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A Holistic Approach to Enhance the Leadership Skills of Engineering Students

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ABSTRACT

Students usually begin their engineering education in college or university during the late adolescence (17-20 years). In this dynamic period of lifespan, the need, importance, dimensions and impact of leadership skills in the overall development of a person through education is deconstructed in this paper. The researcher presents the outcome of an experimental study on holistic education programme and its impact on the leadership skills of engineering undergraduate students. The research design of this study was single group pre-test, post-test and delayed post-test experimental design. The sample consisted of students pursuing first year engineering programme from a University in India. The researcher developed and standardised a training programme with the support of the relevant literature and the subject experts. Statistically, significant impact was observed on the leadership skills of the students in all the dimensions after the intervention programme.

Keywords-- Holistic Education, Impact, Leadership Skills, Leadership Skills Inventory

I. INTRODUCTION

The goal of education is not just information but formation and transformation. Any education institution should aim at realising the holistic and integral development of students. Integral formation involves developing various kinds of skills and competencies like leadership skills, emotional competence, and social competence and so on. Thus, keeping the expectations of any educational institution in mind this study was taken to develop a training programme called 'Holistic Education' to enhance leadership skills in engineering students.

II. LEADERSHIP SKILLS

Leadership is a complex, multidimensional concept that involves several personality traits and skills (Whitehead, 2009; Komives, Lucas & McMahon, 2007)00. There were two twenty-one definitions on leadership published between 1900 and 1990 (Rost, 1991 as cited in Hackman & Johnson, 2009)00. The concept of leadership could be understood in various perspectives such as the person, the position, or the process (Grint, 2010)0. According to Gupta (2011) leadership is a process of influencing, guiding or directing the followers for vision and mission for the achievement of certain goals or shared objectives0. Hackman and Johnson (2009) gave the four themes related to leadership: what one is (traits), how one acts (influence), what one does (followership), and how one works with others (collaboration). In general, a leader is a person who can inspire and motivate others to do what he or she wants them to do with a feeling of happiness (Kumar& Hsiao, 2007)0.

Various research studies on the leadership skills have pointed towards an improvement in leadership through training (Roets, 1988; Karnes & Stephen, 1999; Malik, 2001)000. Everyone has the spark of leadership within; it can be in various roles as a volunteer in non-profit institutions, government profession, business, education institutes and so on. Leadership skill training will help one to understand where to use his leadership talent to serve others (Segneri, cfChildren.org)0. Leaders are not born, but leadership is learned through training on the principles, tasks and tools of leadership, along with experience and practice (Pinnow, 2011)0. Roets (1988) states that skilled leadership can be taught as an art, it must be practised and mastered. So, opportunities to exercise leadership qualities should be encouraged through the school or college curriculum.

The present study assumes that leadership can be developed through training and experience. The leadership skills explored in this study include nine skills as explained

by Karnes and Chauvin (2005)0. The nine skills are as follows:

1. Fundamentals of Leadership (FL): It refers to the basic knowledge of the terms, and styles of leadership. It is the ability to understand one's leadership style and the responsibility of the position one holds.

2. Written Communication Skills (WCS): It is the ability to write to persuade others. It consists of knowledge about the source of information, presenting one's ideas clearly, distinguishing facts from opinions.

3. Speech Communication Skills (SCS): It is the ability to speak in a clear manner, express feelings, active participation in discussion and debates, defend and state one's viewpoint clearly, listen to others carefully and being honest and sincere in speaking.

4. Character-building Skills (CBS): It involves an understanding of one's feelings, to be sensitive to other's needs, to have respect for the right of others, doing what one speaks, having personal convictions and standard, willing to accept mistakes, being loyal, etc.

5. Decision-making Skills (DMS): It refers to the ability to understand the steps and skills in decision making, to analyse the facts for decision making, based on the facts deciding quickly and accurately, ability to reach legal conclusions, etc.

6. Group dynamic Skills (GDS): It is the ability to convene a meeting, group discussion, to do brainstorming, understand the viewpoint of others, conflict resolution, giving credit and praise for other's work, etc.

7. Problem-solving Skills (PSS): This includes one's capability to understand various methods of problem-solving, identifying the problem, select the best way to solve the problem among different options, evaluation of the strategies.

8. Personal Skills (PS): It refers to one's ability to be self-confident, understanding the strengths and weaknesses, accepting mistakes and constructive criticisms, being persistent, honest, dependable, making friends smoothly, empathetic and so on.

9. Planning Skills (PlS): It is the ability to set goals for oneself and the group, set objectives to attain the goals, set measures to check the output, take the initiative in group planning, seeking the opinion and suggestions of experts, accepting change, a delegation of authority, review of strategy time to time.

III.   HOLISTIC EDUCATION

Shroff (2012) outlined that the main objective of life skill education is to enable students todevelop self-confidence and an awareness of oneself as a worthy citizen of the society0. Besides acquiring knowledge, students should have social skills, emotional balance, time management skills, financial literacy, health consciousness, and problem-solving skills. Holistic education prepares one to lead a creative, meaningful,

purposeful, and ethical life in this ever changing and complex world (Adeolu, 2011)0.

The researcher designed the facilitative tool of 'Holistic Education Intervention Programme' used in the present study. This instructional material consisted of 20 sessions of two hours each in the classroom, one-day outing to an amusement park, and two days and one night stay in a village. The sessions were aimed at introducing the concepts of human values, social competence training, and leadership skills training.

IV.   NEED AND SIGNIFICANCE OF THE STUDY

As Mohanty and Dash (2016) puts its higher education in general and engineering education, particularly, needs a paradigm shift to meet the challenges faced by the professional communities in a multidisciplinary dynamic ever-changing world0. Engineering education should be more than the just transmission of technical knowledge; skills such as creativity, oral and written communication, critical thinking, interpersonal skills, management skills, collaboration and teamwork, and visionary leadership skills should be part of the curriculum and pedagogy. The article by Farr and Barzil (2009) explores the changing nature of engineering and addresses why leadership skills are so important in an engineering career0. According to them, leadership development programs should be part of undergraduate level education in engineering to understand the importance of leadership skills for subsequent career growth. This article concludes that judicious mix of hard and soft skills is required to guarantee long-term success. As Russel and Yao (1997) state, 'an engineer is hired for her or his technical skills, fired for poor people skills, and promoted for leadership and management skills'0. Colleges and universities are criticised by the practising professionals very often saying that educational institutions are producing engineers who are intellectually and technically gifted, however, not equipped for real world engineering life (Bakos, 1997; Nair, 1987)00.

There are not many research studies available on holistic education in relation to leadership skills of engineering students. This study will fill the gap and give a substantial contribution in the training of engineering students to improve on their skills. The researcher hopes that the findings of this study will create a greater awareness among the academicians, educational administrators and policy makers of technical educational institutions about the need for a mandatory course in holistic education, which will enhance leadership skills.

V.   OBJECTIVES

1. To measure the leadership skills of engineering students.

2.To find out the impact of holistic education intervention programme on leadership skills of engineering students.

VI.   HYPOTHESIS

There is no significant difference in the leadership skills of students in the pre-test, post-test and delayed post-test phases of the Holistic Education intervention.

VII.   METHOD

Tool for Data Collection
The leadership skills of the students were measured by the Leadership Skill Inventory (LSI) developed by Karnes and Chauvin (2000) which was adapted and standardised for the Indian population by Devassy and Raj (2012)00. This scale has 125 items. The reliability by Cronbach alpha was 0.98, and the intrinsic validity was 0.96 based on the square root of Guttman split-half reliability. The reliability scores of the subscales are fundamentals of leadership 0.85, written communication skills 0.83, speech communication skills 0.85, character building skills 0.93, decision-making skills 0.82, group dynamics skills 0.89, problem-solving skills 0.78, personal skills 0.92, and planning skills 0.87.

Participants of Intervention
Fifty-five students from the first-year engineering class of a university in Bengaluru were selected for the present intervention study using stratified random sampling method. The students included 31 boys and 24 girls from all specialisations and representing various religions and other demographic features.

Research Design
The present study was an experimental study with Pre-test, Post-test, Delayed Post-test Single Group Design. The Study was conducted in three phases.
•   Phase 1: Preparation and Validation of Holistic Education Intervention Programme Modules, and Pre-test
•   Phase 2: Holistic Education Programme as an Intervention
•   Phase 3: Post-test and Delayed Post-test
Normality of scores is tested with Shapiro-Wilk test of normality. The significance of the differences at various phases of the research is tested with repeated measure of ANOVA and Friedman's ANOVA. The effect size was measured by Partial eta squared, and Kendall's coefficient of concordance.

Procedure
The researcher explained the purpose of this study in detail to the participants and the university authorities. Informed consent was taken from the students with the approval of the University authorities. The measures of leadership skills was given to the participants on the first day of interaction itself.   The next day onwards six sessions of two hours each on social competence were administered to the students. After that, a unit test was conducted. Then six sessions of two hours each on leadership skills were conducted to the students. Another unit test was done again. Six sessions of two hours each on various values were discussed on the following days. A unit test for that was done again. A one-day excursion was planned after that. The researcher gave the objectives of that tour, and the students made all the arrangements and went to an amusement park in Bengaluru. Then the researcher conducted a session on rural India and the students organised two days and a night stay in a village in Bengaluru. In the concluding session of the intervention, feedback was taken from the participants about the programme and the measures of value preference, social competence, and leadership skills were administered. After one month of the intervention, the participants gathered again, and the measures were re-administered for a delayed post-test.

VIII.   RESULTS

Summary of Repeated measure ANOVA and Friedman's ANOVA performed for Leadership Skills is presented below.

TABLE 1
LEADERSHIP SKILLS AT PRE-TEST, POSTTEST AND DELAYED POST-TEST PHASES(*Complete, N = 55*)

Variables	Phases						F	$\eta p2$
	Pre-test		Post-test		Delayed post test			
	M	SD	M	SD	M	SD		
CBS	33.89	5.29	44.02	3.57	44.15	3.68	250.327**	.823
DMS	16.93	3.39	23.75	2.30	23.82	2.37	279.327**	.838
FL	13.65	3.74	21.16	3.20	21.09	3.32	223.085**	.805
GDS	33.31	6.59	46.33	5.07	46.40	5.06	224.004**	.806
PIS	25.91	5.88	38.84	4.65	39.05	4.75	251.674**	.823
PS	36.51	7.12	52.33	4.51	52.29	4.56	284.757**	.841
PSS	9.20	2.52	13.36	2.01	13.42	2.05	102.878**c	.935d
SCS	20.05	5.59	31.60	3.83	31.78	3.92	101.799**c	.925d
WCS	15.89	5.78	26.35	4.26	26.31	4.27	235.013**	.813
Total	205.64	39.67	295.43	29.62	298.31	28.85	368.455**	.872

** $p < .01$, [c] chi square statistic for Friedman ANOVA, [d] Kendall's W

Summary of Repeated measures of ANOVA and Friedman ANOVA presented in the Table 1 indicate that scores of all dimensions of leadership skills such as CBS (character building), DMS (decision making), FL (fundamentals of leadership), GDS (group dynamics), PIS (planning), PS (personal), PSS (problem solving), SCS (speech communication) and WCS (written communication), and total of all participants significantly increased at various phases of the intervention, F = 250.327, 279.327, 223.085, 224.004, 251.674, 284.757,

235.013, 368.455, p< .01.□□□= 102.878, 101.799, p< .01. Effect size of the intervention on the leadership skills are 82.3 %, 83.8 %, 80.5 %, 80.6 %, 82.3 %, 84.1 %, 93.5 %, 92.5 %, 81.3 %, and 87.2 % respectively.

TABLE 2
PAIRWISE COMPARISON FOR LEADERSHIP SKILLS WITH BONFERRONI CORRECTION

(I) Phase	(J) Phase	Mean Difference (I-J)									
		CBS	DMS	FL	GDS	PIS	PS	PSS [e]	SCS [e]	WCS	Total
Pre test	Post test	10.12*	6.81*	7.50*	13.01*	12.92*	15.81*	7.43*	7.58*	10.45*	92.38
	Delayed post test	10.25*	6.89*	7.43*	13.09*	13.14*	15.78*	7.72*	8.15*	10.41*	92.96
Post test	Delayed post test	.127	.073	.073	.073	.218	.036	.286	.572	.036	.582

[*] $p < .05$, [e] Non parametric pairwise comparison (Z statistics)

Results of pairwise comparison of the scores of leadership skills of the male participants, indicate that scores of CBS (character building), DMS (decision making), FL (fundamentals of leadership), GDS (group dynamics), PIS (planning), PS (personal), PSS (problem solving), SCS (speech communication) and WCS (written communication), and total are significantly increased from pre-test phase to post-test phase of the intervention, MD = 10.12, 6.81, 7.50, 13.01, 12.92, 15.81, 10.45, 92.38, p< .05, Z = 7.43, 7.58, p< .05. But the increment in the scores from the post-test phase to delayed post-test phase are found to be insignificant, MD = .127, .073, .073, .073, .218, .036, .036, .582, p> .05, Z = .286, .572, p> .05.

IX.   CONCLUSIONS

The main objective of this experimental research was to find the impact of Holistic Education on the leadership skills of Engineering students.   A null hypothesis was formulated and tested for its statistical significance. The results show that the Holistic Education intervention programme has impacted the leadership skills of engineering students. Based on this findings the null hypothesis was rejected. Also, it is observed that Holistic Education has enhanced significantly all the important nine dimensions of leadership skills of students namely fundamentals of leadership, decision-making skills, character building skills, group dynamics skills, planning skills, personal skills, problem-solving skills, speech communication skills, and written communication skills.

X.   LIMITATIONS OF THE STUDY

1. The sample of the study is restricted to one engineering college of a University. The differences in the university background, culture, core values, or ambience may affect the variables.
2. The sample is selected from the city of Bangalore only. Universities from various metropolitan cities, and other small towns, or in the rural or urban background could have affected the variables.
3. The Holistic Education Programme was administered by one instructor. Depending on the passion and enthusiasm of the instructor the impact also may vary a certain extent.

XI.   IMPLICATIONS

The study has implications for both practice and further research. The investigation results revealed that there is a significant difference after the intervention of Holistic Education programmefor the leadership skills of engineering students. While in India, the education focuses more on academic achievement compared to other skills like social competence, and leadership skills Holistic Education program could be included in the curriculum of students to develop their competencies to make them productive citizens of the society (Thomas & Swamy, 2015) [23].

Through this study, it is understood that the leadership skills of students could be improved by systematic training. Every university curriculum shall include modules to understand the concept of leadership, to comprehend the various approaches to leadership, to appreciate the skills required for effective leadership such as effective followership, good communication, goal setting, effective decision making, critical thinking, humility and self-assertion. This kind of training will help the students to develop an in-depth understanding of leadership concepts and will develop a better understanding of good leadership behaviour as a skill set that can be practised and improved upon.

Students could go on a tour as part of leadership skill training wherein they participate in all the activities and have fun doing so. During the trip, students learn to interact with each other. They imbibe and practice the values of discipline, safety, cooperation, trust, faith, tolerance, adjustability, empathy, consideration, and understanding. They also build self-confidence and leadership while enjoying themselves. They will learn how to inculcate values of discipline, adjustability, and co-operation and will demonstrate leadership in different situations. During the entire trip, different student leaders shoulder various responsibilities; demonstrate situational leadership, camaraderie, adjustability, and co-operation. During the tour, the trainer could monitor the behaviour of the students inside the vehicle, at the venue and during various activities with gentle reminders on appropriate social behaviour and safety norms.

This study shows the importance of Holistic Education Programme to initiate a meaningful and creative learning environment in the campus and classrooms. All the educational institutes and policy makers shall encourage the concept of introducing Holistic Education programme in the classroom and workplace. It would be advisable that the policy makers like University Grant

Commission (UGC) and National Council for Teacher Education (NCTE), make the decision to implement Holistic Education Programme in all colleges and universities. Finally, it is suggested that these Holistic Education Programme developed by the researcher could be used in the training of teachers and all the principals and policy makers in the field of higher education. Thus, the present research has considerable implications for education in which the basic objective is the integral development of a student.

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