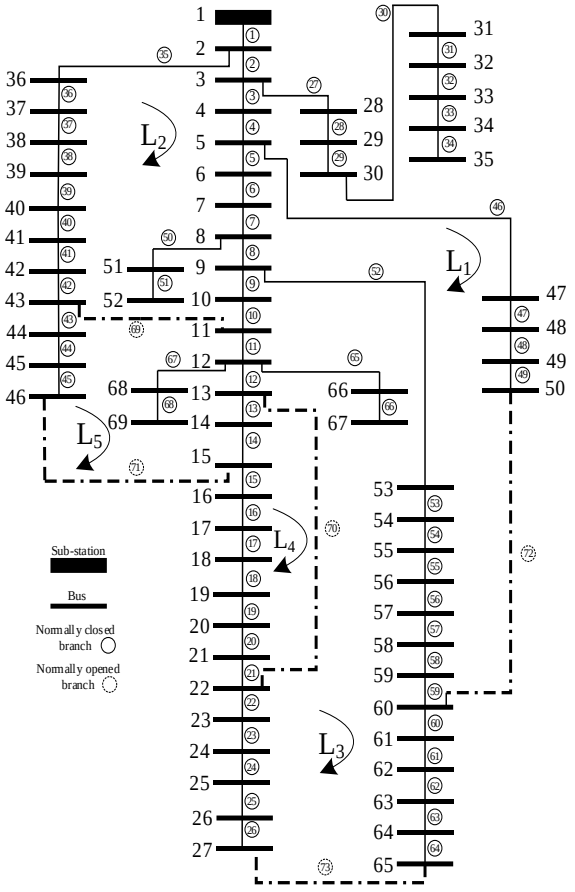

Fig. 5. Base configuration of 69-bus

TABLE I. Fundamental loops of 33 and 69-bus networks

Network	Switches (sectionalizing and Ties) in Fundamental Loops	# Switches
33-bus	2, 3, 4, 5, 6, 7, 18, 19, 20, **33**	10
	12, 13, 14, **34**	4
	8, 9, 10, 11, 21, 33, **35**	7
	15, 16, 17, 29, 30, 31, 32, **36**	8
	22, 23, 24, 25, 26, 27, 28, **37**	8
69-bus	3, 4, 5, 6, 7, 8, 9, 10, 35, 36, 37, 38, 39, 40, 41, 42, **69**	17
	15, 16, 17, 18, 19, 20, **70**	7
	11, 12, 13, 14, 43, 44, 45, **71**	8
	46, 47, 48, 49, 52, 53, 54, 55, 56, 57, 58, **72**	12
	21, 22, 23, 24, 25, 26, 59, 60, 61, 62, 63, 64, **73**	13

TABLE II. Parameters of Co^2DE for case 1 to case 6

Study Cases	Pop size	Power Factor (PF)	Decision variable	Max Gen
Case 1 to 4	100	1	5, 6, 6, 12	100
Case 5	150	1	17	150
Case 6	150	[0.8, 1]	20	150

Furthermore, six study cases of single and weighted sum multi objective are considered.

Case	Description
1	Power loss minimization considering the only reconfiguration
2	Power loss minimization considering only DG
3	Power loss minimization considering only SCB
4	Power loss minimization considering simultaneous DG and SCB
5	(a) Power loss minimization considering simultaneous DG (without controllable power factor) and SCB allocation along with optimal reconfiguration. (b) Weighted sum multiobjective optimization (power loss, VD, and VSI) considering simultaneous DG (without controllable power factor) and SCB allocation along with optimal reconfiguration.
6	(a) Single objective (minimization of power loss) considering simultaneous DG (with controllable power factor) and SCB allocation along with optimal reconfiguration. (b) Weighted sum multiobjective optimization (power loss, VD, and VSI considering simultaneous DG (with controllable power factor) and SCB allocation along with optimal reconfiguration.

5. Simulation Results, Discussion and Comparison

The simulation results are illustrated, evaluated, and contrasted in this section with similar previous research. Each case is run ten times, and in each run, output results are compatible with insignificant differences between separate runs.

5.1 33-bus Distribution Network

The simulation results and comparison of the proposed algorithm with the most recent algorithms for case 1 (only reconfiguration) are shown in Table 3.

C^2oDE accomplishes the minimum kW loss in case 1 along with some other algorithms as mentioned in Table 3. Results and comparison of case 2 to case 4 given in table 4 and it is clearly shown that the solution of C^2oDE algorithm is good compared to most of the algorithms in terms of small cumulative rating of DGs, SCBs, and objective functions. Simulation results of case 2 compared with that of HSA (Rao et al., 2013), PSO (Moradi & Abedini, 2012), FWA (Mohamed Imran et al., 2014), TM (Meena et al., 2015), BFOA (Mohamed Imran & Kowsalya, 2014), GA and hybrid GA/PSO (Moradi & Abedini, 2012). C^2oDE algorithm gives 79.02 kW losses with 61.0% compared to the base case. DGs are allocated at buses 25, 30 and 14 with the injection of 0.4266, 0.9055 and 0.6678 MW, respectively. The minimum voltage level (0.9595 p.u) appeared on bus 33. Simulation results of case 3 (only SCBs allocation) are compared with the other methods BFOA (Mohamed Imran & Kowsalya, 2014), and PSO (Moradi & Abedini, 2012). In this case, SCBs are optimally allocated at bus numbers 30, 24 and 13 with the injection of 1.143, 0.566, and 0.423, respectively.

TABLE III**.** Simulation results and comparison of Case1

Algorithm	Tie Switches	Ploss (kW)	Vmin (bus)
Base	33, 34, 35, 36, 37	202.6	0.9131 (18)
C^2oDE	**7, 9, 14, 32, 37**	**139.55**	**0.9378 (32)**
RRA (T. T. Nguyen et al., 2017)	7, 9, 14, 32, 37	**139.55**	0.9378 (32)
CSA (T. Nguyen & Truong, 2015)	7, 9, 14, 32, 37	**139.55**	0.9378 (32)
FWA (Mohamed Imran et al., 2014)	7, 9, 14, 28, 32	139.98	0.9413 (32)
ACSA (T. T. Nguyen et al., 2016)	7, 9, 14, 28, 32	139.98	0.9413 (32)
UVDA (Bayat et al., 2016)	7, 9, 14, 32, 37	**139.55**	0.9378 (32)

In addition, Table 4 shows that the C2oDE effectively finds the optimal capacity and site of SCB with the lowest operational losses of 132.16 kW and connected SCBs capacity is 2.132 MVAr with the minimum voltage 0.938 p.u appeared on bus number 18. Case 4 suggests the injection of three DGs at three different buses 14, 25 and 30 with the injection of 0.605, 0.507 and 0.873 MW respectively and three SCBs at buses 11, 30 and 24 of the rating 0.447, 1.017 and 0.414 respectively. Power loss18.878 kW is reached in comparison to GA [31], BFOA [20], LSHADE [32] and WCA [21]

TABLE IV. IEEE 33-Bus Simulation Results and Assessment of Case 2 to Case 4

Case #	**Method**	**DG size (bus #)**	**SCB size (bus #)**	**Ploss (kW)**	**Vmin (bus #)**
Case 2	**C²oDE**	**0.4266 (25), 0.9055 (30) 0.6678 (14)**	--	**79.02**	**0.9595 (33)**
	HSA (Rao et al., 2013)	0.5724 (17), 0.107 (18), 1.0462 (33)	--	96.76	0.967 (29)
	FWA (Mohamed Imran et al., 2014)	0.5897 (14), 0.189 (18), 1.0146 (32)	--	88.68	0.968
	TM (Meena et al., 2015)	0.5876 (15), 0.1959 (25), 0.783 (33)	--	91.305	0.958 (30)
	BFOA (Mohamed Imran & Kowsalya, 2014)	0.633 (17), 0.09 (18), 0.9470 (33)	--	98.3	0.964
	GA (Moradi & Abedini, 2012)	1.50 (11), 0.4228 (29), 1.0714 (30)	--	106.3	0.981 (25)
	PSO (Moradi & Abedini, 2012)	1.1768 (8), 0.9816 (13), 0.8297 (32)	--	105.35	0.980 (30)
	GA/PSO (Moradi & Abedini, 2012)	0.9250 (11), 0.8630 (16), 1.2 (32)	--	103.4	0.980 (25)
Case 3	**C²oDE**	--	**1.143 (30), 0.566 (24), 0.423 (13)**	**132.16**	**0.938 (18)**
	BFOA (Mohamed Imran & Kowsalya, 2014)	--	0.349 (18), 0.821 (30), 0.277 (33)	144.04	0.936

	PSO (Askarzadeh, 2016)	--	0.9 (2), 0.45 (7), 0.45 (31), 0.3 (15), 0.45 (29)	132.48	0.945
Case 4	**C^{2}oDE**	**0.605 (14), 0.507 (25), 0.873 (30)**	**0.447 (11), 1.017 (30), 0.414 (24)**	**18.87**	**0.981 (18)**
	WCA (El-Ela et al., 2018)	0.973 (25), 1.04 (29), 0.563 (11)	0.465 (23), 0.565 (30), 0.535 (14)	24.688	0.980 (33)
	GA (Saonerkar & Bagde, 2014)	0.25 (16), 0.25(22), 0.50 (30)	0.30 (15), 0.30 (18), 0.30 (29), 0.60 (30)	71.25	0.971
	LSHADE (P. P. Biswas et al., 2018)	0.665 (14), 0.446 (25), 0.889 (30)	0.950 (3), 0.341 (14),1.009 (30)	19.37	0.9863 (8)
	BFOA (Mohamed Imran & Kowsalya, 2014)	0.542 (17), 0.160 (18), 0.895 (33)	0.163 (18), 0.338 (33), 0.541 (30)	41.41	0.978

TABLE V. IEEE 33-Bus Results of C^{2}oDE for Case 5 and 6

Case No.	**DGs (MW)**		**SCB (MVAr)**	**Open Switches**	**Objective function**	**Ploss (kW)**	**VD (p.u)**	**VSI (p.u)**	**min Voltage (bus)**
	Power Factor	Size (location)	Size (Location)						
Case 5 (a)	1	0.696 (33), 1.221 (25), 1.226 (8)	0.242 (33), 0.991 (30), 0.606 (08)	11, 4, 13, 15, 23	8.839	**8.839**	**0.000404**	0.9919 (14)	**1.0336 p.u**
Case 5 (b)	1	0.796 (31), 1.035 (25), 1.057 (9)	0.651 (25), 0.796 (30), 0.514 (9)	33, 6, 13, 17, 25	**4.9062**	**9.286**	**0.028101**	0.9940 (17)	**1.02397**
Case 6 (a)	0.9745, 0.9401, 0.9016	0.8038 (33), 1.002 (8), 1.2661 (25)	0.145 (15), 0.469 (30), 0.157 (17)	35, 20, 12, 30, 27	**7.6859**	**7.686**	**0.000302**	**0.9946 (22)**	**1.0247**
Case 6 (b)	0.9022, 0.9396, 0.9273	0.902 (8), 0.939 (25) 0.927 (32)	0.001 (10), 0.652 (30) 0.1477 (23)	35, 5, 12, 15, 25	**4.1969**	**7.827**	**0.07678**	0.9876 (13)	**1.0558**

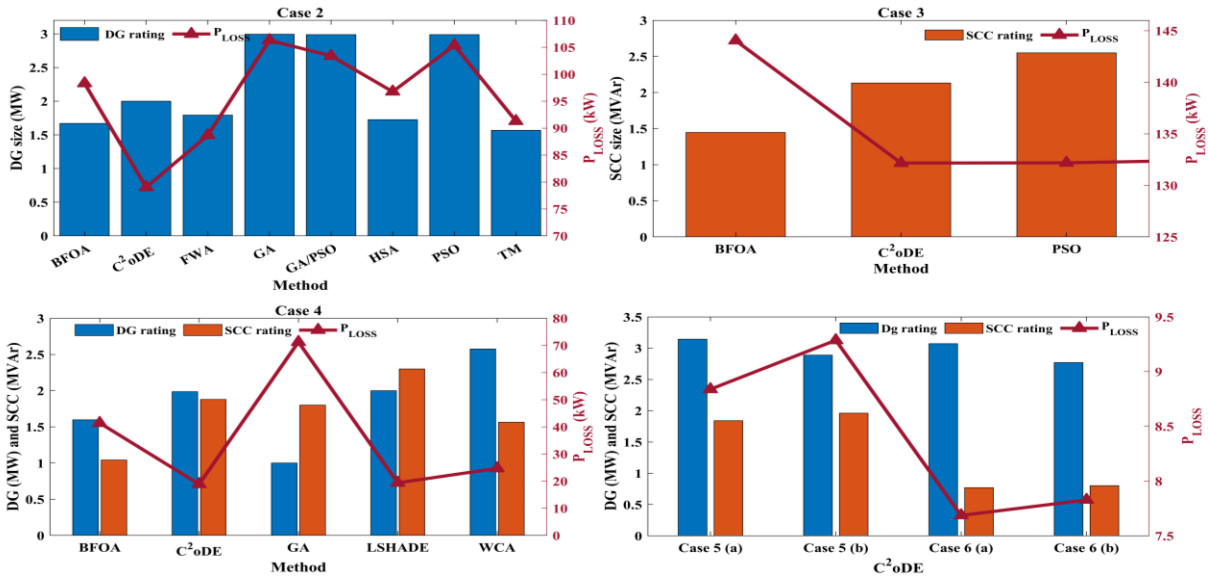

Fig. 6. DG and SCB rating of all the cases of 33-bus

Minimum p.u voltage 0.9813 is found at bus 18. The last column of Table 3 and Table 4 indicates minimum voltage experiences the bus in the system. Suggested capacity and allocation of DG and SCB, C2oDE gives better voltage deviation from the 1 p.u. As shown in Fig. 6, C2oDE gives the smallest active power loss as compared to other methods along with optimal DG and SCB injection. Further, Table 5 shows the simulation results of cases 5 and 6 in which controlled and uncontrolled PF of DG is considered. In Case 5 (a) (single objective) objective function 8.839 kW loss whereas 0.000404 p.u VD and 1.0336 p.u VSI appear by reconfiguration and cumulative 3.1439 MW DGs and 1.8397 MVAR of SCBs injection. In Case 5 (b) (multi-objective) power loss, VD and VSI incurs 9.2864 kW, 0.028101p.u and 1.02397p.u respectively, whereas weighted sum multi objective function is approach is 4.9062 with 50, 25 and 25 priorities. Cumulative DG and SCB injection are 2.25 MW and 2.69 MVAR.

However, in case 6, each DG's PF is controlled and considered the decision vector in the optimization process. In Case 6 (a) (single objective), objective function power loss is reduced up to 7.6859 kW, approximately 95% reduction with the integration of a total of 3.0722 MW and 0.7705 MVAr. However, in case 6 (b) (weighted sum multi objective), minimize the active power loss up to 7.82755 kW, slightly less than case 6 (a) with the injection of 2.7691 MW and 0.802 MVAr.

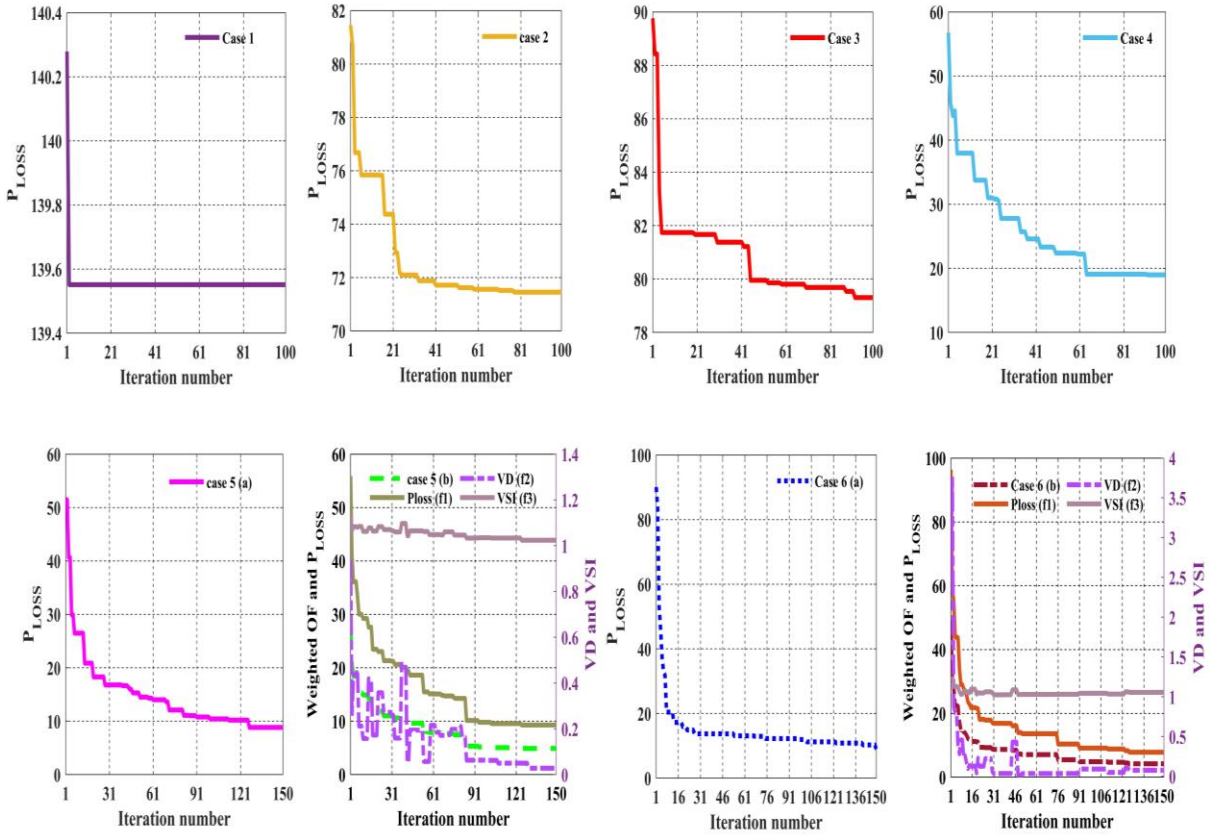

Fig. 7. Convergence curve of case 1 to case 6 of 33-bus test system

However, in case 6, each DG's PF is controlled and considered the decision vector in the optimization process. In Case 6 (a) (single objective), objective function power loss is reduced up to 7.6859 kW, approximately 95% reduction with the integration of a total of 3.0722 MW and 0.7705 MVAr. However, in case 6 (b) (weighted sum multi objective), minimize the active power loss up to 7.82755 kW, slightly less than case 6 (a) with the injection of 2.7691 MW and 0.802 MVAr. It is concluded from the simulation results of cases 5 and 6, as shown in "Table 5", that the optimal network reconfiguration with optimum DG allocation considering controllable PF and SCBs such as case 6 (a and b) is effective. Fig. 7 shows the convergence of the objective function for Case 1 to Case 6. Fig. 8 shows a comparison between the voltage level of all the study cases of 33-bus network. The voltage profile of case 6 (a) (PF of DG is controlled) close to 1 p.u compared to other cases.

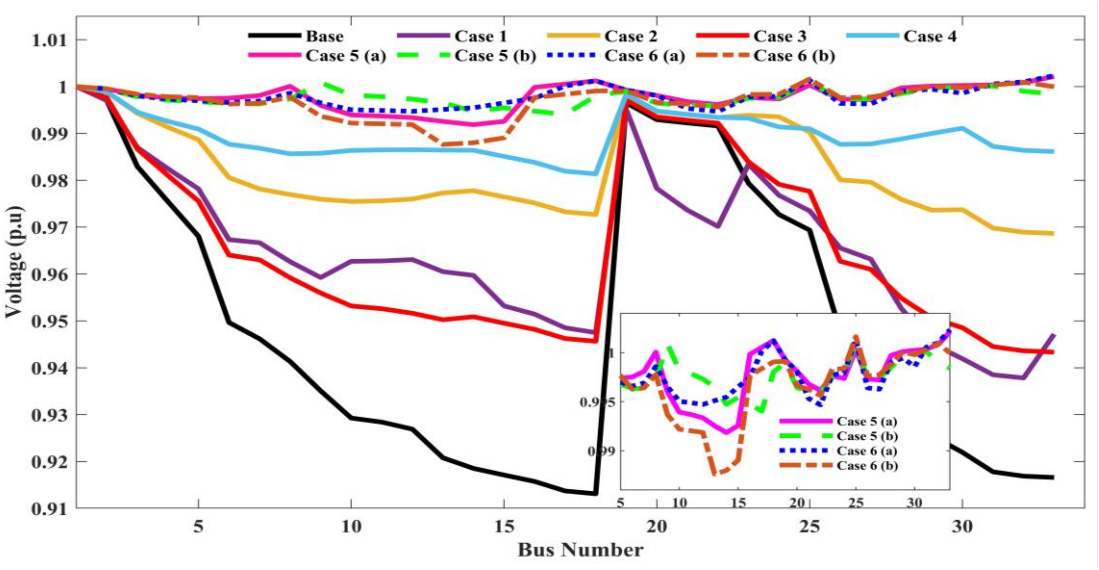

Fig. 8. 33-bus voltage curve of all the case studies

5.2 69-bus Radial Distribution System

Tables 6 and 7 presents the simulation results of case 1 to case 4. In case 1 (only reconfiguration) , the proposed algorithm achieves the lowest active power loss and the UVDA algorithm. Howev er, a small variation in the performance of different algorithms is due to network data approximat ion. In Case 1, switches between 55 to 58 can be on/off in the subsequent loops with no significa nt changes.

TABLE VI. Simulation Results of 69-Bus System For Case 1

Algorithm	Tie Switches	Ploss (kW)	Vmin (bus)
Base	69, 70, 71, 72, 73	225	
C^{2}oDE	14, 58, 61, 69, 70	**98.58**	0.9495 (61)
CSA (T. Nguyen & Truong, 2015)	14, 57, 61, 69, 70	98.59	0.9495 (61)
FWA (Mohamed Imran et al., 2014)	14, 56, 61, 69, 70	98.59	0.9495 (61)
ACSA (T. T. Nguyen et al., 2016)	14, 57, 61, 69, 70	98.59	0.9495 (61)
UVDA (Bayat et al., 2016)	14, 58, 61, 69, 70	**98.58**	0.9495 (61)

In Table 7, in comparison to other algorithms, C2oDE attains minimum power loss. In cases 2 and 3, losses are 70.77 and 145.11 kW, respectively. Further, in both cases, a minimum voltage appears on 65th bus equal to 0.9749 and 0.9314 p.u.

In both the cases (case 2 and case 3), obtained results are assessed and compared with that of HSA [19], GA [35], WCA [21], FWA [28], RGA [36], CVSI [37], PSO [13], DE [15] , DE-PS [16], TLBO [17], and DSA [18]. Simulation results are shown in Table 7, which clearly shows that C2oDE is efficient for finding the optimal capacity and site of SCB and DG allocation with the smallest losses. Moreover, case 4 suggests that the injection of three DGs and SCBs at three different buses significantly reduces more power loss than a single DG and SCB of the same rating. In Case 4, three DGs injection at three different buses 61, 22, and 69 with the injection of 1.6422, 0.3582, and 0.2493 respectively and three SCBs at buses 61, 22, and 11 of the rating 1.1987, 0.2321 and 0.3663 respectively. Smallest power loss 5.2669 kW is reached in comparison to LSHADE [32], WCA [21], MOEA/D [22] and IMDE [24]. Furthermore, Fig. 9 shows the comparison between the DG and SCB injection of various algorithms with respect to active power loss minimization and C2oDE gives the smallest active power loss as compared to other methods along with optimal DG and SCB injection.

Fig. 9 shows that, compared to cases 2 and 3, simulation results of case 4 is more useful to reduce power loss and inject minimum cumulative rating of DG and SCB. Table 8 shows the simulation results of cases 5 and 6, in which the optimal integration of DG and SCB are computed. In Case 5 (a) (single-objective), C2oDE attains 4.3364 kW power loss, about 98% reduction with 0.0382 VD and 1.0262 VSI, cumulative 2.9876 MW of DGs, and 1.7409 MVAR of SCBs injection. Case 5 (b) weighted sum objective function is 2.4794 with priority factor of 50, 25, and 25 percent.

TABLE VII. Simulation Results of Case 2 To Case 4

Case	Algorithm	DG size (bus)	SCB size (bus #)	Ploss (kW)	Vmin (bus)
Case 2	**C^2oDE**	**0.2811 (12), 0.3128 (21), 1.6560 (61)**		**70.77**	**0.9749 (65)**
	HSA (Rao et al., 2013)	0.1018 (65), 0.3690 (64), 1.3024 (63)		86.77	0.967
	GA (Nara, Shiose, Kitagawa, & Ishihara, 1992)	1.9471		88.5	0.969
	RGA (Zhu, 2002)	1.7868		87.65	0.968

	CVSI (Gantayet & Mohanty, 2015)	1.895 (61)		83.18	0.968 (27)
	WCA (El-Ela et al., 2018)	0.775 (61), 1.105 (62), 0.4380 (23)		71.5	0.987 (65)
	FWA (Mohamed Imran et al., 2014)	0.2258 (27), 1.1986 (61), 0.4085 (65)		77.85	0.974 (62)
Case 3	**C^{2}oDE**		**1.4112 (61), 0.4310 (11), 0.2464 (21)**	**145.11**	**0.9314 (65)**
	PSO (Prakash & Sydulu, 2007)		1.015 (59), 0.241 (61), 0.365 (65)	156.14	0.934
	DE (Neelima & Subramanyam, 2011)		0.2 (16), 0.7 (60), 0.5 (61)	149.55	0.928
	DE-PS (El-fergany, 2013)		0.95 (61), 0.2 (64), 0.05 (65), 0.15 (95), 0.3 (21)	146.13	0.931
	TLBO (Sultana & Roy, 2014)		0.6 (12), 1.050 (61), 0.150 (64)	146.35	
	DSA (Raju et al., 2012)		0.9 (61), 0.45 (15), 0.45 (60)	147	
Case 4	**C^{2}oDE**	**1.6422 (61), 0.3582 (22), 0.2493 (69)**	**1.1987 (61), 0.2321 (22), 0.3663 (11)**	**5.2669**	**0.9942 (50)**
	LSHADE (P. P. Biswas et al., 2018)	0.310 (12), 0.313 (21), 1.627 (61)	0.582 (12), 0.881 (49), 1.227 (61)	**5.81**	0.9943 (65)
	WCA (El-Ela et al., 2018)	0.5408 (17), 2 (61), 1.1592 (69)	1.1879 (2), 1.2373 (62), 0.2697 (69)	33.339	0.994 (50)
	MOEA/D (Partha P Biswas et al., 2017)	0.520 (17), 1.731 (61)	0.353 (17), 1.239 (61)	7.20	0.9943 (69)
	IMDE (Khodabakhshian et al., 2016)	479 (24), 1738 (62)	1.192 (61), 0.109 (63)	13.83	0.9951

TABLE VIII. Simulation Results of Case 5 and Case 6

Case No.	**DGs (MW)**		**SCB (MVAr)**	**Open Switches**	**Objective function**	**Ploss (kW)**	**VD (p.u)**	**VSI (p.u)**	**min Voltage (bus)**
	Power factor	Size (location)	Size (location)						
Case 5 (a)	1	0.7143 (12), 0.6323 (49), 1.6410 (61)	1.2173 (61), 0.2881 (13), 0.2355 (69)	10, 56, 13, 17, 73	**4.3365**	**4.3365**	**0.0382**	**1.0262**	0.9935 (65)
Case 5 (b)	1	0.3611 (66), 1.7956 (61), 0.3982 (19)	0.4642 (50), 1.2369 (61), 0.3902 (22)	9, 57, 13, 16, 73	**2.4794**	**4.6091**	**0.0256**	**1.0183**	0.9962 (69)
Case 6 (a)	0.8706, 0.8597, 0.8844	1.6821 (61), 0.6949 (12), 0.6582 (50)	0.2162 (64), 0.0765 (22), 0.0901 (41)	69, 54, 14, 17, 73	**2.9203**	**2.9203**	**0.0239**	**1.0149**	0.9962 (17)
Case 6 (b)	0.8739, 0.8207 0.9204	0.6139 (61), 1.7331 (61), 0.8644 (50)	0.0678 (68), 0.0918 (29), 0.1947 (67)	8, 72, 71, 16, 64	**1.9362**	**3.3636**	**0.0057**	**1.0119**	0.9968 (69)

With these priorities, active power loss, VD and VSI are 4.6091 kW, 0.0256 p.u, and 1.0183 p.u, respectively. Optimal total DGs injection of 2.5549 MW and SCBs 2.0913 MVAR injection. However, in case 6, each DG's PF is controlled and considered the decision vector in the optimization process. In Case 6 (a) (single-objective), power loss minimized up to 2.9203 kW approximately 98.5% reduction with 3.0352 MW of DGs and 0.3828 MVAr of SCBs injection. However, in case 6 (b) (weighted sum multi-objective) minimize the objective function up to 1.9362 with priority factors of 50, 25 and 25 that gives 3.3636 kW, 0.0057p.u and 1.0119 p.u of

power loss, VD and VSI respectively, with the injection of 3.2114 MW and 0.3543 MVAr. It is concluded from the simulation results of case 5 and 6, that the optimal network reconfiguration with DG allocation considering controllable PF and SCBs is useful to reduce power loss and VD with maximization of VSI.

Furthermore, the convergence curve of all the study cases is shown in Fig. 10. From the convergence curve viewpoint, C2oDE converges in 100 iterations for cases 1 to case 4, while up to 150 iterations, it gives a global or near-global solution for case 5 and case 6. However, Fig. 11 shows a comparison between the voltage level of all the study cases of a 69-bus network. In all the cases voltage levels are within desirable limit, and case 6 (b) is more effective than other cases

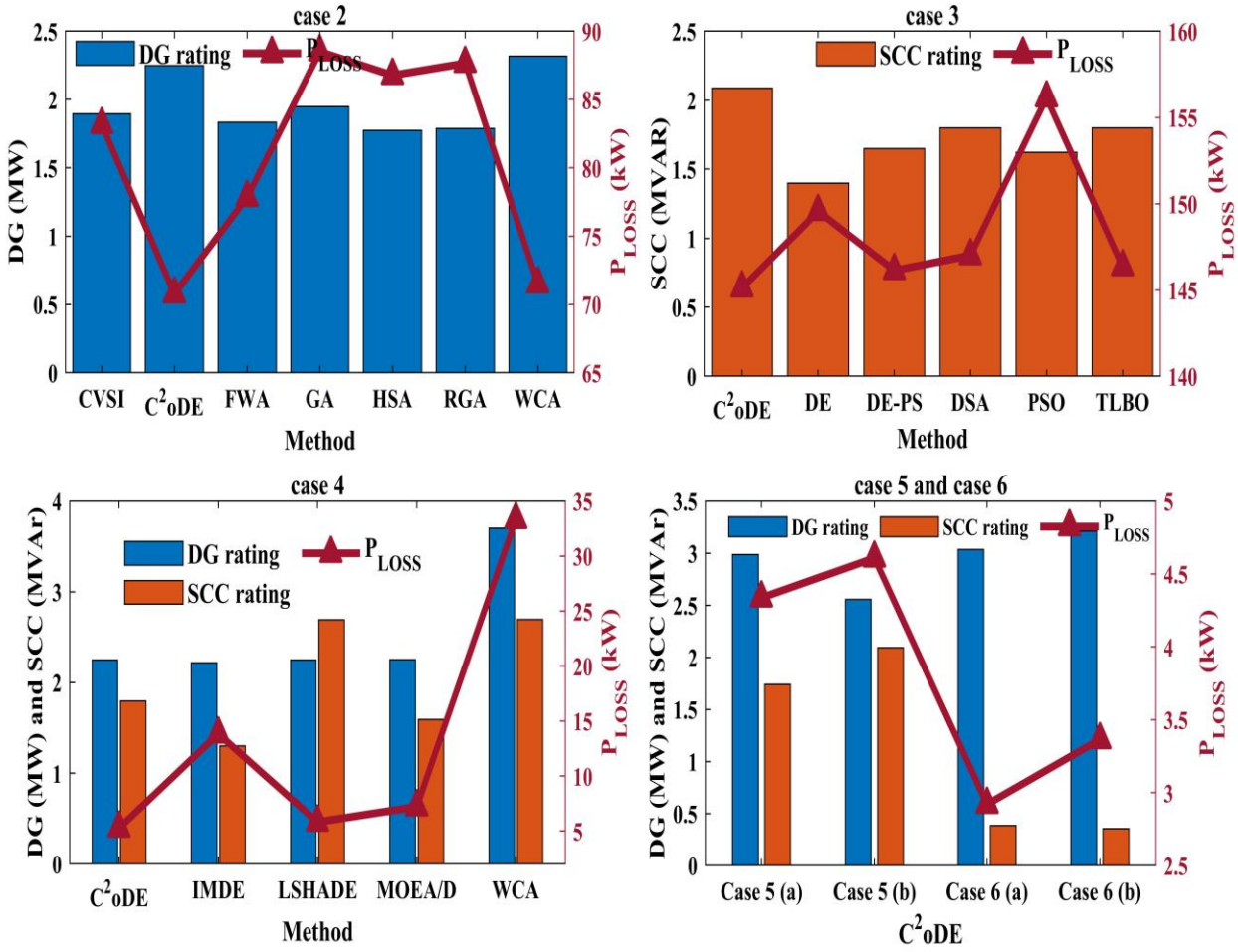

Fig. 9. DG and SCB rating of all cases vs. past methods

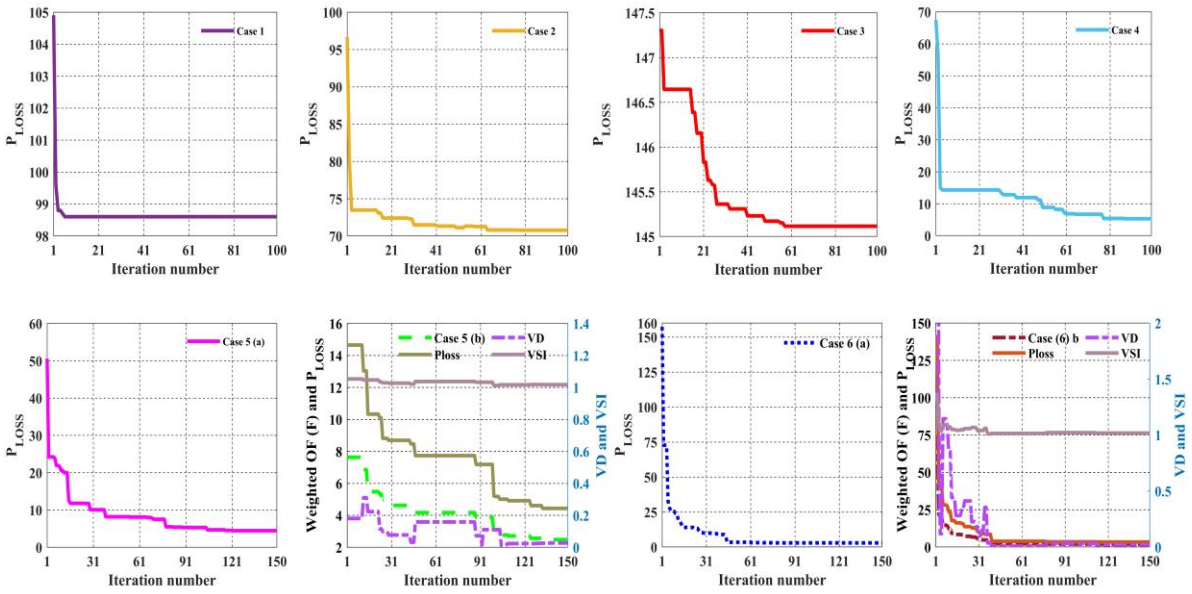

Fig. 10. Convergence curve of case 1 to case 6 of 69-bus test system

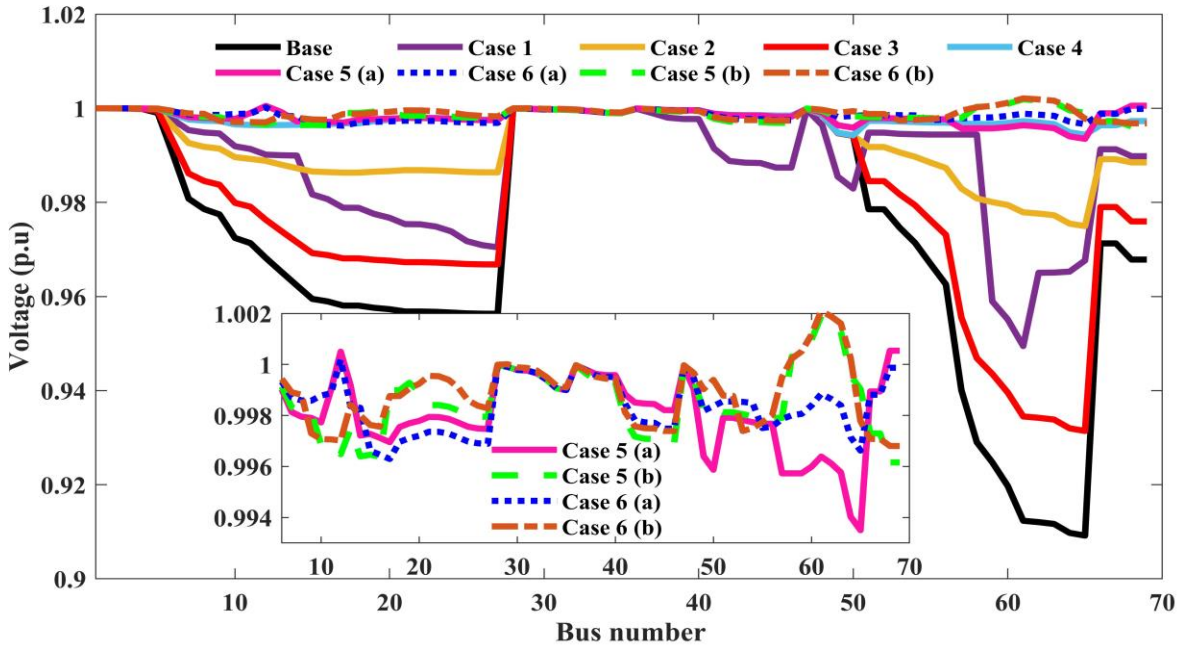

Fig. 11. Voltage profile of 69-bus test system of all cases

6. Conclusion

In this paper, a constrained composite differential evolution algorithm is used to optimize network reconfiguration along with site and size of DG and SCB allocation. Six cases of single and weighted sum multi objective functions are formulated to optimized power loss, VD, and VSI. IEEE 33-bus and 69-bus test systems have been considered to show the proposed algorithm's superiority and performance. Simulation results and comparison with the most recent methods show that the proposed method can find the optimal global solution to non-linear and mixed-integer problems. It is clear from the simulation results that optimal reconfiguration and optimum site and capacity of DG and SCB are most efficient. The proposed algorithm has fully and efficiently utilized the installed capacity of DGs and SCBs.

In comparison to all the cases, case 6 (b) effectively integrate the active and reactive power of DG and find the best compromise values of objective functions. Furthermore, the integration of controlled PF DG enables to increase the overall security of the system. Overall voltage profile and minimum voltage at the bus enhanced with the integration of reactive power of DG. In the future, the cost of DG and SCB and emission factors shall be considered for finding the effectiveness of the proposed algorithm.

7. RERENCES

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Analysis of the Effects of Teachers' Scaffolding on Project-Based Learning of BS- English Students of University of Sindh, Jamshoro, Sindh, Pakistan

Abdul Sattar Gopang[1], Summayya Sattar Gopang[2], and Zubair Ahmed Chachar[1]

[1] Department of Curriculum and Special Education, Faculty of Education, University of Sindh, Elsa Kazi Campus, Hyderabad, Sindh, Pakistan
[2] Institute of English Language and Literature, University of Sindh, Jamshoro, Sindh, Pakistan

Corresponding author's email: sattar.gopang@usindh.edu.pk

Abstract
The present study investigates the effects of scaffolding on project-based learning (PjBL) of BS-English students at the University of Sindh. The objectives of the study were to disclose students' behaviour and the impacts of scaffolding during project work. This study adopts the mixed research methods under the explanatory research design to obtain the answers to the research questions. This study used questionnaires and reflection accounts for data collection. The statistical packages for social sciences (IBM SPSS Statistics version 23) were used for questionnaire data analysis and reflection accounts' data were analysed through content analysis. Considering data analysis distinct major themes emerged that were associated with the benefits and challenges of scaffolding and PjBL. Moreover, in the Pakistani context rarely teachers and students are familiar with modern ELT methods and their implementation is quite challenging. It is therefore recommended that mainly in PjBL that teachers not only focused on the outcomes of the project but it is important to consider whether students acquire various skills during project work which is also the integral aim of PjBL. Hence, teacher's scaffolding is not confined to the completion and outcomes of the project but the teacher must observe whether the student develops the language and soft skills during project work.

Keywords: *Scaffolding, project-based-learning, English learners*

1. Introduction

The term Scaffolding was first discussed by Wood, Bruner and Ross in 1976, that defined scaffolding as a metaphor of assistance and supervision in learning. Contemporary, the term used in Vygotsky's sociocultural theory (1934) believes learning is a social process rather than the individual. On the other hand, project-based learning was first created by David Snedden in the mid of the 1800s and further refined by William Heard Kilpatrick and John Dewey's students in the 1900s. Thuan (2018) states that project-based learning (PjBL) consists of several characteristics such as student-centeredness, lifelong learning, autonomy, cooperative learning, critical thinking and creativity. The current study focused on the above-mentioned characteristics

of the students in a project. Thus, it explored whether providing teacher scaffolding (more knowledgeable) in the project work affects learners' attitudes negatively or positively.

Traditionally, many researchers conducted studies on scaffolding about its functions, methods and how it facilitates the understanding of difficult tasks (Brown, 1992; Palinscar & Brown 1984). In addition, most of the studies have emphasized on interaction, dialogue and modelling, while others considered technology as an external scaffold (Lin & et al., 1999; Lin& Lehman, 1999, Saloman, et al. 1989). Likewise, the study by MacLeod & Veen (2019), "scaffolding interdisciplinary project-based learning: a case study", discussed the appropriate scaffolding for interdisciplinary PjBL through improved course and problem-design. Though finding captivated the attention to particular aspects of course design that can better accommodate real interdisciplinary interactions among students. Scaffolding does not offer clear and fixed strategies about the methods that should be used to attain successful instruction (Hammond 2002). In fact, it arises as an umbrella term for any sort of teacher assistance (Jacobs 2001). Ungaretti et al. (2015) illustrated that project-based learning is a learner-centred approach where students were given realistic problems to solve and acquire the project product. Rooij (2008) investigated the effects of online scaffolding through project-based learning among intra-team interaction that can facilitates positive project outcomes in the discipline of project body management.

There were several studies carried out on scaffolding and PjBL and both became the trends of the 21st century and are widely practiced in a classroom context. These studies focused on the success, failures and outcomes of scaffolding in a PjBL. Crismond (2011), in his paper, "scaffolding strategies for integrating engineering design and scientific inquiry in PjBL environments" explored, the challenges and controversies of using design task in PjBL environment and find its unique capabilities while using such approaches in K-16 classroom. Thomas (2000); Seet & Quek (2010) illustrate project-based learning as student-centred that engages the learners in active interactive learning.

In so far this research highlighted the behaviour and perception of students during performing the project and it disclosed how the learners acted during the process of scaffolding. The study by Jamaluddin et al. (2018), focused on scaffolding through PjBL in the change of student achievement. Further, the quasi-experimental design was employed with the pre-test and post-test. The sample of this study was 40 respondents from 4 pupils of private schools in the state of Selangor, representing 20 respondents of treatment group and 20 respondents of the control groups. The findings showed that there is significant difference between the mean score of the treatment group and the control group Jamaluddin et al. (2018). As far as current research is concerned, it focused not on the outcomes but on how student perceived scaffolding in PjBL and how it has impacted the learners' creative and critical thinking.

2. Research Objectives, Questions, and Hypotheses

The objectives of this research are:

(a). To ascertain the effects of scaffolding on project-based learning of undergraduate students;

(b). To investigate the perception of students towards teachers' scaffolding during performing the project. While the research questions are (a). What are the effects of scaffolding on project-based learning on undergraduate students? (b). What are the perceptions of students towards teachers' scaffolding during performing the project? And the hypotheses are (a). Ha1: There is significant relationship between the mean score of treatment group and control group; (b). H02: There is no significant relationship between teachers' scaffolding and the development of students critical thinking skills.

3. Literature Review

Previously, there were many studies on project-based learning that focused on benefits, challenges, students' perceptions and its implementation in a classroom context. The study conducted by Sultan & Javaid in 2018 put light on students' perceptions, benefits and challenges of project-based learning during its implementation. Another study led by Paruntu, et al. (2018) describes learners' curiosity and usefulness of the project-based learning model with scaffolding in enhancing mathematical communication skills. Repko, et al. (2017) described, project-based learning engages student teams in a reasonable and complex task which leads them to find the solution through data collection, inferences and investigation. Thus, students polish their professional skills while applying and integrating such notions and procedures.

Verenikina (2003), in his study examined the methods by that scaffolding has been understood, explained, and applied in educational research. The scaffolding instructing procedure assist individual based on their zone of proximal development ZPD (Chang, et al., 2002). Vygotsky (1978), argued that the ZPD plays a crucial function in the learning process, and considered as the gap between the actual development level and the potential development level which is regulate by problematic task with the support of more competent mates. There is only possible way of developing potential levels in language development within ZPD is through scaffolding (Troike 2006). Hence, the foremost purpose of using the scaffolding method is to make the learner an autonomous and problem solver (Hartman, 2002).

Furthermore, the study problematizing project-based learning by scaffolding problem-based learning investigated the curricular design principles that deepen the "problem-ness" in PjBL and elucidates a scaffolding approach to transit to problem-based PjBL (Pang 2017). Ngalimun, (2015) postulated throughout project-based learning, students determine the skills such as how to plan, organize, collaborate, gather the data and present the project and realize who is accountable for each task.

Additionally, Land & Saul (2003) explored that the usage of technology as an external scaffold in the project- based learning that assist the learners to construct scientific explanations. Further, the primary purpose of the research was to comprehend how learners increasingly enhance explanations in the open-ended project-based learning milieu (Land & Saul 2003). Land & Greene (2000) examined what are the techniques used by learners in a project-based environment to

discover, regulate and integrate information resources. Participants were asked to create projects to incorporate the internet into the curriculum. The participants of the study were nine undergraduate pre-service teachers. The tools that were used for data collection are; Think aloud protocols, observational method, and student-generated documentation.

Project-based learning strategy is a constructivist teaching and learning strategy and past researchers seen PjBL as the best and the right platform for cultivating students' high-order cognitive skills aside from encouraging meaningful learning (Kizkapan & Bektas, 2017). Gibbes & Carson (2014) asserted that the crucial features of PjBL are believed to be team work, negotiation and interdisciplinary. It generates communication and collaboration skills, management and accordingly assists the learners to develop required professional skills, attitude and system. The study "Good practice: scaffold, collaborative project-based learning" by Jones (2018), occurred in a U.S. based business school, in an honours section of a core business curriculum course called business information systems. The study presented the findings from the project-based learning implementation with the second-year honours students at a business school, collaborative project-based learning may be applied within any course offered by any college or program, regardless of course level, disciplinary focus, or class size (Jones,2018).

According to Marhaeni (2012), the concept of scaffolding is giving a temporary support or assistance given by the teacher to the learners at the beginning of learning and then it is slowly reduced when the students are able to do the task independently and make them to grow alone. The support that is given to the learners, such as guidance, reminder, encouragement, analyses the problems at the steps of solution, and giving example. Olson & Prat (2000) defined, in scaffolding teaching strategy learner integrate their background knowledge in order to internalize new information, where more knowledgeable other (teacher, parent, peer) plays an integral role in the learners' development. Hammond & Gibbons (2001) stated scaffolding as temporary assistance in the classroom context where teachers facilitate their students to accomplish a task or develop new understandings. Hence, in future, they will be able to acquire the same task independently or without teachers' aid. Similarly, Janson, et al. (2020) described scaffolding technique as the provisional assistance that make the learner self-assured and knowledgeable to acquire skills.

Scaffolding is provided to help students in building their understanding of new knowledge and processes (Stone, 2004). Pokharel (2021), examined whether scaffolding and project-based approach are incorporated to provide students with project management skills by using general learning model. Regarding data collection, the survey method has been used and data analysed through statistical analysis. Therefore, it concentrated on the objects that are used by the learners and the teachers for active learning and certainly focused on the improvement of a unique learning model.

This study has explored the effects of scaffolding and students' behaviour during project and whether the findings supports or opposes the above given hypothesis. Nearly, many studies examined how scaffolds impact students' achievement levels and performance in project-based learning. However, the current research has investigated how ESL students behave towards scaffolding during project-based learning.

4. Research Methodology

This research has adopted the mixed-method to study the research problem. Kumar (2019), asserts in mixed methods two or more methods have been used to explore the research problem and it utilizes the strengths of both type of research methods including qualitative and quantitative. Thus, using mixed methods provide better understanding of the research problem. Moreover, under mixed method an explanatory sequential research design has been used to study the research problem. According to Creswell & Clark (2011), an explanatory sequential mixed methods design is also called a two-phase model. In the first phase quantitative data collection provide a general picture of the research problem and then qualitative data further describe and clarify the general picture (Creswell,2012).

Paruntu et al. (2018) in their research "Analysis of mathematical communication ability and curiosity through project-based learning models with scaffolding" used mixed methods of sequential explanatory type and data collection tools were observations, questionnaire, tests and interviews. Further, the subject of the research was the students of VIIA class of state junior high school. Data were analysed by descriptive analysis and statistical test of the comparison and regression effect test. Determination of research subjects using purposive sampling technique. The research has taken one sample class as an experiment class. Furthermore, the experimental class is given a questionnaire of curiosity, project-based learning treatment and given a test of mathematical communication ability. Similarly, Rooij (2008) used both qualitative and quantitative method and employed the quasi- experimental study design.

Sultan & Javaid (2018) used the qualitative research to get a deeper understanding the views of participant. Data collection tools were reflective accounts and drawing used by researchers and then the data were content analysed. On the other hand, Jufriadi et al., (2018) use interviews, questionnaire and the cognitive test as data collection tool. Questionnaire and interviews were conducted on students and teachers. While the cognitive test which describes students' mastery of the concepts is obtained from students' use of E-scaffolding and E-assessment.

In the current study, the sample was BS- English part III students both male and female of around 20-23 age were assigned a project which is related to their English language teaching ELT course. Accordingly, this study has employed purposive sampling for determination of research subjects. Pandey, (2015) asserted that the purposive sampling is identified as the demonstration of the population as a whole, or it is recognized that it will construct well identical groups. This sampling is applicable when the study values the control of certain specific variables. The total number of participants was 72 of which six groups were formed and each group was consisting of twelve members. The researcher after forming the groups was provided the material about the project and the data collection process commenced from here. In this connection, the material concerning to the selected ELT method e.g., grammar translation method, direct approach etc. has given to each group and they were asked to discuss the origin, advantages and disadvantages and diagnose the given language teaching method critically. In addition, out of six three groups were taken as treatment group and three groups were taken as control group to gauge the learners' behaviour

towards scaffolding. In the treatment group, researcher played the role of scaffolding and guiding students regarding project. On the other hand, in the control group, there was no interference of the teacher or any other more knowledgeable student to assist the group to clear the task. They worked independently without anyone's support and solve problems with communication and collaboration. It is noteworthy that students were allowed to use an internet during the project. The duration of the project was only four classes that lasted for four days consecutively and the time duration of each class was one hour.

The tools that have used to collect the data were the close-ended questionnaire, and reflection accounts. A questionnaire tool has used to gain the students' perception and experience regarding scaffolding and project work. This tool is highly effective for measuring the attitude and behaviour of the subject about certain notions. It is easily approachable in this study to gather information about how many respondents have particular thoughts on teacher's scaffolding. The questionnaires collect survey data, provide arranged and often statistical information, can be conducted without the occurrence of the investigator, and are frequently easy to analyse (Wilson and Mclean 1994). For data collection purpose seven items of questionnaire were developed on theoretical basis from the perspective of the study of Sultan and Sameera (2018). Further, eleven items were adapted and adopted from the study of Rooij, (2009) "Scaffolding project-based learning with project management body of knowledge". These items have contributed the data about learners' critical thinking, autonomy, discipline, team work, creative skills, problem-solving, communication and collaboration and understanding of the subject matter and their behaviour towards scaffolding during project work.

Further, the reflection accounts were used as a supportive tool to confirm the students' perception regarding scaffolding in the project work. Farrell, (2007,2015), indicated that reflective practice is now an important part language teacher education and development programs. This research tool is mainly used by language teacher to critically analyse the methods and principles that are the part of classroom. With the help of such reflection, they will be able to improve their teaching methodology. In same context Bliss et al. (1983) suggest that "expressiveness" and "persuasiveness" are characteristics that concluded the individual account of participants as it does not have confined boundaries regarding reflecting the perceptions. Thus, the participants had to give an unrestricted comment on a few rigorous planned prompts on PjBL (Secord & Peevers, 1974). In this research, the students have analysed themselves and wrote the review and experience of each day of the project work. Two open-ended questions were given to them as their homework to reflect on themselves. The questions were about sharing their experience and how they evaluated teacher's scaffolding during project work. Additionally, questions of accounts were given to them as homework because when students reflect on themselves they must be in their comfort zone and critically analyse themselves. The purpose of the researcher was to get pure data which was not affected by other classmates' thoughts and outside factors.

As far as the close-ended questionnaire is concerned, five-point Likert scale has used to know the students' responses. Statistical package for social sciences (IBM SPSS Statistics version 23) software has been used to analyse the quantitative data. The data were analysed through a t-test

in which an independent samples't-test was conducted to compare the responses of the control group and as well as treatment group. Content analysis has used to analyse the reflection accounts. Bryman (2018) defined content analysis is the method of analysing documents and texts that measure the content in to the predefined and organized categories and as well as in reproducible manner. Therefore, written accounts were critically analysed to identify the distinct behaviour and perceptions of students through coding.

5. Findings

The findings of close-ended questionnaire were described through tables and pie charts to show the students responses thoroughly. Whereas, both open-ended questions of reflection accounts were interpreted which include the benefits and challenges of PjBL and scaffolding.

5.1. Questionnaire Findings

Table no:1 Independent Sample T-Test

Group Statistics

	GROUPS	N	Mean	Std. Deviation	Std. Error Mean
	Treatment group	11	88.09	27.977	8.435
	Control group	11	88.18	24.819	7.483

The above table no:1 shows the analysis of t-test for the mean score between treatment group and control group. The findings indicate that there is significant relationship between mean score of treatment group M= 88.09 and control group M=88.18. Hence, the hypothesis 1 is accepted and it proves that both groups have similar perception of the teachers' assistance in the group work. Accordingly, the responses of the treatment and control group concluded that teachers' scaffolds are practicable even in project work and they have positive attitude towards scaffolding. Moreover, frequency analysis and pie charts were also used to distinguish the responses about certain items which are deemed to be the aim of the current research findings which are the following.

Control group table no:2

Do you think that guidance of the teacher during project is practicable?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	16	44.4	44.4	44.4
	Strongly agree	20	55.6	55.6	100.0

	Total	36	100.0	100.0	

The above tables showed the responses of control and treatment group regarding their perception on teachers' scaffolding in PjBL. The table no: 2 shows that none of the respondents in the control group disagreed on above statement i.e. teachers' scaffolding is whether practicable or not in group work.

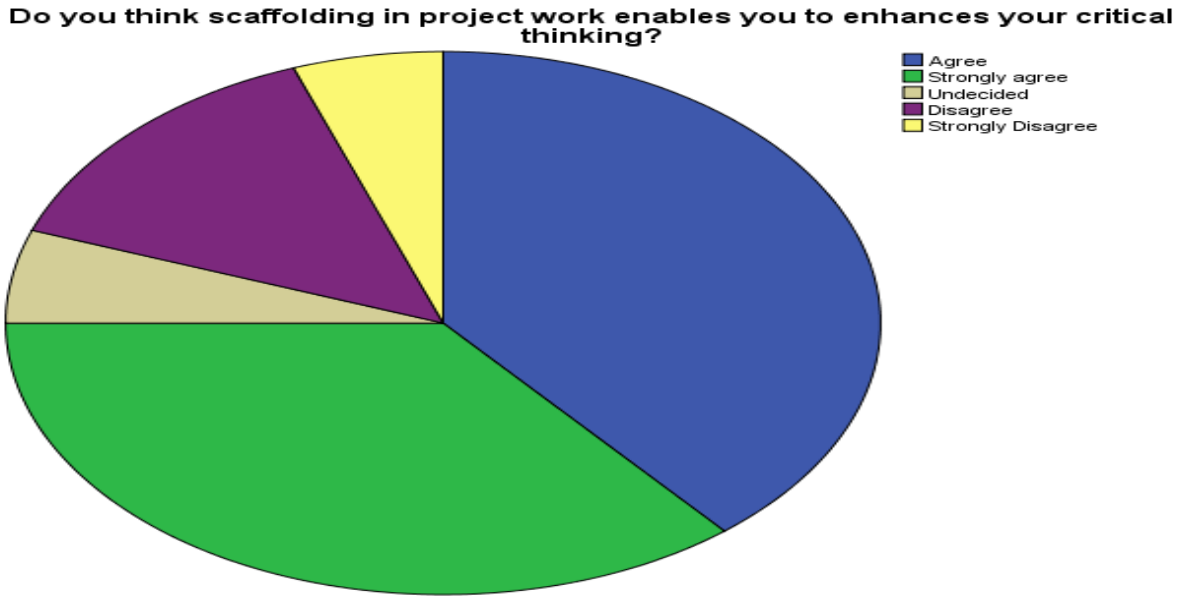
Table 3 Treatment group.

Do you think that guidance of the teacher during project is practicable?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	24	64.9	64.9	64.9
	Strongly agree	11	29.7	29.7	94.6
	Disagree	1	2.7	2.7	97.3
	Total	37	100.0	100.0	

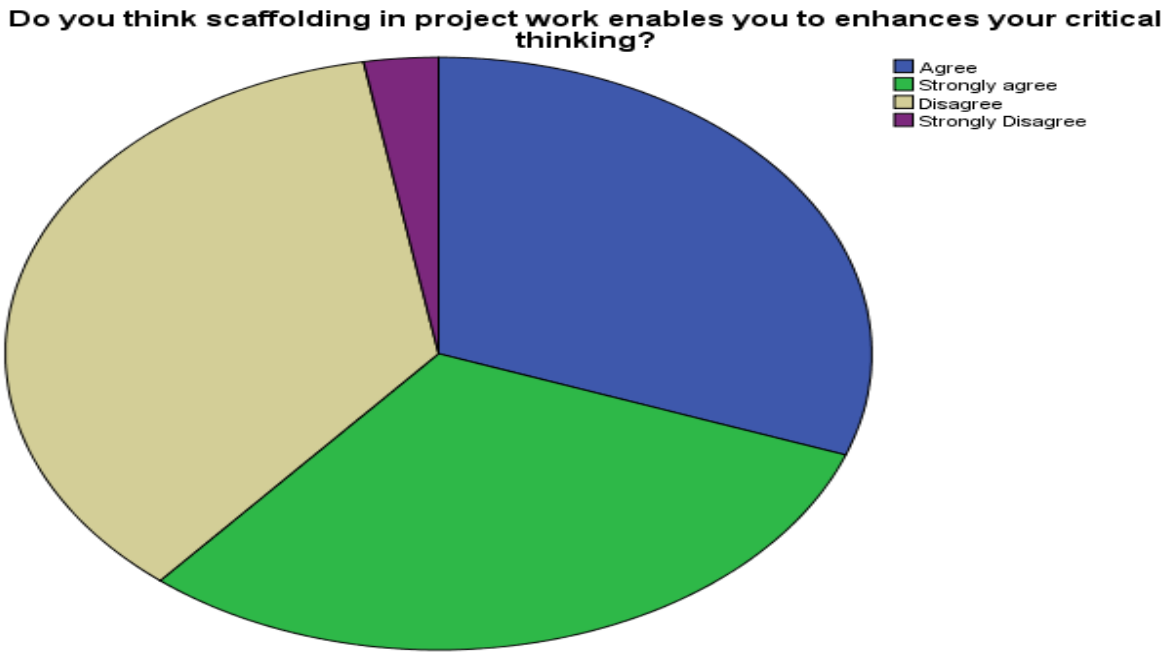
On the other hand, table no: 3 shows that except one respondent, none of the respondents in the treatment groups disagreed on practicability of teachers' scaffolding in PjBL.

Control group pie chart no: 1



Pie charts no:2 are used to show that the hypothesis no:2 has been rejected according to the responses that students can develop their critical thinking skills effectively by providing teachers' scaffolding in group work. In pie chart no:1 green and blue colours refer to the respondents' agreement in which 75% respondents in control group agreed that teachers' scaffolding in project work enables the students to enhance their critical thinking skills effectively. 18% respondents were disagreed whereas, 7% were undecided regarding above statement.

Treatment group pie charts no :2.



In the above pie chart no: 2, 60% respondents in treatment group agreed that students can develop their critical thinking skills effectively during project works instead of providing teachers' scaffolding. However, only 40% respondents were disagreed on the above statement. Therefore, scaffolding is not a barrier to critical thinking skills in PjBL. The questionnaire data indicated that the interference of teachers is significant in PjBL where learners can polish their various skills such as language, professional, creative and critical thinking skills.

5.2. Reflection Account Findings

Out of 76 respondents, 50 were chosen through purposive sampling to provide the reflection accounts, from them 36 respondents returned back the reflections in which two questions were given to them in order to know further about their understanding and behaviour towards scaffolding. Some of the respondents declined in writing, the reflection accounts. On inquiring the reasons of not submitting the reflection accounts, the responses were the language barrier or they did not take project work seriously.

5.2.1. Analysis of Reflection Account Questions

1. Mention whether the teacher's interference during the project was helpful.

In response to the above statement, in total, out of 50 respondents, 36 wrote their perceptions. The majority of the 30 students were satisfied with the teacher's scaffold in project work and considered scaffolding very helpful even in group work.

5.2.2 Benefits of teacher's scaffolding

The respondents mentioned dissimilar benefits which are as follows:

- the teacher is necessary because he/she controls or manages the group activities.
- without teachers' assistance students cannot be able to attain the goals successfully.
- teacher instructs the students towards the right direction, explains the topic and clears the doubts.
- students need some proficient assistance or guidance, it gives both physical and mental aid.
- when teacher observed students' activities they feel more responsible about the completion of target.
- the teacher plays a major role in implementation of PjBL.
- teacher controls the group members which is very difficult to handle.
- teacher maintains discipline and motivate the students.
- teacher enhances communication and collaboration, those who were not active during classroom lectures become active, and increases confidence.

However, the 6 students believed that teacher interference is quite disturbing because they were hesitant to share their ideas to the teacher as compared to other group members. The teacher only interferes when they got stuck somewhere and did not get some concepts. In the light of students' perspective, it is concluded that, the teachers' scaffolding is significant in groups and they have optimistic attitudes toward teacher guidance. Teachers' scaffolding enhances critical thinking and helped the students to understand the concepts and project work properly.

2. Write briefly about your experience in group work

In above statement, 28 out of 36 respondents asserted that group work was an interesting and productive activity. In contradiction, 05 students examined project work as not very useful in

grasping the concepts thoroughly. Only 02 respondents formulated that PjBL is as a time-wasting activity and only 01 respondent expressed that group work was not an informative activity. They jotted down the both benefits and challenges they came across during the project work.

5.2.3. Benefits of project-based learning

According to the respondents, firstly, PjBL develops their confidence as a part of a group where they felt more comfortable and did not feel any kind of reluctance during the interaction. Secondly, most of the students came across certain notions that they didn't infer during classroom lectures but possibly they learnt through communication and collaboration which is reflected to be another major benefit of PjBL. Thirdly, it enhances various skills such as reading, listening, and speaking, increases the understanding of subject matter, motivation, negotiation and building self-confidence. Out of 36 respondents 25 demonstrated that boosting confidence in a Pakistani classroom context is the primary issue. Many students were not being able to share their ideas and ask questions from teachers because of fear of judgement and the language barrier mostly in SLA classrooms. As regards, building of confidence, the PjBL is a favourable task for less confident students. Lastly, 11 respondents mentioned that those who rarely participated in class activities participated in the project.

5.2.4 Challenges

During the project, the participant realized the importance of teachers, according to them without teacher's assistance it was hard for them to imagine the culmination of the project effectively. Solely students cannot accomplish the task effectively, thus, teachers' support was mandatory. Further, they ushered that, it was worthy to pay heed to other students' understanding of the ELT method but some students did not seem more interested in the project work and sharing their understanding of the topic. Considering individual differences, learners had different attitudes, intelligence, learning styles, and personality traits (introvert & extrovert) towards their learning. Few students yearned to work alone, who were not much involved and exposed to discussions and activities effectively that made group work impractical and inefficient. Though, maintaining discipline was a tremendous challenge for students because some students talked to each other during important discussions. They did not know what to do and failed to get the concepts and instructions. Hence, PjBL was a very interactive and productive activity, where in a short period of time students got substantial knowledge through cooperation. Even so, they figured out the significance of teachers after confronting challenges during the project work.

6. Discussion

The findings of the current study point out that students have favorable attitudes and perceptions respecting the experience of PjBL and teachers' scaffolding. Students experienced numerous advantages of scaffolding and faced challenges during project work. Though, these challenges helped them to realize the importance of teachers' scaffolding and implementation of PjBL in a classroom learning context. As far as the questionnaire findings are concerned, the responses of

both control and treatment groups unveil their positive behavior towards scaffolding. Reflection accounts further provide the data on how in PjBL teachers' scaffolding is necessary.

The international study by Jamaluddin et al. (2018), came up with similar results as the present study determined that the use of scaffolding in PjBL has a positive impact on students' learning. In contradiction, Verenikina (2003) analyzed scaffolding to its relationship with the concept of the zone of proximal development, inferred that it can be an obstacle in a child's development rather than assistance depending on the context. Another study Jufriadi et al (2018) studied on E-scaffolding and whether it improves the quality of learning. The study concluded that the E-scaffolding model can improve learning quality and also develops the student's comprehension of concepts.

Furthermore, Sultan & Javaid (2018), divided the benefits of PjBL into academic and non-academic benefits. Similarly, in the current study students mentioned both benefits in reflection accounts wherein in academic benefit, learners get an understanding of the subject matter, whereas, in non-academic benefits, learners develop their soft skills such as leadership, negotiation, discipline, time management, problem-solving, confidence and creative skills.

Therefore, assessing the current study results overall students' outlook on teacher scaffolding in PjBL was positive. In addition, students believed that through scaffolding and PjBL, they comprehend such concepts they cannot be able to infer during classroom lectures. The study by Verenikina (2008), summarized the results that scaffolding is a very advantageous strategy that help teachers to direct their instruction from a traditional classroom to a more refined educational tool. To sum up, in the ESL classroom context scaffolding strategy was believed to be very effective as students found it very beneficial in PjBL.

7. Conclusion and Recommendations

This study brought out to observe the effects of scaffolding on PjBL in Pakistan. It studied how BS third-year students of the English department at university of Sindh Jamshoro acted towards scaffolding during their project work. The mixed research methods have been used and data was collected through questionnaires and reflection accounts. The students were asked to discuss the ELT method critically in a group. After completion of the project, the questionnaire was given to them and then students were asked to write reflection accounts. The questionnaire data were analyzed through SPSS and reflection account data were analyzed through content analyzed. Hence, the data showed that students have favorable attitudes towards scaffolding and it has a positive impact on students' behavior.

It is recommended that the process during project work is equally important as the outcomes of the project. During the project, the focus is made only on outcomes whereas it is also crucial to see that students process various skills such as developing language and soft skills is also significant in PjBL. Thus, when scaffolding is provided, the teacher should be vigilant about the activities of students and their participation in a group work. Hence, it is recommended for further study that the students should be assessed on both levels on how they process during project work and what are the outcomes of the project-based learning after providing the teacher's scaffolding.

It will give a clearer picture of students' performance, behavior and perceptions regarding scaffolding. It is also recommended that students should be engaged in another activity besides PjBL to identify the impacts of scaffoldings that must be studied for a deeper understanding.

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WhatsApp's SMS Application: A Tool for Vocabulary Learning

Sahib Khatoon[1], Muhammad Usman Thaheem[2], and Quratulain Mirza[1]

[1] Mehran University of Engineering & Technology Jamshoro, Sindh, Pakistan
[2] National University of Modern Languages Hyderabad, Sindh, Pakistan

Corresponding author's email: sahib.khatoon@faculty.muet.edu.pk

Abstract
Since this world is progressing and the new generation is increasingly adopting mobile phones in their everyday lives, thus, WhatsApp media and other mobile applications are increasingly being used at educational institutions all around the world. Therefore, the current study investigated the WhatsApp SMS application's use in the vocabulary learning in the engineering university, Sindh, Pakistan. The study used a mixed-mode quasi-experimental pre-test post-test research design, in which students' vocabulary ability was assessed before they participated in WhatsApp classes and subsequently through post-test after the experiment. Moreover, students' experiences were also documented through the analysis of SMS messages they posted on a WhatsApp group (during experiment). The quantitative data was analyzed by conducting independent-samples t-test on SPSS and the findings of the study revealed that WhatsApp's SMS application usage posited a significant difference in the enhancement of vocabulary of the experimental group of students. Moreover, students' postings (SMSs) on WhatsApp group were analysed qualitatively following the thematic analysis. The qualitative analysis also revealed positive experiences of students concerning WhatsApp's SMS application in learning vocabulary. The current study reveals the benefits of WhatsApp's SMS application on tertiary students worldwide, as well as instructors, syllabus designers who develop courses for tertiary students, and policymakers who make educational policies, by instilling technology-enabled social media tools (specifically WhatsApp) in the ESL classroom context both nationally and internationally.

Keywords: *WhatsApp, vocabulary, engineering students, SMS messages.*

1. Introduction

Pakistan is still considered a developing country. It has a poor literacy rate and ranks low on the list of literate countries, moreover, in rural regions, the situation is considerably worse (Bhatti, 2016). English is the only foreign language in Pakistan that is required to be taught to students as a compulsory subject from primary school through graduation. It is the language of Pakistan's educated and privileged classes, and it is necessary to speak English to acquire a respectable job in the country (Bilal & Azhar, 2021). Moreover, integration of technology is even more complicated in Pakistani educational institutions, due to many reasons such as lack of resources,

lack of training, and so on. Nevertheless, the higher education commission of Pakistan is emphasizing to promote technology integration at the tertiary level of education (universities).

Although, integrating technology and using technological tools in educational institutions is yet in infancy; it is the trend, and of the time nowadays in Pakistan (Farhat & Dzakiria, 2017). But, teachers and students incorporate a range of technology gadgets and social media sites to teach and study English in today's digital world globally (Khatoon et al., 2020). Since, the integration of various sophisticated gadgets and equipment, new paths for instructors and students have opened in which technology-based techniques and methods are being used to help minimize time and location constraints, allowing learners to study whenever and wherever they want (Islam & Hasan, 2020). Following the trend and need of the time, Khan (2009) performed research at Pakistan's Virtual University, which provides degree programs online. Students who took online classes had their perspectives about internet access, motivation, contentment, and they expressed their experiences with online learning. The study findings revealed positive effects of online programs. Similarly, the mobile devices are much used by practitioners and students in the teaching-learning environment because it has fostered practical effects on students' learning language in ESL/EFL context (Moreira et al., 2016). Accordingly, this new transformation in teaching and learning English methods and approaches have propagated the trend of E-learning and Mobile-Assisted Language Learning (Islam & Hasan, 2020). Moreover, the students, researchers, and teachers are in favour of these gadgets, devices used in the classroom for teaching and learning due to their resourcefulness, and flexibility and they provide opportunities for studying everywhere and at any time (Moreira et al., 2016).

Different social media platforms, such as Facebook Messenger and WhatsApp, offer messaging services. WhatsApp is a freeware, registered, cross-medium, and end-to-end encrypted MIM application for mobile phones with multimedia, group chat, and limitless messaging features (Kartal, 2019). According to Dehghan et al. (2017) on messaging services WhatsApp social network is growing fast among all other messaging services among all social networks. WhatsApp is a commonly widespread application on everyone's phone. It can be used on phones, laptops, and tablets also. The prime objective of WhatsApp was to offer instant message service at no cost with a connection to the internet. Those short messages "SMS" become the trend of the trade extensively. In addition, under Mobile-Assisted Language Learning, practitioners and students commonly employ mobile instant messaging (MIM) services in teaching and learning in ESL/EFL settings (Moreira et al., 2016). Moreover, social networking sites have evolved promising new ways to improve second-language specifically, vocabulary acquisition (Bensalem, 2018).

Vocabulary acquisition is a key element of language learning and one of the most essential aspects of second language acquisition (Knight 1994; Laufer 1992; Nation 2001; Yoshi & Falitz 2002). Since mastering vocabulary is one of the most essential aspects of learning a new language; it is a key component in improving students' language skills, particularly their reading comprehension (Fard & Vakili, 2018). Thus, vocabulary teaching through WhatsApp is very much possible. Since vocabulary learning through different social media tools is not a new idea whereas, vocabulary learning through WhatsApp' SMS application is in scarcity, thus, there should be studies on it. As

Knight (1994) stated, vocabulary learning is the fundamental aspect of learning a second language. In addition, WhatsApp is found an influential educational instrument to boost second language communication and it has an incredible potential to trigger students' participation which is one of the minimum exploited functionalities of mobile phones, and it encourages students' dynamic participation (Panah & Babar, 2020).

Linguists and academics in the early twentieth century focused on gender disparities in human language learning and investigated gender differences in vocabulary, communication, and grammar (Bhatti & Mukhtar, 2020). According to Khatoon et al. (2020), Pakistan has had a gender disparity in every sphere of life since, with the engineering industry being the most male-dominated, with women outnumbering males. Differences can be seen between engineering fields as well. For example, civil engineering is a predominantly male-dominated discipline, but software engineering has a sizable female student population. Gender differences breed other differences, such as behavioural and attitude differences. Thus, the current study is focusing on gender also in terms of finding out the differences (if any) in the enhancement of vocabulary performance after learning in the WhatsApp application context.

2. Literature Review

2.1 Vocabulary Learning in ESL context

Listening, speaking, reading, and writing are the four essential skills needed to master a language. Listening and speaking skills are usually the first to be grasped, followed by reading and writing skills. Furthermore, language learners must have a sufficient vocabulary to acquire these language skills. Simultaneously, no one can deal with or communicate without words in any language competence, according to Hunt and Belglar (2005), claim that "*words are the core of language understanding and use is a part of the lexicon"* (p. 2). Therefore, acquiring vocabulary is an important part of learning a language (Mahdi, 2018). Likewise, Wilkins (1972) stated that without grammar, very little can be communicated, and without vocabulary, nothing can be communicated at all.

The importance of vocabulary in the language acquisition process cannot be overstated. And this is only possible if the learners are taught using specific effective approaches for vocabulary instruction in particular and language acquisition in general (Raheem et al., 2021). Furthermore, vocabulary plays an important part in the development of a student's language competency in all linguistic skills, and there is no doubt in, ESL students who have a larger vocabulary will find it easier to improve their language skills (Yaacob et al., 2019). In second language acquisition research, the efficiency of vocabulary learning techniques has been extensively researched (e.g., Nakata, 2017; Nation, 2015; Webb & Chang, 2015). In the second part of the twentieth century, students were instructed to focus on implicit and accidental vocabulary acquisition. This meant that they were expected to provide them with techniques for recognizing vocabulary-related hints in a particular context—in this example, a textual context (Raheem et al., 2021). A substantial amount of recent research has focused on how computer-assisted language learning (CALL) and

mobile-assisted language learning (MALL) may help L2 learners in both EFL and ESL contexts improve their vocabulary knowledge (Yang et al., 2021).

2.2 Technology-based vocabulary learning in the ESL context

Technology has advanced tremendously, and its function in language acquisition has become increasingly important. These technologies may be utilized for language teaching and learning in a variety of ways is well-documented in the literature. The use of these technologies in foreign language learning and teaching has received a lot of attention recently, and several studies have investigated their possibilities in language learning contexts (Kartal, 2019). In both English as a Second Language (ESL) and English as a Foreign Language (EFL) settings, vocabulary acquisition is essential for second language (L2) learners (Yang et al., 2021).

Researchers and professionals in ESL have been investigating the modalities of vocabulary growth, both in conventional and digital learning, as a result of studies in vocabulary acquisition and learning in second language environments (Asllani & Paçarizi, 2021). In this vein, a study explored the acquisition of second language vocabulary through contact with two types of internet media: written blog posts and video blogs. It also investigated if there were any differences in which parts of vocabulary knowledge (orthography, semantics, and grammatical function) were best learned through these different mediums. The findings revealed that reading blog posts and viewing video blogs resulted in almost comparable amounts of accidental vocabulary development. There were some shreds of evidence that the two forms of media provided distinct types of vocabulary knowledge. Written blog articles resulted in more orthographic knowledge increases than movies. There was also some indication that the films helped people remember the grammatical functions of the target words as well as recognize and recall their meanings (Arndt & Woore, 2018).

Besides, the study was conducted in an Iranian university to see how Telegram stickers affected EFL learners' vocabulary development. The convenience sample technique was used to choose 60 Iranian intermediate EFL students (30 males and 30 females) from the Islamic Azad University, Shahreza Branch, who were enrolled in the second semester of the academic year 2016-2017. They were then divided into experimental and control groups at random. The learners' vocabulary knowledge was then assessed using a pre-test in both groups. The experimental group got their lectures via Telegram, whilst the control group was taught via traditional methods. The participants in both groups were then given an authorized post-test to see how far they had progressed. The findings suggested that teaching vocabulary using Telegram stickers might provide significant benefits to students. Overall, social networking aided the learning of new vocabulary items among Iranian EFL students. The findings have important consequences for language learners, instructors, and content creators (Ghobadi & Taki, 2018).

The study was conducted to use a mobile phone to look up the definition of a word in comparison to the traditional method of employing a printed dictionary. A vocabulary pre-test and post-test were carried out to determine the efficacy of utilizing compared to printed materials, cell phone technology is the more advanced dictionary. The findings of the experiment demonstrate that using

mobile phones improve students' knowledge of learning and understanding the meaning of words. When compared to a printed dictionary, the vocabulary got richer (Govindasamy et al., 2019).
Moreover, a meta-analysis was done on research that examined the effects of students learning vocabulary using mobile devices with traditional methods of learning. The influence of utilizing mobile devices on vocabulary learning was investigated in this meta-analysis, which looked at 16 research with a total of 986 participants. In comparison to traditional methods, using mobile devices to acquire vocabulary was related to higher success ways. The results of the meta-analysis show that utilizing mobile devices has a moderate influence on vocabulary learning (Mahdi, 2018).
Besides, the study was conducted with grade III students studying in various English medium institutes in Lahore Pakistan. The study aimed to explore how mobile assisted language learning (MALL) affects the vocabulary of young ESL students. The quantitative research strategy was used to achieve the present investigation's aims because the data was numerical. The results indicated a significant difference in performance between the experimental and control groups. The findings indicated that MALL may be used to transform vocabulary instruction in Pakistani ESL classrooms (Ali, Bashir etal., 2020).

2.3 WhatsApp instruction in learning vocabulary in the ESL context

Numerous social media sites have become the platform for interaction and integration of information, where people communicate with each other for sharing their thoughts, and information (Monica et al., 2014). Besides, numerous social media sites i.e. Facebook, Twitter, LinkedIn, Telegram, and WhatsApp, are persistently used by teachers and instructors in educational setups and all these social sites have a variety of functions and traits which make them different from others and they become apt for different purposes in educational contexts according to their suitability in the learning context (Alghazo & Nash, 2017). WhatsApp has surpassed other social media applications as the most widely used social networking application on mobile phones and desktops for university students, especially when it comes to language learning (Alqahtani, 2018; Yeboah et al. 2014). WhatsApp assists teachers in saving time, better managing the classroom, and keeping students informed about classroom activities (Awada, 2016). WhatsApp has become a strong instrument in L2 development in the realm of Second language learning (Andújar-Vaca & Cruz-Martínez, 2017).
Moreover, the WhatsApp application has numerous proficiencies including sending and receiving text messages, images, audio, and video files, and links. Precisely, the WhatsApp application is a social network site that people are using for communication rapidly. It has multiple features which offer ease to its user such as one can create the group as a platform of communication that can easily be used for different purposes. Thus, such interconnecting features make this device suitable device for educational purposes (Dehghan et al., 2017).
WhatsApp has been utilized in educational settings, such as language learning, and studies have shown that WhatsApp has a good influence on language acquisition (Kartal, 2019). Although WhatsApp is the latest invention, there is limited study on its efficacy in second language education in general, and in teaching and acquiring language skills or material, in particular, are found

(Dehghan et al., 2017). In this vein, a study was conducted, the purpose of this study was to look at the impact of WhatsApp in improving vocabulary acquisition among Iranian junior high school EFL students. There was a pre-test and a post-test. Four English groups were instructed, with the experimental group receiving vocabulary teachings through WhatsApp four days a week for four weeks, while the control group was taught textbook vocabularies within the classroom by a teacher. The findings indicated that WhatsApp had a major impact on students' vocabulary development (Jafari & Chalak, 2016).

Similarly, research was conducted to examine if WhatsApp might be used to teach new vocabularies in a foreign language and compare the results to traditional L2 vocabulary teaching methods. A pre-test revealed that there was no significant difference between the two groups. The first group received all their new L2 vocabulary teaching through WhatsApp, while the second group received traditional face-to-face instruction in the classroom. To compare the groups, a vocabulary exam was employed. The findings revealed no significant differences between the conventional and WhatsApp groups' vocabularies performance (Dehghan et al., 2017).

Moreover, one of the studies was conducted at Adiban English language institute, Baghmalek, Khuzestan, Iran. The researcher used the WhatsApp application for teaching ESL vocabulary to the experimental group whereas, the control group was taught in their conventional class. The pre-test and post-test were conducted to gauge the students' vocabulary performance. The post-tests of the experimental and control groups showed a significant difference, according to the findings of paired samples and independent samples t-tests. In the post-test, the experimental group outperformed the control group by a considerable margin (Fard & Vakili, 2018).

The study was conducted to compare the improvement of academic vocabulary knowledge of EFL students using WhatsApp to traditional vocabulary instruction at a public university in the Arabian Gulf area. It also attempts to find out how students feel about using WhatsApp to acquire language. The study included 40 Arab EFL students at the primary level who were enrolled. The findings revealed, that the WhatsApp group considerably outperformed the traditional group (Bensalem, 2018).

Besides, a comparative study was conducted to evaluate the impact of Facebook and WhatsApp on English vocabulary learning performance and learners' perceptions of the implementation method. Between the pre-test and post-test, the success of the students in the Facebook, WhatsApp, and control groups revealed a significant difference, indicating that the learning environments had varied effects on student performance. According to the findings, there was a significant difference in the mean scores of the students in the WhatsApp, Facebook, and control groups, and WhatsApp was more successful in increasing success. Although the Facebook group's mean scores increased higher than the control groups, the difference was not determined to be significant. According to the overall findings, WhatsApp is more successful in teaching vocabulary than Facebook (Çetinkaya, 2018).

2.4 Gender influence in learning English in the ESL context

Gender differences exist in all the human language learning processes, thus, they cannot be ignored in language learning and research (Ahmadi-Azad, 2019). Males and females view the world in very different ways. Females see themselves as individuals functioning in a network of relationships, whereas males see themselves as individuals living in a hierarchical social society. Gender disparities have deep historical roots. In various human civilizations, men and women have distinct roles, and as a result, the shift from a matriarchal to a patriarchal culture leads to a dominant position for the male, which may or may not be beneficial (Na, 2016). Males and females use distinct forms of language because of their varied attitudes toward social groupings. As a result, among the many elements that influence the quality of student-teacher interactions in the classroom, gender must not be overlooked (Holmes & Meyerhoff, 2005). Besides, language acquisition performance in virtual learning environments can be influenced by a variety of factors. Thus, gender can be a significant element among learner factors such as age, educational credentials, technological knowledge, and gender (Lin, L. F. 2011). One of the most important criteria utilized in SLA research to discriminate between learners is gender. Pakistan is a gender-biased country where gender influences in many ways (Khatoon et al., 2020). Gender disparities in various areas of second language acquisition have been the subject of several studies (Gallego, 2001).

Such as research in a Pakistani university that looked at undergraduate English as a second language (ESL) students' English language learning beliefs, anxiety, and learning outcomes. This research collects data from undergraduate ESL students using Horwitz's Views about Language Learning Inventory (BALLI) and investigates the impact of gender on Pakistani undergraduate ESL students' English language learning beliefs. Males and females had similar views on the component Motivations and Expectations, but considerably different beliefs in the factor Nature of Language Learning, according to the findings. The other three variables had gender disparities as well, although they were statistically insignificant (Iqbal & Yongbing, 2017).

Another study explored the influence of vocabulary acquisition techniques on ESL students in Pakistan by an experimental study. This research included 100 students in Grade 9 throughout the 2019-20 school year. The data was collected via a test and a questionnaire. Students who were taught using ESL learning strategies (semantic mapping, imagery, pictures, visual and auditory, group association, and word contact) progressed better than students who were taught using conventional vocabularies. In the experimental group, female students performed better. ESL male learners prioritized social association learning, whereas ESL female learners prioritized visual and auditory learning (Bhatti & Mukhtar, 2020).

Besides, the study to see how two learner background variables, namely gender, and discipline (academic major), influence the frequency with which learners employ vocabulary acquisition strategies. A questionnaire with 93 items on vocabulary acquisition techniques was used to collect data from 79 Turkish graduate students pursuing their master's or Ph.D. studies in a range of departments at 27 Turkish institutions. The findings of the study indicated a significant difference

in frequency of VLS usage between male and female learners in favor of females, with non-significant findings between science majors and arts and humanities majors (Yilmaz, 2017).
Moreover, the influence of interventionist dynamic evaluation on vocabulary learning in Iranian EFL learners was investigated, as well as any gender disparities in this process. Two complete courses of general English at Tabriz Azad University were chosen to attain this objective. Following a homogeneity test, one of the classes in the experimental group got mediation, while the other class in the control group did not. There was no statistically significant difference between the experimental and control groups, according to data analysis. Furthermore, there was no significant difference in performance between males and girls (Ahmadi-Azad, 2019).
Similarly, the research study with the purpose to see if there was a significant difference in vocabulary learning method preferences between males and females, as well as to see if there was a link between students' vocabulary learning tactics and their vocabulary size. The students in SMAN 1 Natar's first grade (100 students) were the sample of the study. Schmitt and Clapham's (2000) questionnaire and vocabulary size test were used as instruments. The study's findings indicated a significant difference in vocabulary learning strategy preferences between male and female participants (Lestari et al., 2009).

3. Methodology

The study followed a quasi-experimental pre-test post-test mixed-mode research design; in which students' vocabulary performance was checked through two tests (pre-test and post-test) before and after studying under the WhatsApp's SMS application's context. Moreover, students' experiences were also investigated by analysing the students' SMSs that they posted on the WhatsApp group. Thus, two groups two intact (experimental and control) (n=80) undergraduate students of computer system (section A) engineering students' (male and female) were taken for the study as an (experimental group) whereas the computer system engineering students' group (section B) was selected as a (control group) for the study. Before taking WhatsApp sessions on vocabulary learning, a pre-test and after the sessions, a post-test was administered. The experimental group was taught under the SMS application of WhatsApp five days a week for six weeks. On the other hand, the control group students were taught in their conventional class.

3.1. Sample of the study

The background of the two groups (experimental and control) was the same they all were from an engineering university, first-year students whose ages ranged from 19 to 21 who were studying "Functional English" subject during their second semester of study. The two intact classes of the engineering university were randomly selected for the study as there were three sections (A, B, C) of first year English class. Table 1 is demonstrating the group's representation.

Table. 1. Demographic representation of participants

Group	Number	Age	Gender	Discipline & Section
X Group	40	19+	Male & Female	Computer System Engineering (A)
Control Group	40	19+	Male & Female	Computer System Engineering (B)

3.2. Instruments

This study administered the pre-test and post-test before and after conducting the sessions in the engineering students' class (experimental group+ control group). As the piloting of the tool is a must thus, both tests were piloted with 20 students who were not involved in the actual study thus knowing the errors and imperfect leads and choices in the tests, pilot testing helped. Cronbach's formula of reliability measure was employed to estimate the reliability of the tests which was 0.82.

3.3. Intervention

Before the commencement of the experiment, participants were informed of the study's goal. All participants took a vocabulary pre-test before receiving their first session of vocabulary test items. Both the experimental and control groups were given the same list of 240 words over six weeks, with an average of 40 words every week. The duration of the class was 40 minutes, and it was conducted thrice a week. The experimental group received word lists through WhatsApp's SMS application after the teacher created a WhatsApp chat group and each participant provided their consent. On the other hand, the control group was given printed versions of the same word lists. All the students were allowed to use the dictionary also for their help. After the sessions, the participants were given the post-test in the same manner as they were given the pre-test. The goal of the post-test was to see how much the students' vocabulary had improved. Both the pre-and post-tests were the same. The researcher had to alter the materials to prevent students from memorizing the right answers rather than answering the questions based on their knowledge.

4. Findings and Discussion

4.1. The objective of the study

To answer the first objective of the study:

- To explore if there is a significant difference in the vocabulary enhancement of experimental group participants using the WhatsApp application in the ESL context.

In the quantitative analysis Independent Samples t-test is done on SPSS to answer the above-mentioned questions. As the pre-test was conducted thus, the pre-test results of both groups (experimental and control) were computed on SPSS-26.

4.2. Quantitative Analysis

Pre-test results

Data were computed and by independent-samples t-test both groups' (experimental group and control group) pre-test scores were compared. The results are displayed in Table 2 which explain that there was no significant difference in the vocabulary pre-test mean scores of the experimental group (M=15.93, SD=1.78) and control group (M=16.30, SD=1.76); t (59) =.743, p = 0.47 found thus, both groups were homogeneous.

Table. 2. Pre-test scores of both groups (Experimental & Control)

Groups	N	Mean	SD	t	df	p
Pre-test	40	16.30	1.76	.743	59	.47
Experimental Group	40	15.93	1.78	.744		

The second objective was accomplished by computing the data to know the difference between the female and male students separately, the results are demonstrated in Table 3. Hence, an independent-samples t-test was conducted to compare male and female students' pre-test scores. Thus, the results showed that there was no significant difference found in the mean scores of boys' participants in the study (M=16.70, SD=1.62) and girls' participants (M=15.33, SD=1.54); t (27) =-.98, p = 0.34 in the vocabulary pre-test scores thus, boys and girls' students were homogeneous in the pre-test.

Table. 3. Mean scores of Pre-tests of (males &s)

Group	N	Mean	SD	t	Df	p
Female	34	16.70	1.62	.98	27	.34
Male	46	15.33	1.54	.98	26.9	.34

Post-test Results

To know the difference between the two groups after they took sessions through the WhatsApp application the data was conducted through post-test from both groups (Experimental and Control). The results were computed by carrying out the independent sample t-test to see the difference in the mean scores of the two groups (Control and Experimental).

Table. 4. Post-test scores of both groups (Experimental & Control)

Groups	N	Mean	SD	t	df	p
Control Group	40	19.23	1.99	6.16	44.78	0.00
Experimental Group	40	23.93	3.66	6.16		

To know the post-test scores difference of both groups an independent-samples t-test was conducted to analyse the difference in the scores after using WhatsApp as an application for the

enhancement of vocabulary. The results are presented in Table 4 which describes that there was a significant difference in the scores of the experimental group (M=23.93, SD=3.66) and control group (M=19.23, SD=1.99); t (58) =.6.16, p < .001/ respectively. Thus, the results are clearly showing that the WhatsApp' SMS application remained fruitful and effective in enhancing students' vocabulary.

Similarly, to answer the second objective of the study as to find out if there is a significant difference in terms of gender (males/females) vocabulary improvement in the context of the WhatsApp application in the ESL context. Students' (male and female) scores were separately computed to know the difference between both (male and female) participants' scores if any. Moreover, an independent-samples t-test was conducted.

Table. 5. Mean scores of Post-test of (males & females) Experimental group

Groups	N	Mean	SD	t	Df	p
Male	15	24.53	3.75	.89	27.94	.37
Female	25	23.33	3.59	.89	28	.37

An independent-samples t-test was conducted to compare males' and females' students' post-test mean scores. Thus, the results shown in Table 5 revealed that there was not a significant difference in the scores of boys' participants in the study (M=24.53, SD=3.75) and girls' participants (M=23.33, SD=3.59); t (28) = .89, p = 0. .37 in the vocabulary post-test scores thus, boys' and girls' students similarly performed in the vocabulary test of both groups.

4.3. Qualitative Analysis

To answer the objective of the study: "the students' experiences of learning vocabulary through the WhatsApp application" were analysed by students' chatting and postings on the WhatsApp group (created by the teacher) concerning learning on WhatsApp. Students' names are pseudo names to keep the research ethics in consideration. Their chatting snapshot is placed in the following Figure 1.

Fig 1 *WhatsApp chat on group*

Moreover, the researcher analysed those postings qualitatively by thematic analysis. According to Ivankova et al. (2006), "Qualitative data analysis entails classifying things, people, and events, as well as the qualities that define them."
The following are the themes derived from the data, as indicated in Table 6 (Themes):

Table. 6. Students' experiences concerning WhatsApp use in vocabulary learning (Themes)

Themes	Narratives/ SMSs	No of occurrence
Easy	Learning through WhatsApp is effortless and easy.	34
Objective oriented	I feel is quite a focused sort of group where we are only talking about learning and easily learning a language. It is quite a goal-oriented group.	31
Motivating	I love learning through WhatsApp, I feel motivated to learn vocabulary whenever I open WhatsApp and feel interested to open the group to learn.	44
Flexible	Isn't it quite practical we are holding phones in our hands and learning even any time anywhere with ease?	43
Exciting	Every time I attend sessions on WhatsApp my excitement increases to stay in the learning class more than before.	35
Practical	I think it's a very practical way of learning vocabulary through WhatsApp because we are not facing any problems with internet speed or laptop resources (which I do not have). It is easy to attend class on phone.	43

5. Discussion

Based on the findings mentioned in Table 2, students' pre-test means scores demonstrated there was no difference between both groups and were homogeneous and had no difference in acquiring the vocabulary performance in the pre-test before taking the treatment of WhatsApp application for learning vocabulary. Likewise, Table 4 and Table 5 are demonstrating the post-test results in which the experimental group surpassed and achieved good grades than the control group.

Moreover, the current study findings imply that the WhatsApp application is effective in teaching and learning vocabulary in the ESL context. As students of the experimental group were added to the WhatsApp group (created by the teacher). Thus, they were allowed to post their SMSs concerning their experiences of their current learning. All experiences expressed by them also revealed that students' found WhatsApp applications easy, comfortable, manageable, practical, exciting, motivating, objective-oriented, and flexible for learning ESL vocabulary. These findings demonstrated there is a significant difference in the mean scores of the two groups' post-tests results. These findings are consistent with the findings of (Bensalem, 2018; Çetinkaya, 2018; Fard & Vakili, 2018; Jafari & Chalak, 2016). All these studies showed an experimental group of these studies took the WhatsApp application's treatment for learning vocabulary in the ESL context and outperformed. The current study is in contrast with the findings of Dehghan et al. (2017), which demonstrated that there was no significant difference found after taking the treatment through the

WhatsApp application for learning vocabulary students of both groups (control and experimental) performed in post-test similarly.

Moreover, the current study revealed that vocabulary learning through the technology-integrated application (WhatsApp) is effective. Such findings are in line with (Ali et al.; Arndt & Woore, 2018; Ghobadi & Taki, 2018; Govindasamy et al., 2019; Mahdi, 2018; Yang et al., 2021). All these studies demonstrated that vocabulary learning becomes more effective when they are taught through any technology-integrated tool.

Besides, boys and girls concerning gender were also tested as demonstrated in Table 3 both gender had no difference in acquiring the vocabulary performance in the pre-test, which demonstrated no difference before taking the treatment. Likewise, when the post-test was computed it also revealed there was no significant difference found related to gender (boys' and girls') vocabulary mean scores in the post-test. These findings are in line with those (Ahmadi-Azad, 2019), which revealed there is no influence of gender students had on their language acquisition. Whereas this study's findings are in contrast with those (Bhatti & Mukhtar, 2020; Iqbal & Yongbing, 2017; Lestari et al., 2009; Yilmaz, 2017). These studies presented evidence of differences among male and female students' language learning specifically in vocabulary learning because of gender influence. Moreover, the claims (Ahmadi-Azad, 2019; Gallego, 2001; Holmes & Meyerhoff, 2005; Lin, L. F. 2011; Na, 2016) are also in contrast that gender influences students' language learning and language performance in the ESL context.

5.1. Pedagogical Implications

Information technology and social networking sites are rapidly intruding on every area of our community's social life, with obvious consequences in daily life. As a result, using WhatsApp, Facebook, and other similar social media platforms in education can be beneficial because students are already familiar with them and do not require training to use them in a learning environment. As a result, these platforms should be promoted in their educational setting. The study found that using WhatsApp as a platform for ELT teachers, English language learners, and institutions can improve vocabulary learning performance in the ESL context, and it also showed the potential outputs of using WhatsApp as a platform for ELT teachers, English language learners, and institutions.

It's a fascinating way for teachers to push their students to be more attentive and responsible. According to the present study's findings, students have more possibilities to become adept learners because of SMS posting, and therefore the concept of the authoritative class goes away. In the context of ESL, instructors are also becoming more updated and modifying their lesson plans to foster a more student-cantered setting, and the WhatsApp group has provided them with the ability to interact with peers and teachers at any time, which promotes a more student- cantered atmosphere. Instructors can create lesson plans and WhatsApp groups to enhance English language acquisition, and this atmosphere can also encourage students to study English.

6. Conclusion

In this study, researchers used WhatsApp to acquire new vocabulary items and compared the outcomes to standard vocabulary learning for ESL students. When compared to the traditional technique, the results demonstrated that utilizing the WhatsApp application greatly enhanced learners' vocabulary learning. Furthermore, for most participants, utilizing WhatsApp as a learning tool has been a positive experience since it has improved their motivation to learn vocabulary. Considering these findings, language instructors should think about utilizing the WhatsApp application to teach vocabulary and incorporating it into the classes and their lessons. Because educators may not have enough time in class to teach many vocabulary items, WhatsApp allows them to do so. It also allows them to communicate with all students via virtual communication.

7. Future Directions

Important to note that the instrument and sample utilized in the study have inherent limitations. The researchers believe that a sample drawn from any ordinary institution rather than an engineering university would have provided a more accurate image of the WhatsApp application in an ESL environment. Because engineering university students are more interested in their major engineering subjects and less interested in their compulsory or minor subjects (English), the findings can have a variety of directions and student experiences, so future researchers can conduct studies in public universities. Furthermore, the current study employed quasi-experimental research methods; additional research using different research designs is needed.

Furthermore, investigations comparing the effects of different social networking sites on educational settings should be undertaken. Although the present study focused on vocabulary acquisition with WhatsApp application courses, more research is needed to see how WhatsApp may be used to acquire other language skills including reading, writing, speaking, and listening. Educators' opinions on the usage of WhatsApp and similar apps in the classroom should be sought out, and they should be encouraged to participate. The current study focused on the tertiary educational institute further studies can be conducted in secondary schools also with the same social media application (WhatsApp) and English language skills (vocabulary learning, reading, writing, listening, speaking). More research studies can be done with or without gender differences or with other demographic variables. More comparative studies can be conducted on WhatsApp applications and any other social media sites to analyse their effect on learning the English language learning.

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Impact of Classroom Rules on the Achievement Level of Students at Secondary School Level in Peshawar

Dr. Safi Ullah[1], Bashir Muhammad[1], and Dr. Farkhunda Rasheed Choudhary[2]

[1]Department of Education, Qurtuba University of Science & Information Technology, Peshawar, Pakistan
[2]Department of Educational Planning Policy Studies & Leadership
Allama Iqbal Open University Islamabad, Pakistan
Farkhunda.rasheed@aiou.ed.pk

Corresponding author's email:safiullah.pedo@gmail.com

Abstract
Classroom rules have a direct impact on the behavior of students which eventually contribute towards academic achievement of students. The main concern of this descriptive research study was to find out the impact of classroom rules on the achievement level of students at Secondary Level in Peshawar. The population of the study comprised all secondary school teachers and 240 teachers were randomly selected. The academic achievement was obtained from 9th class results at BISE Peshawar. Data was analysis through SPSS and used one sample t-test, Pearson correlation and regression. It was found that the majority of the respondents agreed to apply classroom rules in the class. Coefficient Pearson Correlation between classroom rules (CR) and student's achievement (SA) shows a positive relationship. Regression analysis results show that independent variable contributed statistically significantly in a positive way towards student achievement. It is recommended to apply proper classroom rules so that effective classroom management can be made which eventually contributes for the better academic achievements of students.

Keywords: *Classroom Rules, Secondary School Teachers, Boys Secondary School, Average Score.*

1. Introduction

Education plays a significant role in the development and prosperity of a country and research has found its close relationship with the economic and social development of a society. It cannot be denied that the quality of education in a society depends on the quality of its educators. Teachers should possess all those characteristics that are needed for a quality teacher. Teachers as role models should represent some specific attitudes that may lead to their credibility and success in the occupation. Teachers who have these characteristics can improve students' academic achievement. (Gray, et al, 2011).

Maliki (2013) stated that the aim of education is to bring about desirable changes in students regarding their skills, knowledge, and attitudes so that they may effectively perform their changing roles in an ever changing society. Dutta, et al (2017) describes education is a process of molding the youth for a congenial and comfortable life with the goal of harmonious development of society. Educating someone or helping somebody to learn through required information is teaching. Simonsen (2008), pleaded that the teacher has produced process for organization with a few attainable issue zone. Classroom rules can be easily conveying for the effective classroom management. Sucuoglyal. (2010) stated that classroom management plays a pivotal role in the academic performance and overall development of students. A well-managed classroom is directly proportional to the performance and excellence of the teacher. It is a significant component to apply classroom rules. The primary purpose of effective classroom management is to keep the learners actively and effectively engaged in the teaching-learning process. Such are engagement means getting a learner to work with and act upon the material presented, progress through seatwork at a steady pace, participating in classroom discussion and being attentive when called upon.

There are many classroom rules; some are efficient rules which directly impact student's behavior and some classroom rules are not efficient. If the classroom rules are not properly implemented in time, the learners result will be affected. It should be the responsibility of the person that created the classroom rules to implement them in time. According to Klamer-Hoogma (2012), classroom rules to respond; a. It should provide an early break in to teach a lesson or b. Classroom rules are briefly and not probably to recur. However, there come issues in applying classroom rules when some students come into the classroom during lecture time and the teacher allow them. It is the choice of teacher to allow more flexibility in one's response, but teachers do not give permission to the learner to just come for talking. According to Barbetta (2005), classroom rules should be clear, easy and quantifiable, as well as shaped with students 'contribution. Classroom rules would be compatible with school rules. Different types of classroom rules are necessary for successful classroom management; the rules may be divided into four different categories i.e. (a). Academic work; (b). Classroom conducts; (c). First teaching day can be communicated later. School is a socialization institution for students and teachers are in the front seat to develop the students' personality and their social and academic outcomes. Modern trends in education lay the responsibility of student's intellectual and character development on schools and teachers.

Türk et al., (2019), narrated that classroom rules are usually needed on the commencement of the first day class. For classroom conduct, there are different classroom rules and they worked for the elementary grades. It is recommended that these rules may be presented orally, but in lower grade students, the rules may be in written form because their memory is less then as compare to the upper grade students. One may follow the rules in the class and students may copy them. Therefore, consideration must be given to the classroom rules for effective classroom management.

1.1 Significance and the Statement of the Problem

Classroom management is an important aspect of teaching learning process. It evolves the seating arrangement, the lesson plan, the classroom rules, rewards and punishment and actual teaching-learning process. The study encompasses all the essential ingredients of the classroom management. The study is significant for the beginner teacher as well. The adherence to the classroom rule facilitates effective classroom management which in turn leads to improve the achievement level of the students. Classroom management ensures the conducive atmosphere in the class for the better achievements level for the students. The issue has been tackled appropriately yielding some very significant findings and conclusions which may help the policy maker, the administration and the educational management to take concrete steps for the effective classroom management.

Effective Classroom Rules have always been recognized as in integral part of the teaching learning process. It entails effective classroom rules, teaching learning process and rewards and punishments. For the beginner teacher it is foremost important to master the skills to implement classroom rules for effective control. For some teachers, declaring the classroom rules on the first day brings regularity and discipline among the students. It has been observed that most of the teachers are ignorant about the classroom rules and may face difficult situation in the classroom environments. Therefore, this study aims at exploring the Impact of Classroom Rules on the Achievement Level of Students at Secondary Level in Peshawar**.** The research in hand fulfills the much needed requirements. This has taken up the issue of the classroom rules in logical and scientific manner.

Objectives of the Study and the Hypothesis of the Study

The main objective was to find out the impact of classroom rules on the achievement level of students.

Hypothesis

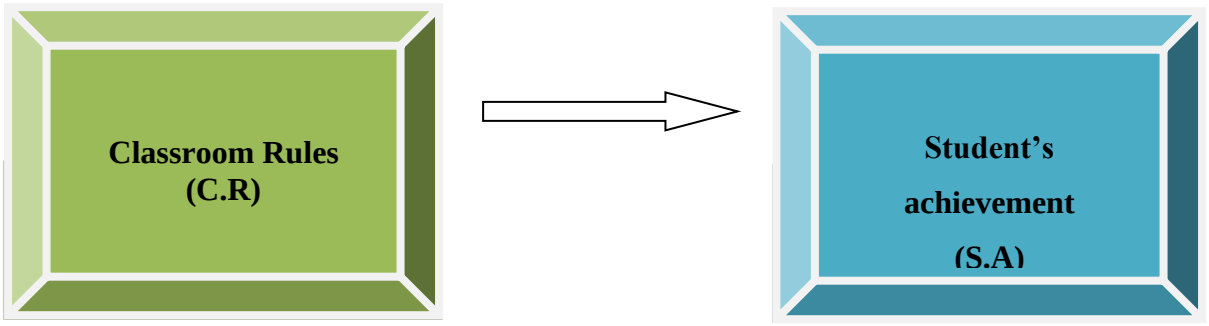
H0 There is no relationship between classroom rules and student's achievement level.

1.2 Theoretical and Conceptual Framework

In the context of classroom rules this research focused on Reactive Interventionist Discipline Method for the classroom rules introduce by Canter & Canter (1992). The Assertive Development Method was widely fruitful for educator to implement a systematic plan launched for controlling behavioral issues. The research has also benefited from the Skinner (1950) suggested that an educator can managed classroom environment through various strategies. Skinner agreed with concept, "problems can be solved, even the big ones, if those who are familiar with the details will also adopt a workable conception of human behavior".

Skinner (1950) implied that a teacher can control the classroom environment through instantaneous reinforcement. These reinforcements can come in positive (special opportunities,

celebrations, candy) and negative (loss of opportunities, office referrals, in school suspension, out of school suspension) forms to create an environment where each student works productively. Based on the above discussion, a conceptual framework of the study is presented as follows Student's achievement is dependent variable whereas classroom rule is the main independent variable.



Conceptual Framework of the Study (Self-constructed)

2. Literature Review

The review of relevant literature is developed around central theme regarding classroom rules and its effect on students' achievement. This information is provided for better understanding of the education processes in the government schools of Khyber Pakhtunkhwa province of Pakistan. Literature on classroom rules, rules of effective classroom management, setting up classroom rules, Classroom Instruction, relationships and how these effects the students' achievement is important. Education plays an impotent role to uplift of a society. It can guarantee success in different fields of life. It changes the economy and improves national and social structure. The development of a country depends upon the availability of well-trained people and civilized societies have recognized the importance of education.

2.1 Classroom Rules

We have rules in every walk of life that make our life civilized. To make it effective and fruitful, such rules should be communicated to the learners on the very first day of class, and the teacher should make it application possible throughout the academic year. Practicing students in maintaining overall classroom rules and conduct/procedures is visually a positive way to encourage student's involvement. It is necessary to evaluate the method opted to establish post rules, as well as the rules themselves for grade-level effectiveness (Marzano & Pickering, 2003). Rimm-Kaufman, and Curby (2009), said that not always "first day" classroom rules are equally significant and additional rules may be added as particular situation need. Klamer-Hoogma (2012), stated that classroom rules can establishing and maintaining an effective learning environment which leads to succeed in class. Poor classroom management can cause loss of attention towards Teachings which may result in poor performance by the students. School can affect students

learning in the class and has an influence on classroom rules and students' academic achievement as well. Thus, effective classroom rules are pre-requisite for the better academic achievement of students.

Fairbanks et al. (2008), commented that classroom rules are to be changed when situation changes. If the student frequently ignores one rule, it will have an unfavorable cause on his skill to regulate the rules successfully. According to Barbetta (2005) classroom rules should be clear, easy and quantifiable, as well as shaped with students' support. Classroom rules would be reliable with school rules. Different types of classroom rules are necessary for successful classroom management; the rules may be divided into four different categories i.e. (a). Academic work (b). Classroom conducts; (c). First teaching day and can be communicated later. Larrivee (2005), stated that rules make our life more organized and sophisticated. Rules that are effective and productive, must be communicated to the students on the day first of class, and the teacher should make it possible during the academic year. Practicing overall classroom rules and procedures is visually a way to encourage learner's participation. It is very necessary to evaluate the way teachers establish position as well as the grade level efficiency rules. There are four main class rules of effective classroom management. According to Larrivee (2005), there are four rules of effective classroom management. They are:

2.1.1 Rule one: get them in

Rule one emphasizes the position that instruction which make a risk and avoid the difficulties which can occur if learner is not quickly busy in useful activity. The procedure of getting them in could be seemed to connect three different phases, salutation, places and introduction.

2.1.2 Rule Two: get them out

The second rule states that, most of disciplinary issues arise from an unsatisfactory start to the course lesson; another weak time providing many opportunities for problem making is the end of lessons. Educators carefully planning the end of the lesson because it is very important part of the way in which skill teacher effectively feel change. Therefore, the teacher needs to believe different two phase, closing a chapter and finish the class.

2.1.3 Rule Three: get on with it

It is referring to the main important parts of the lesson, the nature of the content and the way of its appearance. Learner's response and intellect of ability on a particular area topic will depend to as considerable level on the teacher's skill to get on with it.

2.1.4 Rule Four: get on with them

Educators build up relationship with their learners by development shared trust and respect. Teacher need to be attentive of youngster as a being and be aware to the temper of the group and keeping track of what's going on?

2.2 Setting up classroom rules

Roesler (2009), stated that classroom rule is to encourage behavior by obviously stating learner prospect. They set limits to how learners behave. Following example is a suitable set of classroom rules:

1. Pursue instructions the first time they are given.
2. Raise your hand for permission to speak.
3. Stay in your seat until got permission to do else wise.
4. Stay hands, feet, and stuff to yourself.
5. No abuse and irritating.

Most of the classroom rules are operate unwritten when learners interacting with their teacher. It should be latterly impossible to trace a set of rules that should cover everything. So therefore, it is necessary to limit the number of classroom rules. Lastly, credit should be given to the learners who stick to the classroom rules. Teachers are not advocating for a comprehensive corruption system, but teachers do identify the best reward of a job well done, teachers are dealing with youngsters. Classroom rules may be adopted at a broad level to include a range of apparent behaviours. Give honor to other people's belongings and being covers a range of misshapes, such as theft, looking here and there, throwing objects etc. To honor teacher desires allows you to shun off a verity of true thing and disruptive behaviors that no list of rules could widely cover. On the other hand, one should be cautious enough to state a rule so commonly that the particular misshapes, to which it relates, stay ambiguous to students e.g. a rule indicating simply, obey the teacher, may not be materialized (Curby et al, 2009).

2.3 Classroom Instruction

Curby (2009), stated that the terms, teaching consists of two parts but intertwined set of activities, instruction and management. The managerial activities are those activities which are carried out to create and maintain conditions in which the classroom instruction would take place effectively, while instructional activities are those that are deemed vital to improve the learner's academic achievement. Classroom teaching has two mechanisms, order and learning. The Order is served by classroom management, while learning is served by instruction.

2.4 Relationship between Students and Teachers

Vairamidou, and Stravakou, (2019) classroom is the main area of teaching learning process where the teacher and learner interact with each other for the attainment of educational goals. To recognize the educational goal, the duty of the teacher is to create a conducive atmosphere that invites the students in the classroom activities and their relationship as well as to assist the learning process. Classroom management is all events performed by edifies in the classroom to make education situation that encourages social contact, lively appointment in education. From the above statement we understand that classroom management could be used as an instrument to create good relationship between students and teachers among all the learners. Good relationship is very important they should treat students equitably according to their needs and to plan the

teaching learning experience. According to Charles (2008) our job as a teacher is to teach all learners fairly by treating them.

3. Methodology

3.1 Research Design

Descriptive Research Method was used in this study. Primary data was collected through questionnaire and secondary data was obtained to the review of related literature including relevant books, researches carried out on the subject conference /seminar proceeding various educational policy, education plan and the martial found through internet.

3.2 Population, sampling procedure and sample size

The target population comprised of the study comprised all the SST/SET teachers at the secondary level. Forty Government High and Higher Secondary School were randomly selected for the selection of the sample of the study. There are total 658 SST/SET male teachers at the secondary level and total 240 SST/SET teachers were selected from the 40 schools in Peshawar.

3.3 Research Instrument and Analysis

The researcher used Classroom Rules Scale (CRS) developed by Frankel and Wallen (2004), which consists of 10 items. The scale was translated into Urdu which was given along with the English statements. Student's average score of class 9th session 2017 was obtained from the respective respondents in their own subject taught being Dependent Variable (Student Achievement, SA). The participants were informed that the data was to be kept confidential and used only for research purposes. Different statistical tools i-e One sample t-test, Pearson Correlation and Regression were used for analyzing data, collected from the respondents, using the questionnaire/scale already introduced in the preceding section.

According to UmaSekaron (2003), the reliability value falling below 0.60s is poor, the 0.70s range is acceptable and 0.80 range and above are good. The reliability of the variables tested is acceptable to good range.

Table 1. *The reliability test of variables*

Variables	Cronbach's Alpha
Classroom Rules (CR)	.734

4. Results, Findings and Discussion

One sample t-test Statistics for variable CR (Classroom Rules)

One-sample t-test statistics, for variable Classroom Rules (CR), we got the following results in Tables.

Table 2. *One sample t-test Statistics for variable CR*

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
CR	240	3.3142	.66626	.04518

Table 3. *One Sample Test*

One-Sample Test						
	Test Value = 3					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
CR	6.953	239	.000	.31417	.2252	.4032

In case of the above both tables 1 & 2 the mean value of CR was 3.31 which was higher than the midpoint 3, the t-value was 6.953 & $p<0.05$ which was significant. So, it showed that the responses of the majority were on the agreement side.

Table 4. *Person Correlation between Classroom Rules & Students Achievements*

Descriptive Statistics			
	Mean	Std. Deviation	N
AvMarks	58.2583	10.65197	240
CR	3.3288	.66626	240

Table 5. *Correlation*

Correlations			
		AvMarks	CR
AvMarks	Pearson Correlation	1	.150*
	Sig. (2-tailed)		.020
	N	240	240
CR	Pearson Correlation	.150*	1
	Sig. (2-tailed)	.020	
	N	240	240
*. Correlation is significant at the 0.05 level (2-tailed).			

4.1 Testing the Hypothesis

H0 There is no relationship between & classroom rules and student's achievement level.
Two hundred and forty Teachers of high and higher secondary schools were surveyed about the Classroom Rules (r= 0.150, Sig. 000 <0.05), the coefficient of correlation shows that the CR and SA was significant. So, correlation result suggests that the Classroom Rules and Student's Achievements have a weak but positive relationship with each other. On the basis of above correlation result, the null hypothesis was rejected.

Table 6. *Regression Model*

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	49.249	3.915		12.58	.000	41.537	56.961
	CR	2.659	1.138	.150	2.337	.020	.417	4.900

a. Dependent Variable: AvMarks

4.2 Applying Regression Model

Regression analysis was applied for calculating, whether the explanatory variable Classroom Rules (CR) is contributed towards dependent variable i-e. Student's achievement (SA) and how much it is contributed to our data. Hence, to capture the effect of independent variable Classroom Rules (CR) and dependent variable student's achievement (SA) (β= 49.249, p=.000<.05)
(Where SA is representing the dependent variable Students Achievement (Score/Marks) and CR (Classroom Rules)

SA = 49.249+ 2.659CR
(3.915) (1.311) (Std. Error)
(12.580) (2.337) (t- Statistic)
(.000) (.020) (p- Value)

(F = 5.461; p = .001) and explanatory variable classroom rules (CR)is statistically significant (t = 2.337; p < 0.05). The Independent Variable Classroom Rules (CR) contributed statistically significantly in a positive way towards student achievement. Classroom Rules (CR) contributes 2.659 units in the dependent variable Student Achievement (SA) for every unit (=1) increase in

explanatory variable the SA score also increase by 0.492.So, on the basis of the above results the explanatory variable Classroom Rules (CR) positively contributes towards Student Achievement (SA) level.

It was found that the reliability of the items was to acceptable range and One-Sample t-test confirmed that most respondents were agreed side. It was also found that classroom rules positively contributing towards students' achievements. The study found that a classroom rule was positively related to students' academic achievement. This finding of the study is in line with Şen (2022), who investigated a positive relationship between classroom rules and students' achievement. Similarly, this research is in line with Özdal and Çağanağa (2017), Owusu et al., (2021) and Erdem & Akyol, (2021) reported that classroom rules had a positive influence on students' performances.

5. Conclusion

It was concluded that there was a positive and statistically significant relationship between classroom rules and students' academic achievement. Classroom Rules was positively contributing towards students' academic achievement. The whole estimated regression model was significant. The Classroom Rules leads to better students' achievements. It were concluded that Classroom Rules plays a very effective role to manage classroom but also positively contribute towards student's achievements.

6. Recommendations and Future Directions

1. Classrooms rules may be displayed in the classes for the reinforcements.
2. Classroom rules may also be communicated to the parents using different modes of communication.
3. Student's perspective regarding classroom rules may also be explored.
4. Further studies can be carried out to compare the implementation of classroom rules at different educational levels.
5. Studies can also be carried out to examine the classroom rules of elite schools, madrassah stream schools and the government schools.
6. Further studies can be carried out to explore the effect of class room rules on the academic achievement of female students.

7. Limitations of the Study

A limitation of the study was that it utilized a self-report survey, which According to Colton and Covert (2007) may limit the acquisition of data because the items in self-report surveys limit the response choices of respondents. Some of the respondents might not know the meaning of certain statements and respond to these items from their own interpretation. Vaughn (2012, p.6) has argued that surveys question habits of mind, and these are not essentially limited to the items in surveys used for studies.

This study was limited to assumed 9th-class students in two districts of Khyber Pakhtunkhwa with the assumption that they would be better able to respond to the questions about classroom rules, and would be better able to express their problems/feelings. It is a limitation of the study as students in other classes may perceive teachers differently, and, as a consequence, the findings may be generalized with caution.

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The Perspectives of Secondary School Educators Towards Project-Based Learning (PBL): A Case Study of Private and Public Institutes of Sukkur, Sindh

Hira Naimatullah[1], Rabia Baby Shaikh[1], Preety Kataria[1], and Noorunisa[1]

[1]Department of Education, Sukkur IBA University, Sukkur, Sindh Pakistan, 65200.
Corresponding Author: rabia.shaikh@iba-suk.edu.pk

Abstract
This qualitative study investigates the perspectives of both private and public secondary school educators towards Project Based Learning (PBL) in the context of the Sukkur, Sindh province of Pakistan. PBL is a student-centered approach to learning that makes use of challenging real-world issues as a means of fostering conceptual and theoretical understanding. The term perspectives comprise only teachers' perceptions, motivation and experience of the said instructional strategy. A case study was conducted on 08 secondary teacher educators (N=4) from a private school and (N=4) from a public school in Sukkur. The objective of the study is to develop the necessary skills of students at a higher level of education. The data was collected by personal in-depth semi-structured interviews. Thematic-descriptive analysis carried out on the data revealed that all participants regarded PBL as a more engaging and collaborative pedagogy than traditional teaching approaches because it develops learners' critical thinking, problem-solving and communication skills. Most teachers, however, do not apply PBL in class because of time constraints, low pedagogical knowledge, preference for lecture method, management barriers and lack of resources. The professional literature on PBL in teacher-education courses is enriched by this study, which may persuade teachers to include PBL in their curricula.

Keywords: *project-based learning (PBL), perspectives, perception, motivation, case study, thematic-description analysis*

1. Introduction

In the era of technological advancement, the area of education demands modern teachers who can develop and transform with the rise of new challenges. The twenty-first millennium requires educators to adopt innovative teaching and learning approaches that give students more freedom to express their ideas and perspectives. To prepare students, to thrive on these skills in a globalized society beyond high, there must be a switch of teacher focus and teaching practices (Boyers 2018). Teacher-centered education is one of the fundamental components of instructional methodologies which is quite a traditional approach. In contrast, such a change in strategy needs a fresh method of instruction that supports student-centered teaching. Among the most effective methods for taking into account, certain demands and prerequisites have been discovered to be project-based

learning, which has acquired the instructors' huge support (McCarthy, 2016). PBL (project-based learning) is an active teaching technique that emphasizes greater student involvement in the educational process. It calls on the teacher to energize the classroom by encouraging students to collaborate on research, decisions, and solutions to the project's issues. Besides, it highlights the formation of an evaluation system that promotes consciousness, reflective practice, and a critical attitude, enabling the most in studying (de la Torre-Neches et al., 2020). PBL is a form of instruction whereby students spend a significant amount of time, researching and responding to a challenging but authentic issue, problem, or obstacle (Buck Institute of Education 2018a).

PBL has already been promoted as a significant pedagogical approach, among several others, to help students get ready for the demands of their career prospects and everyday life. For PBL to be implemented successfully, it is crucial to support the instructors' viewpoints on the subject. (For instance, Kay & Greenhill (2011), Han et al. (2015), and Larmer et al. (2015).

According to Awan (2014), education is crucial to a country's success or failure, particularly in the twenty-first century. The development of international rivalry in science and innovation is mostly to blame. The main requirement for any country's success in this competitive atmosphere. Awan (2011) asserts that all nations, notably Pakistan, have distinct educational systems that may be divided into two main groups: private and public schools. To promote long-term national development, our private schools are currently receiving enormous attention. Hence, this paper aims, to understand the perceptions, motivation, and implementations of higher secondary school teachers of both private and public educational institutions specifically regarding the Project-based learning approach in their teaching culture. With the addition of techniques like PBL, the new skill set will make classrooms student-centered (Wan Husin et al., 2016). Teachers could no longer rely on educating pupils and utilizing grades as the main measure of proficiency (Riley & Ward, 2017). Teachers are expected to design lessons that will enable students to construct, express, cooperate, investigate, analyze, resolve issues, and use technology and information effectively in the 21st century (Smith & Gibson, 2016).

To help their students, teachers need to be equipped with the necessary tools and abilities. They must become facilitators in the classroom so that pupils can take ownership of their learning (Canuto, 2015) Although, no similar study was conducted in the Sukkur region especially when it comes to comparative analysis of both public and private sectors schools and secondary school instructors' understanding of PBL is still unclear. The Sukkur region currently has a knowledge and practice gap, which this research aims to overcome.

Physical facilities are requirements for providing quality education at secondary schools in the Sukkur region. Sukkur is a district in Sindh Province in Pakistan. It is the third biggest city in

Sindh. The Sukkur education system is mainly categorized into Public and Private sectors. Generally, it is assumed that private sector schools are providing better quality education as compared to public schools. A public institute is the responsibility of a governmental unit or over which a governmental unit exercises administrative control. In contrast, a private institution means an independent entity owned by a non-state entity, such as a firm, business enterprise, or individual. These private schools are self-sustaining; depend on the fee paid by students. Additionally, this study was conducted to compare physical facilities, teachers' perception, motivation, and their implementation of project-based learning at public and private secondary schools in district Sukkur using action theory frameworks to reveal how they are making sense of designing PBL, its role, and then transferring those understandings into practice (Tighe, Christina 2020). The results of this study will be useful for policymakers, academicians, teachers, and heads of educational institutions.

1.1 Research Objectives and Questions

The aims and objectives of the study are i.e. (a). To explore the perception, motivation, and experiences of secondary school teachers regarding PBL in classroom settings; (b). To compare the perspectives of public and private secondary school teachers of Sindh Pakistan on PBL and its implementation; and (c). To identify the challenges and opportunities for adopting PBL in secondary schools in district Sukkur. Whereas, the research questions are i.e. (a). What are the perceptions of private and public sector secondary school teachers regarding Project-based learning (PBL)?; (b). To what extent private and public sector secondary school teachers are motivated to implement PBL?; (c). Do private and public sector secondary school teachers implement PBL?; and (d). How different are the perceptions motivations and experiences of public and private sector secondary school teachers from each other?

2. Literature Review

2.1 Project-based learning

PBL has been described in a variety of ways by various authors. As a result, there is no single definition for this phrase, and no consensus has been formed (Baş, 2011). Project-based learning is often regarded as a viable alternative to traditional teacher-led instruction. This approach is an active instructional strategy that encourages maximum engagement of students in the learning process. It requires the teacher to activate the learning environment by promoting students to work together to investigate, make decisions, and respond to the project's problems. It also focuses on the activation of an assessment system that fosters awareness, reflexivity, and a critical mindset, allowing for more in-depth learning (de la Torre-Neches et al., 2020).

Project-based learning (PBL) assists students in developing abilities to solve problems and other meaningful learning content by incorporating self-directed learning to assist students in building

their knowledge, processing and realistically completing their work, and showcasing their products (Ibragimov, 2021). This is a teaching approach that allows teachers and students to implement their ideas. As a result, project-based learning is a process-based learning strategy that demands interactive classroom settings. PBL is an essential teaching approach since it accommodates a variety of learning types, such as cognitive, visual, kinesthetic, auditory, and verbal (Markula & Aksela, 2022). During the project-based learning process, students are allowed to work independently or in groups. Students in project-based learning handle challenges through innovative, program-related, and frequently multidisciplinary group activities (Belayneh, 2021).

Project-based learning has a medium to big favorable influence on students' academic achievement when compared to traditional schooling, according to authors Chen and Yong (2019). Students can learn more specifically by looking for answers, asking questions, discussing ideas, creating plans, and connecting with others (Choi et al., 2019). Project-based learning encourages student collaboration, with the teacher serving only as a guide throughout the project (Greenier, 2020). It supports critical thinking and problem-solving, interpersonal communication, information, and media literacy, cooperation, and leadership (Chu et al., 2017). Project-based learning is seen as a valuable instrument for student mobilization, engaging interpretation of educational content, acquiring new knowledge, as well as the development of personal characteristics necessary for collaborating with others and resolving problems (Chmelárová & Pasiar, 2017). It establishes a clear link between students' participation in their projects and their learning outcomes (Pedersen & Hobye, 2020). Consequently, project-based learning is regarded as a very effective method of teaching and the pinnacle of a teacher's didactic abilities. The right assumption that students should not memorize abstract definitions but rather learn by completing complex projects is the foundation of project-based learning (Apek, 2019).

2.2 Teachers' Perception, motivation, and Implementation of Using PBL

Due to variances in experience, teaching subject, and other circumstances, teachers understand PBL in a variety of ways. According to empirical studies on teacher perceptions of PBL, instructors have good pedagogical beliefs regarding PBL (Harrigan, 2014; Tamim & Grant, 2013). PBL is perceived by teachers as a student-centered strategy that promotes self-learning (Baysura, Altun & Toy, 2016; Bell, 2010; Harrigan, 2014; Tamim & Grant, 2013). Simultaneously, teachers recognize their position as facilitators and revisors, providing students with direction and scaffolding through teacher-student interactions, guiding questions, peer counselling, and practice worksheets (Intykbekov, A. 2017).

Classroom management, according to PBL teachers, is considerably different from other traditional instructional approaches such as discussion, lecture, or seatwork. During PBL, teachers do not employ teacher-oriented methods, nor do they present information or lead activities. Most of the time, students work independently in small groups. Some teachers even claim to feel as

though they are acting as peers rather than as classroom managers (Intykbekov, 2017), PBL is also viewed by teachers as an authentic learning process in which students are required to create final realistic products, presentations, or models (Yam & Rossini, 2010). Teachers also believe that PBL encourages them to employ continuous assessment, which is regarded as a continuing process of evaluation from the beginning to the end of PBL (Hugerat, 2016). Positive PBL experiences can affect teachers; those who report modifying their teaching approaches when adopting PBL prefer to relinquish control and become facilitators, enabling their students to make decisions (Dole et al., 2015; Li & Tsai, 2018).

2.3 Benefits of implementing Project-based learning in classrooms

PBL is one of the methods for implementing lifelong learning techniques (Arwatchananuku et al., 2022; Ismail et al., 2021; Trilling & Fadel, 2009). PBL supports a variety of learning types, including but not limited to cognitive, visual, inaesthetic, social, and verbal (Indrawan, 2019). PBL provides students with the opportunity to study and use 21st-century skills that prepare them for real-world settings and difficulties (Capraro, 2013; Pusztai Kovácsné, 2021). This teaching style has been shown to increase student interest, and academic achievement, and deepen comprehension of the assigned material (Indrawan et al., 2019; Markula & Aksela, 2022; Pusztai Kovácsné, 2021; Carrabba & Farmer, 2018).

PBL promotes deeper thinking, comprehension, and awareness of real-world circumstances (Knezek & Christensen, 2020). According to Capraro (2013), the positive effects of PBL include higher-order thinking, the ability to break down challenging issues to discover solutions, making links, developing more powerful interests in fundamental subjects (math, science, technology), and encouraging ownership through expansion and solutions. Reid-Griffin et al. (2020) discovered that PBL enables for participation in real-world difficulties and collaborative learning. According to their research, children will learn from others (and themselves) who provide ideas and collaborate.

2.4 Project-based Learning in Pakistan

The literature analyzed above mainly comes from the developed context and suggests that PBL has been used as an effective teaching approach compared with conventional instructional practices. As shown above, this approach not only adds to the enhanced academic achievement of students but also leads to the development of their soft skills. It is interesting to note that, although limited, studies conducted in Pakistan on PBL also present it as an effective approach when compared with traditional approaches. While conducting experimental research on the effectiveness of project-based learning in English language teaching at the college level in Karachi, Sultana and Zaki (2015) found this approach to be a better instructional method compared with traditional approaches. These authors argue that implementing project-based learning allows using child-centred pedagogies and thus, leads to students' active engagement in learning and language

skills development. Consequently, students also develop an interest in language learning which otherwise is quite challenging for them. In addition, while working on projects, students avail opportunities for collaborative work that develops their skills and attitude towards collaboration. Similarly, a study conducted at the school level in Multan (Imtiaz & Imtiaz, 2012) shows that engaging students in project-based learning not only results in their improved language skills but also makes them autonomous learners making them less dependent on others as in conventional teaching. These authors further argue that as the students actively work in different activities during the project, they develop their soft skills such as working in a team, self-regulation, self-motivation, time management and confidence.

Another study conducted on BS level students in Karachi reveals both academic and non-academic benefits of project-based learning (Sultan & Javaid, 2018). The academic benefits were related to a deeper and more meaningful understanding of the content whereas non-academic benefits included time management skills, negotiation skills and critical thinking skills. This study finds two major challenges faced by the students – the challenges related to time management and working with others in groups. Similarly, a study conducted on PBL in the context of higher education in Jamshoro, Sindh (Gopang, Gopang & Chachar (2023) stresses the importance of giving more attention to the process during the project based learning rather than the outcome to ensure that students learn the language skills as well as soft skills such as leadership, time management, problem solving, negotiation and confidence as they work together during the project work.

However, these studies are mainly limited to the teaching of English. In addition, these studies have paid little attention to the perspectives of teachers on PBL. Our understanding is also limited to the main cities such as Karachi and Multan, for example. What we still do not know is how science teachers perceive PBL in the context of Northern Sindh such as Sukkur. The current study aims to fill this significant gap.

3. Methodology

The purpose of this research was to examine the perspectives of public and private secondary school teachers toward project-based learning (PBL) in classroom settings. The study employed a qualitative research method, utilizing an interview guide to gather data. The qualitative approach was chosen to understand the world of the participants and to explore the phenomenon from different perspectives. The thematic analysis method was employed to differentiate between the perspectives of teachers from public and private sector schools. The analysis focused on three categories: the perception of public and private sector teachers towards PBL, their motivation towards PBL in classroom learning, and how they implement PBL. Semi-structured, in-person interviews were conducted to collect the data. The researchers obtained consent and approval from

the participants to record the qualitative data. The interviews were recorded to capture the voices of the participants.

The data was collected from teachers in both public and private sector institutions to provide diversified but reliable data. This research followed a qualitative case study methodology, which allows for the exploration of a phenomenon within a specific context using various data sources. The use of multiple lenses helps to reveal different sides of the phenomenon. The qualitative method was suitable for this research as it focused on the participants' views, allowing for more freedom in analyzing the data and facilitating the emergence of themes during the analysis process. The practical features of qualitative research also made it suitable for this topic.

The sample comprised of total eight secondary school teachers of both public as well as private educational institutions, involving (04 men and 04 women) who teach the students of 9th-12th standard. These school teachers have specialization in one or more than one subjects like English, art, math, science education, and computer literacy. They teach in different classes in a day, based on their specialization. The current study aims to analyze the perspectives of secondary school teachers through a qualitative approach using a semi-structured interview guide tool has been used.

The participants were acknowledged for being part of educational research, the duration, the process, and the obscurity of their data. We have thoroughly followed the ethical principles and guidelines as stated by The Swedish Research Council (2017). To certify confidentiality for the participants, all participants, including people stated in interviews, and schools and locations, have been given fictional names in transcriptions and publications.

4. Results, Findings and Discussion

The findings of the current study on the perception, motivation, and implementation of PBL practices among public and private secondary school teachers include:

1. Both public and private school teachers are motivated to implement PBL in their classes.
2. Teachers from both sectors acknowledge the positive effects of PBL on student academic success.
3. Public school teachers, despite facing resource and privilege limitations, are fully motivated to embrace the PBL approach.
4. Private school teachers are found to be more resilient and active in implementing PBL.
5. Private school teachers actively encourage and engage students in PBL activities.
6. Time constraints and managing activities pose initial difficulties for private school students, but teachers try to facilitate their learning.
7. Private school teachers tend to design more precise lesson plans for PBL.

8. These factors contribute to the development of a productive learning environment and help teachers achieve the goals of their lessons.
9. Both public and private school teachers are dedicated to ensuring the benefits of PBL for their students.

The perspectives of both Public and Private sector secondary school teachers are viewed in the following Table I. and Table II. Which are categorized into perception, motivation, and implementation.

TABLE I.

Codes (key domains)	***Theme***	***Response of Public School Teachers***	***Response of Private School Teachers***
1. Perception	Teacher's beliefs towards PBL	About half of the teachers believe it is the 21st-century approach where students are engaged and through PBL, students gain knowledge.	In the private sector, a large majority of teachers strongly believe that it is the most important approach in which students explore and resolve their problems on their own.
	Students' participation	Half of the teachers are percept that Students are encouraged to participate in PBL when they have been assigned a project.	A majority of the teachers stated that most of the students are highly encouraged to participate in PBL activities. The students usually show their involvement; even those students who remain silent do participate.
	Students' attendance	Half of the teachers stated that there is a beneficial influence on students' attendance because they were enjoying PBL activities.	A majority of the teachers are motivated when Students come into the classes in larger groups when the PBL approaches practices.

	Students' attitude	Half of the teachers are willing to make a strong student attitude to involving them and participating them in PBL.	A large majority of teachers use methods to help pupils acquire a good attitude about PBL, while others believe that employing technology might help them do so.
	Students' involvement	Half of the teachers state that they involve every student in PBL, especially when they conduct any science activity students keep participating with their interests.	A large majority of the teachers are willing that they try to involve every student by having small groups of students participate in the PBL task Since some students are already strongly motivated to engage.
	Teachers' experience	A minority of teachers stated that they had a rich experience in PBL	A large majority of teachers said that they have a nice experience with PBL.
2. Motivation	Effectiveness of the PBL approach	According to half of the teachers, it is the most important method for students' accomplishment where they become good experimental students and effectively learn the idea.	A large majority of teacher states they are motivated to implement PBL in their classrooms therefore it is found to be a highly effective learning technique, students learn with interest through PBL activities
	Objectives behind PBL activities	Half of the teacher's whole focus is on students' understanding of how much they understood about the topic and,	A large majority of teachers focus on students' development and learning outcomes.

		after that, how they explain it too.	
	Benefits for students	The most important benefit for students is that PBL make students more confident in the studies they learn in-depth, given by half of the teachers.	A large majority of the teachers state that PBL helps students in their real circumstances, and they become more practical in their lives.
	Impact of PBL on Students' Learning	According to half of the teachers, PBL encourages the students to deeper learning and establishes students' clear learning goals.	A large majority of the instructors agree that PBL has a significant influence on students' learning because it allows pupils to clarify their understanding and strengthen it in their long-term memory.
3. Implementation	Challenges for teachers to use PBL	Half of the teachers faced challenges in the public sector school while implementing PBL, that is, costly material, lack of resources, and student's prior knowledge.	A majority of teachers faced some challenges, is as student noise, management support, or some right resources.
	Successfully designed activity	Half of the Teachers organized activities like concept mapping, brainwriting, and watching videos to understand the topic, which is easy to understand for students.	A large majority of teachers organized successful PBL activities in different subjects English, science, Pakistan studies, and math.

		Assessment of PBL	A minority of teachers' state that they take the presentation at the end of the class to assess the student's performance.	Half of the teachers create rubrics and indicators to assess students' work, whereas the remaining half of the teachers assess by soliciting feedback from students at the end of the class.

TABLE II.
Use of the PBL approach by public and private sector teachers

S/No.	***Items***	***Total average percentage***
01	Government School Teachers	About half (46%)
02	Private School Teachers	A large majority (94%)

As shown in Table II, it is clear that only around half of public-sector teachers believe in using the Project-Based Learning (PBL) method in their classroom teaching. On the other hand, in the private sector, the vast majority of instructors reported using the PBL method in their classrooms.

The data were taken using the methods of an interview guide. A questionnaire was given to teachers with open-ended questions, and the teacher was asked to describe their situation. Semi-structured interviews were discovered to be an effective tool for conducting this research. Likewise, a semi-structured interview guide was created, with a list of selected questions including, what is the teacher's belief in PBL? What are the teachers' perceptions of learning secondary school education using the method of PBL? What are the positive aspects of applying project-based learning, whether as a study strategy or method? How effective is the use of the PBL approach in secondary students' achievement in science? How much experience do you have with PBL? What objectives do you keep while conducting any particular PBL activity? Do your students have the right and sufficient resources to conduct the project? What are the challenges of using PBL? Please quote any PBL activity that you have successfully implemented in your classroom. Did that PBL project help students get ready for the real world in any way? How? How do you assess your students while engaging them in PBL? Do you think that students based-

learning is easily assessable for teachers? What challenges do you see in assessing PBL? That was in line with the principal points of the study and some designed prompts to ask the participants. Correspondingly, it was attempted to make the interviews seem more casual to lessen the participants' hesitation and reluctance and to make them feel at ease when discussing their opinions and experiences. In particular, the participants' entire conversation was later broken down into various themes related to the research questions. The comments provided by the participants to justify their responses were transcribed and analyzed. The study demands taking advantage of a small group of participants to support the qualitative analyses.

The results of the study have been classified under research questions as discussed:

4.1 How do private and public sector secondary school teachers perceive PBL?

The majority of public school teachers strongly believe in PBL's ability to involve students in an active learning environment and develop their problem-solving skills. PBL is seen by teachers in private schools as a student-centered approach where students investigate the real world, while teachers play a passive role. The instructors claimed that the PBL stimulates student participation and attendance. Teachers also think that creating assessments for courses is simpler. Because there is no "PBL"-based assessment in the curriculum, some teachers (majority of the private sector) believe that pupils are less engaged in PBL. A few reported that teacher attitude frequently has an impact on teachers' responsibility for implementation however, teachers' execution of a plan or project may suffer if the teachers have a negative attitude toward them (Su et al., 2018). Encouraging teachers can put in more effort to embrace the program or method successfully. As they move through the process, effective teachers may foresee the results of their work.

4.2 To what extent private and public sector secondary school teachers are motivated to implement PBL?

The majority of public school teachers are strongly motivated to implement PBL in the classroom. They believe that becoming a good experimental student is an essential stage in increasing student achievement. It works best with conceptual subjects; it offers students and teachers strength and boosts their confidence. In contrast, they do not have the resources needed to put this learning strategy into practice, factors including insufficient resources, inflexible schedules, and lack of technology hinder its application similar barriers were also reported in an earlier study (Aldabbus, 2018). Project-based learning, according to highly motivated private school teachers, is an essential teaching strategy for scientific classes. It is very significant and affects pupils greatly. Most students are unable to comprehend and learn in science classes when a teacher employs the direct technique. However, kids learn well when project-based learning (PBL) is used in the classroom. This method is a powerful teaching and learning tool. They want students to consider developing their reading, writing, speaking, and listening skills. Additionally, the teachers see a

variety of advantages in adding project-based learning into their lessons. Since PBL offers pupils a variety of learning opportunities, most teachers welcome it. This could be about subject knowledge, skills (such as teamwork, social interaction, and problem-solving abilities), or general learning (often related to making videos). They believe students who are motivated by their teachers and encouraged to be curious, and capable of investigation and exploration, will grow into adults who can contribute to the social and economic growth of their communities. Thus, a generation that is capable of developing the tools the community needs as well as of forming responsible members of society will emerge (Hugerat, M., 2016).

4.3 How do private and public sector secondary school teachers implement PBL?

Because PBL is a student-driven technique that enables students to collaborate on the assigned project, the majority of private school teachers are adopting it as effectively as they can. They engage in various activities to promote PBL in the classrooms. They do, however, encounter numerous difficulties, such as time management problems and a dearth of qualified teachers with specific educational knowledge (Mentzer et al., 2017). Additionally, students' independence and responsibility are monitored by their teacher, who watches over them while they complete certain activities and evaluates their performance. Other challenges include their management who also foster PBL but they both are not solely responsible because the way their course (curriculum) is structured encourages pupils to memorize or cram. As it takes time to learn to use PBL in practice—even two to three years for teachers to shift their understanding and teaching practices in teacher training—there is a need to develop long-term or even continuous and collaborative models for teacher training (Aksela & Haatainen, 2019) if the syllabus lacks this capability so neither management nor students are accused of it. This should also include pre-service teacher training. Studies have frequently shown the requirement for lecturers to have preparation training in PBL, notably in facilitation and evaluation abilities (e.g., Lee et al., 2014; Mills and Treagust, 2003). More research is required to comprehend how novice instructors use PBL in practice if we hope to engage more teachers in the usage of PBL in the future. The majority of public-school teachers' comments remarked that it can be difficult to facilitate PBL. This covers all ideas related to teachers' project management and PBL time management abilities.

4.4 How different are the perceptions, motivations, and experiences of public and private sector secondary school teachers from each other?

The fact that secondary school teachers in both the public and private sectors have different opinions on PBL and different justifications for doing so demonstrates the diversity of teachers' perspectives. However, the review reveals that teachers see it as a learning environment focused on students, where they act as facilitators and advisers, and provide students with adequate guidance and feedback rather than lecturers. When it comes to contrasting the perspectives of secondary school teachers from the public and private sectors, it has been found that the public

sector teachers exhibit positive beliefs and their perceptions are strong to practice PBL. They are also found to be enthusiastic and willing towards PBL in the classrooms, but they lack the necessary resources and strategies to do so. Additionally, the data point to and confirm past studies on the challenges instructors have while using PBL. Public sector schools' and teachers' attempts to implement PBL are being inhibited by the structural problems mentioned in this and prior research (e.g., Viro et al., 2020; Mentzer et al., 2017). They demonstrated a lack of administrative system support for engaging in PBL activities which puts them in disagreement with the perspectives of secondary school teachers in the private sector who are more engaged and professional content experts and constantly revise their teaching methods to better pursue learning and academic success. They provide a variety of project-based curricula that not only adhere to the requirements of each academic grade level but also enhance student learning. They have been using PBL in their classrooms, with positive results for student engagement and the development of 21st-century skills. However, they also mentioned difficulties with management, time constraints (Aksela et al., 2019), and persuading parents that PBL is a curriculum-related method that enhances and supports their child's learning. It is also thought to be an excellent tool for encouraging kids to work in teams, share ideas, and support one another as they resolve real-world challenges. Not least of all, PBL is recognized as a successful method for assessing students as it is being implemented.

5. Conclusion

This paper aimed to explore the perspectives of private and public secondary school educators on PBL and its implementation in their classrooms. As PBL is significant for developing problem-solving skills, fostering collaborative skills, and connecting students' learning with real-life situations, it is important to understand the factors that facilitate or hinder its adoption in different contexts. This study found that half of the public secondary school educators are not aware of PBL and face various barriers to implementing it in their classrooms, such as lack of support, experience, resources, and the degree of training and assistance. As was mentioned, the majority of the challenges that educators and learners encounter when implementing PBL are caused by the adjustments that the technique calls for in their roles and responsibilities (Shpeizer, 2019). On the other hand, private secondary school educators plan and execute PBL more effectively due to better administrative and expert support. However, some inconsistencies were observed between teachers' beliefs and practices regarding PBL across both types of schools highlighting the need for further research on how to improve the awareness and strategies of secondary school teachers towards modern pedagogies like PBL. The study, therefore, emphasizes the need for teachers to equip themselves with the necessary tools and abilities to become facilitators in the classroom so that students can take ownership of their learning and ultimately enhance their academic success and life skills.

6. Suggestions

1. The government should ensure that public schools perform well in PBL activities by creating a suitable system of accountability and support. For example, schools should receive qualified teachers, PBL awareness sessions, the necessary materials, and a well-functioning system that fosters teaching and learning.
2. The government should also monitor privately run schools and create clear regulations and rules that ensure the quality and consistency of their faculty, curriculum, and instructional practices.
3. Teachers should focus on meeting the student's needs, facilitating the exchange of material, allocating adequate time for PBL, addressing concerns and issues, engaging students in various activities, and fostering students' self-confidence.

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Relationship between Strategic Leadership Styles of Head Teachers and School Performance at Secondary Level: A Preliminary Study

Dr. Hina Amin[1], Amna Ijaz[2], Dr. Bushra Haleem[3], and Faizan Ghondal[4],

[1]Virtual University of Pakistan
Corresponding Author: hina.amin@vu.edu.pk

Abstract
This research paper aimed to find out the relationship of strategic leadership styles of head-teachers and school performance at secondary level. A cross-sectional correlational research method was employed. All the head-teachers of secondary schools in Tehsil Sargodha were considered population for this study. By using cluster sampling technique, data was collected from all the 171 secondary schools head-teachers. Strategic Leadership Styles Questionnaire by Gaylord Reagan (1998) was adopted to collect the data from head-teachers. According to this scale, there are eight leadership styles which sums up to make strategic leadership style of heads. The instrument was based on Thurstone scale ranging from 1-8 (least to most). A positive, week but significant correlation found between strategic leadership styles of head teacher and school performance. However, regression analysis indicated that strategic leadership style of head teachers effects the school performance to some extent. It is recommended that faculty having experience in educational administration may provide comprehensive and specific instructions for putting strategic leadership techniques into practice so to increase school performance.

Keywords: *strategic leadership, school performance, head teachers, secondary level, correlation*

1. Introduction

Complex educational environment of twenty-first century is expecting the successful performance of organizations (Jaleha & Machuki, 2018). This demand has further laid their hopes on the top leaders and their leadership capabilities for producing desirable results (Aquino et al., 2021). Indeed, organizational outcomes reflect the characteristics of their top executives or the persons in leading positions. A plethora of studies have shown that "top executive's background, past experiences, personality, and values can influence the strategic decision making" in an organization (Singh et al., 2023. p.2). Administrators of successful schools dedicate a significant amount of time to plan and overseeing instructions to improve the productivity of the schools (Simmons & Taylor, 2019). According to Jabeen and Ch (2021) school heads are considered accountable for improving the school culture which further leads to improvement in school performance. In this context, Mulford (2003) highlighted that "school improvement movement from the past 20 years has put a great emphasis on the role of leaders" (Organization for Economic Co-operation and Development, 2001b,

p. 32). Fullen (2002) argued that in current scenarios of high expectations only "Effective school leaders are key to large-scale, sustainable educational reforms" (p.15). Leadership and leadership styles played an essential role in building a conducive working environment and culture within the organizations. Particularly the leadership style of organization's heads inspires their employees to struggle hard to achieve the vision and goals (Sarwar et al., 2022).

Before discussing the strategic leadership, it is useful to highlight evolution of leadership theories. However, there are many leadership styles are discussed under the contemporaneity theories which includes authentic, charismatic, spiritual, transnational and strategic leadership. This research focused on the exploring the importance of strategic leadership and its relationship with school performance.

Figure 1. *Evolution of Leadership theories proposed by Redmond, 2016*

Explaining the importance of strategic leadership, Davies and Davies (2004) argued that strategic leaders facilitate their peers to use different opportunities to adapt and respond to organizational uncertainty. Strategic leadership is considered as critical component for organizational development (Carvalho et al.,2021). In pursuit of high performance, strategic leaders are attributed to create a sense of purpose, direction during interaction with internal and external stakeholders (House & Aditya, 1997). According to Glantz (2002), theory of Strategic leadership implied that strategic leaders have the strategic thinking ability, which helped the organization with a competitive advantage in the disruptive schools' environment. It further includes the imagining, anticipating, maintaining flexibility and mobilizing different human and monetary resources for productivity. More specifically, strategic leadership (SL) has been explained by many scholars (Ireland & Hitt, 1999; Hagen et al.,1998) to have core critical practices which are essential for the performance and stability of organizations in uncertain environments. These practices are as follows: i) developing a sustainable organizational culture; ii) emphasizing ethical values; iii) managing the human and social assets; iv) exploring and explaining the organization's core capabilities and v) determining the long term goals of the organizations. In Pakistani context, the school leaders have ultimate authority to use many resources and develop strategies to improve performance of schools. Thus, make them responsible and accountable in their role as leaders.

1.1 Objectives and the Hypothesis of the Study

Following were the objectives of this study.

(a). Find out the relationship between strategic leadership styles of head -teachers and schools performance; (b). find out the effect of strategic leadership styles of head-teachers on schools' performance. Whereas, the hypothesis of this research are i.e. (a). H_{01} - There is no significant relationship between the command, collaboration and disintegration styles of strategic leadership styles and school performance (b). H_{02} - There is no significant effect of command, collaboration and disintegration styles of strategic leadership on school performance.

2. Literature Review

2.1 Conceptualizing the Strategic Leadership

According to the Singh et al. (2023) that strategic leadership gained significant attention in the literature after the upper echelon theory into the management literature by Hambrick and Mason (1984). The idea of strategy first appeared in the literature of management in the 1980s, but only a few researches were conducted till 1990s (cf. Eacott, 2008b). A detailed framework for strategically oriented schools was established by Davies and his colleagues which consisted of strategic processes, methods, and leadership strategies (Davies & Davies, 2003, 2004, 2006, 2010). Carvalho et al. (2021) asserts that a strategic leader must possess a variety of important qualities such as vision and strategic setting, the ability to put plans into reality, the capacity to develop work successfully, attention to detail, and the capacity to evaluate strategy on the whole. Davies and Davies (2004) further

highlighted that different terms have been used in literature for strategic leadership characteristics as core competencies (Prahalad & Hame, 1990) and strategic capabilities (Stalk et al., 1992). Hoskisson et al. (2004) identified few activities that effective strategic leaders and top management teams must focus on to contribute to the performance of the organization. These activities are interlinked and overlapping to maximize the productivity of the organization. These activities are as follows:

Figure 2. *Flow chart of strategic actions as proposed by Hoskisson et al., (2004)*

Explaining the similar notion, Guillot (2003) explained that strategic leadership is attributed to formulate plans and then carry them out in order to make important decisions in a complicated and ambiguous working environment. Their study further explored that strategic leadership has three major sub-types as Command, Collaboration and Disintegration and all these are helpful in improving the school performance independently (Njukunye & Waithaka, 2020). Hence, Strategic leadership also demands to have the ability to make decisions and to value them with the support of

the faculty or staff (Carr et al., 2009). Wotton (2010) stated that to achieve the strategic leadership based administration, the most essential factor is the knowledge and strategic thinking. Chatchawaphun et al. (2016) have highlighted the characteristics of strategic leadership style in detail. These includes the knowledge, principles, skills which are required to develop respectable administrative culture, long-term planning, expansive vision, and the ability to carry out tasks in order to meet organizational and societal expectations. Many researchers focused on investigating the strategic leadership styles with other key variables i.e. culture of teaching (Khumalo, 2019), collaboration (Ismail et al., 2018), school effectiveness (Prasertcharoensuk & Tang, 2017) and organizational learning (Aydin et al., 2015).

2.2 Strategic leadership and organization performance

Asif and Basit (2021) described the indicators to recognize the strategic leaders. They explained that these leaders have the ability to envision the future and set the long term goals for their team and organization. Several studies have affirmed that leadership styles have a direct relationship with performance if implement strategically. It is one of the most important attribute that influence the people to transform their working behaviors to make organization successful. According to Northouse (2004) the process of influencing the group of people who strive for a common goal is known as Leadership. Only a strategic leader leads the organization to produce a high-industrious performance for the organization. Besides, Ivancevich et al. (2008) explained that only strategic leadership role of heads is critical for the effective and productive organization. Not only strategic leadership is regarded as one of the most important variables influencing employees' inspiration and organizational change, but also it has been identified as an important element of innovation and productivity for organization (Sarwar et al., 2022).

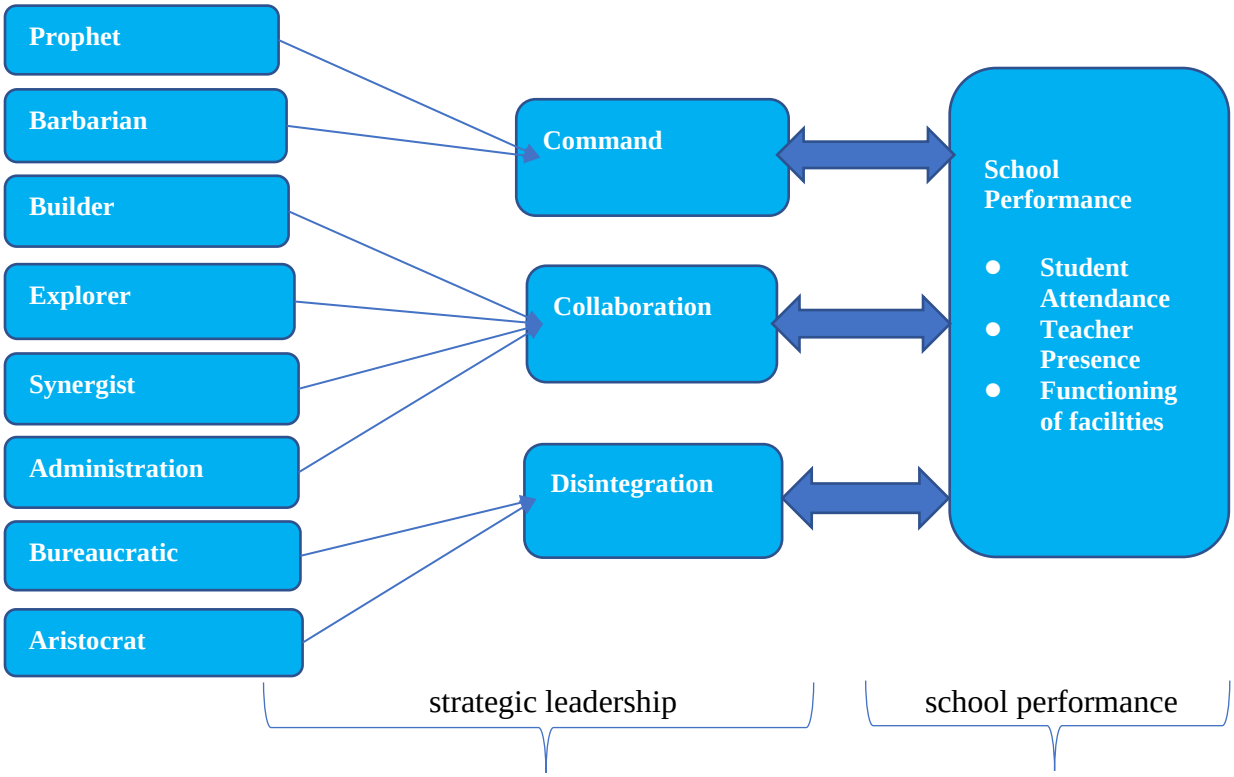
Performance of an organization considered as an indicator of achievement and reflects the success of its leadership behaviors. Moreover, the organizational performance also mirrors the dynamics of organizational life cycle (Carmeli et.al., 2009). Leadership styles always helps to strengthen the intra-organizational relationships which is a necessary drive of employee creativity and effectiveness in long run (Kim et al., 2019). Therefore, over the last two decades, the key focus for those who led have been school effectiveness and performance (Davies & Davies, 2004). Leaders needs to be act strategically to achieve the organizational targets efficiently and effectively (Deeboonmee, 2013). Most of the theoretical work on strategy leadership is related to management and organizational settings and there is still very limited researches are dedicated to these issues in educational setting (Carvalho et al., 2021). The current study helped the researchers to understand the importance of strategic leadership styles for school performance. Jaleha and Machuki (2018) reported that many conceptual and empirical studies have witnessed that strategic leadership has significantly influenced on the organizational performance (Quigley & Graffin, 2017; Ireland and Hitt, 1999). However, Morales et al. (2008) pointed out that there are also substantial studies available which seek to find out direct and indirect path relationship between strategic leadership and performance but failed to

do so due to unidentified situational factors including confounding and intermediate variables (Knies et al., 2016). Thus this paper seeks to fill the research gap by discussing the empirical evidence and aimed to find out the relationship between strategic leadership styles of heads on schools performance in Pakistani context.

2.3 Conceptual Framework

Following conceptual framework was used to find out the relationship between variables.

Figure 3. *Conceptual Framework of the Study*



3. Methodology

Correlational research method was used to find out the relationship between strategic leadership styles of head teachers and school performance at secondary level. For this purpose, all the heads, working at the secondary schools in Tehsil Sargodha was considered population for this study. There are 171 secondary schools in this Tehsil. So by employing cluster sampling technique, data was collected from all the head teachers. However, only 58% participants returned the questionnaire.

3.1 Instruments

To find out if head teachers were using strategic leadership styles or not, Strategic Leadership Styles Instrument by Gaylord Reagan (1998) was adopted to collect the data. According to this scale, there are eight leadership styles which sums up to make strategic leadership style of heads. The instrument was based on Thurstone scale ranging from 1-8 (least accurate to you and your behaviour to the most). There were total 40 statements divided into three factors command, collaboration and disintegration. These three factors further divided into five groups of sub-factors. The second variable of the study was school performance. School performance was limited to only three indicators i.e. student attendance, teacher presence and functioning of facilities available at school and school performance data was taken in percentages from the website of Programme Monitoring and Implementation Unit (PMIU). https://open.punjab.gov.pk/schools/home/districts_performance/.

3.2 Data Collection and Analysis

All head teachers were gathered at "Quaid-e-Azam Academy for Educational Development (QAED/GCET) Sargodha" for 8-days training on School Leadership Development Programme of Head teachers. Data was collected during training session in person.

Descriptive and inferential statistics were applied to analyze the data. Result of analysis has been explained as findings.

4. Results, Findings and Discussion

The findings of the current study were as follows:

TABLE 1. Mean of the factors of strategic leaderships style

Variable	Mean
Command	4.54
Collaboration	4.73
Disintegration	3.96
Strategic Leadership Style	4.41

It is inferred from the table that collaboration has highest mean (4.73), followed by command (4.54) and disintegration (3.96).

Hypotheses

$H0_1$.There is no relationship between the command, collaboration and disintegration styles of strategic leadership and school performance

TABLE 2. Correlation between Strategic Leadership styles and School Performance (N=100)

Variable	Mean	r	Sig.
Command	4.54	.277**	.005
Collaboration	4.73	-.246*	.014
Disintegration	3.96	-.015	.885
Strategic Leadership Styles	4.41	.199*	.047

**p < .001 (2-tailed), *p< .005 (2-tailed)

It is noted that there is a positive and weak correlation (r= .277, p=.005) found between command and school performance and there is negative and weak correlation (r= -.246, p=.014) found between collaboration and school performance. Also, negatively insignificant correlation (r= -.015, p=.885) found between collaboration and school performance. Furthermore, positive correlation (r= .199, p=.047) found between overall strategic leadership styles and school performance.

$H0_2$.There is no significant effect of command, collaboration and disintegration styles of strategic leadership on performance of school.

TABLE 3. Strategic Leadership Styles and School Performance (N=100)

Variable	B	β1	R2	df	F	Sig
Constant	93.04	.277	.07	99	8.157	.005
Command	.557					
Constant	99.59	-.246	.06		6.323	.014
Collaboration	-.85					
Constant	86.80	.199	.04		4.035	.047
Strategic Leadership Styles	1.98					

Table III. explained that command style of strategic leadership predicts the significant amount of variance in the school performance as F (1, 98) = 8.157, p=.005, R2 = .07. The regression coefficient (β1=.277) indicated that any slight change in command style of strategic leadership may predict the changes in school performance. The collaboration style of strategic leadership predicts the significant amount of variance in the school performance as F (1, 98) = 6.323, p=.014, R2 = .06. The regression coefficient (β1=-.246) indicated that any slight change in collaboration style of strategic leadership

may predict the inverse changes in school performance. Therefore, strategic leadership styles predict the significant amount of variance in the school performance as F (1, 98) = 4.035, p=.047, R2 = .04. The regression coefficient (β1=.199) showed that any slight variation in strategic leadership styles may predict the changes in school performance.

This study investigated the relationship between head-teachers' strategic leadership styles with school performance. For this study, positive, significant but week correlation found between strategic leadership styles of heads with school performance. Findings of this study are aligned with study of Bett and Bett (2021) as they found significant effect of strategic leadership on school performance. Furthermore, Jabeen and Ch (2021) found week but significant relationship between leadership competencies and school performance. Quigley and Graffin (2017) supported the aforementioned findings that strategic leadership has a significant impact on organizational performance. Therefore, it is crucial for researchers and scholars to identify those key behaviors of leaders which leads to improved performance of organizations (Mutia, 2015; Jansen et al., 2009; Jouste & Fourie, 2009). Moreover, emphasizing the similar notion, Crossland and Hambrick (2011) said that top leadership roles have sufficient effect on their organizational performance through their strategic choices.

5. Conclusion

This study concluded that school heads needs to be aware of their strategic leadership styles so they may practice them to improve the school performance. Furthermore, regression analysis indicated that strategic leadership style of head teachers effects the school performance to some extent.

6. Future Recommendations

As school leaders have significant importance in improving the performance of their schools, so seminars and dialogues may be organized to enhance the importance of strategic leadership styles of heads. Practical activities may be conducted for head teachers to increase the use of strategic leadership styles through workshops in real context. Furthermore, staff having experience in educational administration may provide comprehensive and specific instructions for putting strategic leadership techniques into practice so to increase school performance.

As this study was conducted in one district only, similar research on different samples and across diverse population may be needed to determine how strategic leadership styles would affect school performance with respect to gender and experience of teachers. Furthermore, researchers may use other research methods such as case study, experimental to explore variables of this study.

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AIRPORT ROAD, SUKKUR-65200, SINDH, PAKISTAN
PH: 071-5644290 - 5644240