

The Role of the National Service Scheme in Fostering Social Skills Among Engineering Graduates

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Abstract : This study embarks on a captivating journey into the realm of National Service Scheme (NSS) engagement, delving deep into its impact on the multifaceted landscape of social skills development among engineering graduates. With data meticulously collected from engineering graduates, who graduated from NMAM Institute of Technology between the years 2021 and 2023, we employ rigorous statistical analysis, guided by SmartPLS 4.0, to unveil the intricate connections between NSS engagement outcomes, vital mediating variables, and the ultimate manifestation of these synergies in the form of overall social development. Through a panorama of hypotheses testing, mediation analysis, and meticulous exploration, our findings offer compelling insights into the transformative potential of NSS engagement. These revelations extend a resonating call to educators, employers, and policymakers to collaboratively nurture an empowered generation poised to flourish within a socially interconnected world.

Keywords: NSS; Social Skills; Engineering; Graduates; Community Service.

1. Introduction

The realm of higher education has undergone a remarkable transformation, transcending the traditional boundaries of academic excellence. As educational institutions strive to nurture graduates who can navigate a dynamic and interconnected world, the quest for holistic development and essential life skills has taken center stage. Beyond the acquisition of knowledge lies the deeper aspiration of nurturing well-rounded individuals equipped with the social competencies needed to thrive in diverse personal and professional environments. Amidst this evolving educational landscape, the significance of engaging students in community service and extracurricular activities has garnered increasing attention (Pinto & Reshma, 2021). These pursuits offer a unique avenue to foster personal growth, cultivate empathy, and hone critical interpersonal aptitudes, complementing the rigors of academia. Central to this journey of transformative experiences stands the National Service Scheme (NSS), an esteemed youth-centric initiative that has left an indelible mark on the canvas of society.

The NSS, as an embodiment of selflessness and social responsibility, beckons students to embark on a journey of service and personal growth (Patel, 2016).

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This nationwide program endeavors to instill a sense of volunteerism and empathy, urging young minds to contribute meaningfully to the well-being of society. Embracing the principles of social service, leadership, and cooperation, the NSS forges a unique tapestry of altruistic endeavors, weaving together the aspirations and dreams of countless young hearts (Pradeep et al., 2019). While the contributions of the NSS to societal development are well-recognized, its impact on the social skills and personal growth of students, particularly among engineering graduates, demands closer examination. As future engineers, these graduates bear the responsibility of transforming technical knowledge into real-world solutions, demanding not only technical proficiency but also the artistry of communication, the synergy of teamwork, the resilience of leadership, and the adaptability to ever-changing circumstances. Hence, this study aims to explore the pivotal role of the NSS in developing social skills among engineering graduates. As a vital component of emotional intelligence, social skills encompass a diverse array of attributes, including effective communication, teamwork acumen, leadership prowess, and adaptability (Hirudayaraj et al., 2021). The study seeks to illuminate the nuanced connections between NSS engagement and the blossoming of these essential interpersonal competencies.

To unveil the intricate web of relationships, the study employs the Smart Partial Least Squares (PLS) analysis, a robust statistical approach that discerns the complex interplay of variables. The utilization of the Smart PLS tool allows for a rigorous investigation into the relationships between NSS engagement and social skill development among engineering graduates, providing valuable insights into the transformative power of community service experiences. By traversing the landscape of academic literature and delving into empirical exploration, this research aspires to contribute to the growing body of knowledge in the field of education and youth development. The revelations unearthed in this quest shall not only empower academia to fine-tune their educational offerings but also enable industry recruiters to recognize the profound value of NSS experiences in prospective employees. Beyond institutional realms, this study seeks to ignite conversations among policymakers and visionaries, guiding the design of community service initiatives that nurture socially responsible and adept leaders capable of addressing the challenges of our times.

2. Theoretical Background and Hypotheses Development

A. About NSS

The NSS stands as a revered bastion of transformative youth engagement, embodying the noble aspirations of social responsibility, community empowerment, and national development. Conceived by the Government of India in 1969, this prestigious program operates under the aegis of the Ministry of Youth Affairs and Sports, bestowing upon young citizens an opportunity to cultivate the virtues of volunteerism, empathy, and leadership (National Service Scheme, 2023). With its resplendent presence in educational institutions across the nation, encompassing universities, colleges, and schools, the NSS offers an illustrious platform for students to become architects of change. Through an array of community service activities, spanning from rural development projects, environmental conservation, and healthcare initiatives to educational campaigns and awareness programs, the NSS forges a profound connection between learning and societal transformation. At the heart of the NSS philosophy lies the sacred belief in the university as a crucible of personal and social metamorphosis. The motto of the watchword of the NSS is not me but you. By nurturing the spirit of selfless service, the program kindles a fire of benevolence, empowering students to embrace the ethos of social consciousness and extend their compassion to the farthest reaches of society. Diversity becomes the harmonious refrain within the NSS as its doors welcome students from diverse backgrounds, transcending the boundaries of caste, creed, religion, and economic disparity. This grand tapestry of unity in diversity fosters an environment of inclusivity and mutual respect, where young minds converge with a shared vision to contribute to the greater good. An integral hallmark of the NSS is its profound commitment to sustained engagement. Through a two-year enrollment period, student volunteers embark on an enduring journey of meaningful service, immersing themselves in regular and special camping activities that further fortify their dedication to the cause of social welfare. Over the annals of time, the NSS has etched indelible imprints upon the contours of societal development, serving as an emblem of youth-driven nation-building. Empowered by the transformative experiences of the NSS, countless young leaders have emerged, carrying the mantle of social responsibility and illuminating the path toward a brighter future. Endowed with a

legacy of impact and purpose, the NSS continues to be a beacon of inspiration, beckoning the youth of today to embrace the mantle of service with humility and dedication. Its luminous contributions serve as a testimony to the immense potential of the young to shape the destiny of a nation.

B. NSS Engagement & Social Skills

Social skills refer to a set of interpersonal competencies and abilities that enable individuals to navigate social interactions effectively, build and maintain positive relationships, and communicate with others in a constructive and empathetic manner (Jurevičienė et al., 2012). According to the trait model, social skills encompass a wide range of behaviors, including active listening, assertiveness, conflict resolution, teamwork, empathy, emotional intelligence, and leadership (Nezlek et al., 2001). Literature reveals that social skills are essential in various aspects of life, from personal relationships to academic and professional environments. According to Matson et al. (1983), individuals with strong social skills are more likely to experience higher levels of social support, lower levels of social anxiety, and enhanced self-esteem. Wentzel & Looney (2007) argued that in educational settings, students with well-developed social skills are better equipped to collaborate in group projects, participate in class discussions, and seek help from teachers when needed. Within the workplace, social skills are critical for effective teamwork, leadership, conflict resolution, and customer interactions (Wu et al., 2012). Employers increasingly value social skills, recognizing their contribution to employee productivity, job satisfaction, and team cohesion (Grant et al., 2009). A meta-analysis conducted by Joseph et al. (2015) demonstrated a significant positive relationship between social skills and job performance across various industries. Research has also highlighted the relevance of social skills in mental health and well-being. Individuals with well-developed social skills tend to have better mental health outcomes, reduced levels of stress, and increased resilience to cope with life challenges (Cacioppo & Patrick, 2008). Socially skilled individuals also experience lower levels of loneliness and social isolation, leading to improved overall quality of life (Qualter et al., 2010). Within the sphere of nurturing essential interpersonal competencies among engineering graduates, acknowledging the pivotal impact of social skills in alleviating loneliness and social isolation becomes paramount. Beyond

academic strides, delving into the role of NSS engagement holds heightened importance, encompassing both professional progression and personal enrichment. This exploration equips individuals with indispensable proficiencies, guiding their journeys through careers and human connections with finesse and empathy. The literature further underscores that honed social skills amplify overall life quality, underscoring the relevance of comprehending the nexus between NSS engagement and social skill development (Lal, 2015). By investigating how NSS engagement can positively influence the acquisition of these social skills, this study seeks to illuminate the potential of NSS in catalysing the creation of a supportive and socially enriched environment for engineering graduates. Moreover, the study aims to shed light on the broader implications of such social skill development, as it may empower graduates to navigate social challenges, build stronger professional networks, and contribute meaningfully to their communities, thereby enhancing their overall life satisfaction and success. Within the ambit of the investigation into the role of NSS in fostering social skills among engineering graduates, social skills assume a paramount position as latent constructs pivotal to the research framework. The present study acknowledges that social skills encompass a wide array of interpersonal competencies and behaviors. However, in this research, we specifically concentrate on four key social skills: communication skills, teamwork acumen, leadership prowess, and adaptability. These particular social skills have been chosen due to their profound impact on personal development, academic performance, and professional readiness among engineering graduates engaging in the NSS.

1. Communication Skills

Communication is a dynamic process involving the exchange of symbolic interactions to share and attribute meaning (Seiler & Beall, 2005). It encompasses purposeful exchanges of ideas, opinions, and information with specific objectives (Iksan et al., 2012). A study conducted by Khandare and Desai (2016) examined the influence of NSS engagement on communication skills development among university students. The study's findings indicated that NSS participation led to significant improvements in both verbal and written communication skills. The research highlighted how NSS experiences served as a platform for students to

practice and enhance their communication abilities, positively impacting their interpersonal effectiveness and adaptability. As effective social interaction relies on communication skills, NSS engagement becomes crucial in honing these skills. Through community service activities, NSS volunteers encounter diverse communication scenarios, requiring clarity in expression and active listening. In the context of the study, exploring NSS experiences delves into how communication skills among engineering graduates are enhanced, empowering them to articulate ideas and collaborate proficiently with others. Based on the findings from the study by Khandare and Desai (2016) that NSS engagement leads to significant improvements in communication skills among university students, we hypothesize the following:

H1: NSS engagement outcome (NSEO) has a significant positive impact on the development of communication skills (CS) among engineering graduates.

2. Teamwork Acumen

Teamwork abilities encompass the capacity to work cohesively with others, leveraging diverse strengths, and collectively achieving shared goals (Harris & Harris, 1996). Studies exploring the effects of teamwork acumen on university students have consistently demonstrated that individuals with strong collaborative abilities excel in group projects and exhibit a higher level of adaptability and problem-solving skills (Beigi & Shirmohammadi, 2012). Based on the research conducted by Nzewi et al. (2015), it was discovered that the collaboration and teamwork within the selected transport companies led to an increase in their revenue. Phina et al. (2018) discovered that team collaboration had a strong and positive impact on employee performance, leading to various benefits such as increased productivity, improved organizational performance, competitive advantages, and higher levels of product quality and quantity. In a similar vein, the implementation of community engagement activities resulted in nursing students gaining improved teamwork skills (Tawfik & El-Sayed, 2018). In the context of NSS engagement, participants are provided with a practical platform to develop and refine these teamwork acumen qualities, preparing them for successful collaboration in future academic and professional endeavors. NSS participants are immersed in diverse team environments during community service projects, where effective teamwork is crucial for achieving

project objectives and making a positive impact. As NSS participants actively engage in community service and collaborate to address real-world challenges, they acquire valuable teamwork acumen, contributing to their personal growth and adding a sense of social responsibility. Additionally, teamwork acumen is highly valued in the workplace, making NSS engagement a valuable experiential learning opportunity for future career success. According to Hairi et al. (2011), employers recognize the value of professionals who can effectively collaborate with colleagues, build strong team dynamics, and navigate diverse situations. All of which are fostered through NSS experiences. Drawing on the extensive literature highlighting the significance of teamwork acumen in various domains, including education, professional settings, and community involvement, we hypothesize the following:

H2: NSS engagement outcome (NSEO) has a significant positive impact on the development of teamwork acumen (TA) among engineering graduates.

3. Leadership Prowess

Embodying the pinnacle of social skills, leadership encompasses the art of guiding and inspiring others toward shared goals (Kunich & Lester, 1999). Numerous studies in the literature highlight how community engagement fosters leadership skills among individuals. By providing real-life experiences and opportunities to lead community-driven initiatives, community engagement allows individuals to practice and refine their leadership abilities (Hastings et al., 2011). Through effective communication, collaboration, and decision-making in diverse and dynamic environments, leaders emerge with heightened competencies, motivating and inspiring others to drive positive change within their communities (Colby et al., 2009). Engaging with stakeholders and addressing community needs also nurtures empathy, resilience, and a sense of responsibility, culminating in the development of ethical and sustainable leaders who can make a meaningful impact on society (Faraazlina & Zunurain, 2017). Within the context of NSS engagement, leadership competencies serve as a driving force behind successful community service projects. Participants taking on leadership roles learn to communicate effectively, motivate team members, and resolve conflicts, which are vital aspects of

guiding projects to successful outcomes. Students participating in NSS are provided with practical opportunities to develop and enhance their leadership competencies, empowering them to lead and contribute positively in both academic and professional settings. Given the substantial literature supporting the importance of leadership competencies in community service and the experiential nature of NSS engagement, we propose the following hypothesis:

H3: NSS engagement outcome (NSEO) has a significant positive impact on the development of leadership prowess (LP) among engineering graduates.

4. Adaptability

Adaptability is a vital skill that enables individuals to navigate through dynamic and unpredictable situations with resilience and flexibility (Ployhart & Bliese, 2006). Community engagement has been extensively studied for its influence on adaptability among individuals. Research performed by Pong & Leung (2023) and Arunajanani et al. (2021) demonstrated that community service learning has a positive impact on student's career adaptability. Similarly, Kodancha et al. (2020) revealed that collaborative learning experiences during the Covid-19 pandemic, resembling those in community engagement, positively influenced the enhancement of adaptability among the student fraternity. In the context of NSS engagement, adaptability emerges as a key competency as participants face diverse challenges and opportunities during community service projects. As NSS participants actively engage in community service, they encounter varying circumstances that demand adaptive responses. These experiences allow them to learn how to adjust their approaches, problem-solve, and cope with changing conditions effectively. NSS engagement cultivates open-mindedness, innovation, and long-term thinking, equipping participants with valuable adaptive skills for personal and professional success. Through community service, individuals develop the ability to navigate changing circumstances, embrace innovation, and make meaningful contributions to their communities. Anchored in this narrative, we posit the following hypothesis:

H4: NSS engagement outcome (NSEO) has a significant positive impact on the development of adaptability (AD) among engineering graduates.

5. Overall Development of Social Skills

NSS engagement acts as a catalyst in the symphony of overall social skill development, providing a dynamic stage for individuals to cultivate and refine their communication, teamwork, leadership, and adaptability abilities. Active participation in community service projects and immersive experiences, NSS engagement hones these skills, allowing individuals to navigate the intricate nuances of human interactions with finesse. This transformative journey within NSS empowers participants to harmonize collaborations, embrace change, and emerge as well-rounded individuals adept at orchestrating meaningful contributions in both personal and professional spheres.

In the present study, the focus revolves around NSS engagement outcome as it is the primary driving force behind the development of social skills among engineering graduates. NSS engagement outcome stands as the catalyst, while communication skills, teamwork acumen, leadership prowess, and adaptability collectively act as intermediary factors that help illuminate the intricate process through which NSS engagement impacts the graduates' overall social skill enhancement. This conceptual framework depicted in Fig. 1 aims to unravel the interconnected relationships between these variables, shedding light on the transformative journey from NSS engagement to a comprehensive spectrum of social skills.



Fig. 1: Conceptual Framework of the Study

Building upon our initial hypotheses (H1-H4), our investigation extends to delve into further pathways (H5-H8) that illuminate how each of the intermediary variables impacts the overall development of social skills among engineering graduates. Additionally, hypotheses H9-H12 elucidate each of the intermediary variables' influence on the association between NSS engagement outcome and overall social

skill development. Finally, H13 encapsulates the direct linkage between NSS engagement and the comprehensive enhancement of social skills. Guided by these interdependencies, we put forth the ensuing hypotheses:

H5: Communication skills (CS) have a significant positive impact on the overall development of social skills (ODSS) among engineering graduates.

H6: Teamwork acumen (TA) has a significant positive impact on the overall development of social skills (ODSS) among engineering graduates.

H7: Leadership prowess (LP) has a significant positive impact on the overall development of social skills (ODSS) among engineering graduates.

H8: Adaptability (AD) has a significant positive impact on the overall development of social skills (ODSS) among engineering graduates.

H9: The relationship between NSS engagement outcome (NSEO) and overall development of social skills is mediated by communication skills (CS) among engineering graduates.

H10: The relationship between NSS engagement outcome (NSEO) and overall development of social skills is mediated by teamwork acumen (TA) among engineering graduates.

H11: The relationship between NSS engagement outcome (NSEO) and overall development of social skills is mediated by leadership prowess (LP) among engineering graduates.

H12: The relationship between NSS engagement outcome (NSEO) and overall development of social skills is mediated by adaptability (AD) among engineering graduates.

H13: NSS engagement outcome (NSEO) has a direct positive impact on the overall development of social skills (ODSS) among engineering graduates.

3. Methodology

A. Survey Instrument

A self-administered e-survey was created and distributed to measure six underlying constructs. The

questionnaire was designed based on inputs from experts and scholars. The survey had two sections - Part one focused on the demographic information of the respondents and questions assessing the effectiveness of contextual factors. The second part focussed on NSS engagement and social skills. The questionnaire related to the second part contained 18 statements (indicators) related to 6 different constructs. To ensure its effectiveness, the survey was tested on 25 different students as a pilot study, and minor changes were made based on their feedback. All statements in the survey used a five-point Likert scale, where participants indicated their level of agreement with each statement, ranging from 1 to 5.

B. Sampling and Data Collection

Data for this study was collected from engineering graduates who participated in the NSS programme for two years while pursuing their engineering degree and graduated between 2021 and 2023 from NMAM Institute of Technology, Udupi, Karnataka, India. NMAM Institute of Technology is a constituent institute of Nitte Deemed to be University. A convenience sampling method was used to identify 225 participants to investigate the impact of NSS participation on overall social skill development. The participants were provided with information about the study's purpose, which aimed to explore the relationship between NSS engagement and the development of social skills, including communication, teamwork, leadership, and adaptability. The questionnaire was distributed electronically, and participants were requested to complete and submit it. Detailed demographic information of the participants is presented in Table 1.

C. Data Analysis Tool

SmartPLS 4.0 was chosen as the statistical

Table 1: Demographic Profile of the Respondents

Demographic Features	Data	Frequency (n)	Percentage
Gender	Male	110	49%
	Female	115	51%
Age	22-23 Years	104	46%
	23-24 Years	70	31%
	24-25 Years	51	23%
Year of Graduation	2021	51	23%
	2022	70	31%
	2023	104	46%

software for data analysis in this study due to its user-friendly interface, which simplifies the complex process of conducting structural equation modeling (SEM) analyses. It utilizes the partial least squares (PLS) algorithm, making it suitable for exploratory research with small sample sizes.

Additionally, SmartPLS 4.0 offers robust estimation methods through bootstrapping and allows for multi-group analysis, providing reliable results.

4. Data Analysis Results

A. Contextual Factor Analysis Results

Contextual factors are pivotal in molding the influence of NSS engagement on social skill development. The way NSS programs are implemented, the educational institution's environment, and the efficacy of leadership and mentorship all impact the level and quality of NSS engagement. These dynamic interactions shape participants' experiences and outcomes, emphasizing

NSS's transformative capacity in fostering well-rounded professionals. Table 2 displays the survey responses of the participants regarding contextual factors.

In the first category, i.e., NSS Program Implementation, participants largely agreed that the NSS programme aligned with their personal and professional development goals (78% strongly agreed, 10% agreed). A substantial majority also found the programme's objectives and goals to be very well defined (80% strongly agreed, 18% agreed), indicating a clear sense of purpose. Moreover, 70% of respondents acknowledged the effective organization and structure of NSS activities. Additionally, 86% of participants recognized that NSS programme activities facilitated skill development and learning opportunities. In the realm of the Educational Institution Environment, an overwhelming 85% expressed that their educational institution supported NSS engagement and acknowledged its value. Furthermore, 77% found the resources provided by the institution for NSS activities were accessible,

Table 2: Contextual Factor Analysis Results

Responses: 1- Strongly Disagree 2- Disagree 3- Neutral 4-Agree 5-Strongly Agree					
I. NSS Program Implementation Related					
a) The NSS programme has significantly aligned with my personal and professional development goals, offering enriching experiences that bridge the gap between academia and real-world application.					
Responses	1	2	3	4	5
Percentage (%)	2	2	8	10	78
b) The objectives and goals of the NSS programme are very well defined.					
Responses	1	2	3	4	5
Percentage (%)	0	0	2	18	80
c) NSS programme activities are well organized and structured.					
Responses	1	2	3	4	5
Percentage (%)	1	2	2	25	70
d) NSS programme activities provide opportunities for skill development and learning.					
Responses	1	2	3	4	5
Percentage (%)	0	0	2	12	86
II. Educational Institution Environment Related					
a) The educational institution is supportive of promoting NSS engagement and recognizing its value.					
Responses	1	2	3	4	5
Percentage (%)	2	1	2	10	85
b) The resources (e.g., funding, materials) provided by the institution to support NSS activities are accessible.					
Responses	1	2	3	4	5
Percentage (%)	5	2	2	14	77
c) NSS activities are well integrated into the formal curriculum or co-curricular activities.					
Responses	1	2	3	4	5
Percentage (%)	2	1	1	6	90
III. NSS Leadership & Mentorship Related					
a) The institute NSS leaders are effective in guiding and inspiring engagement in meaningful NSS activities.					
Responses	1	2	3	4	5
Percentage (%)	0	0	2	10	88
b) I am satisfied with the mentorship provided during your NSS engagement.					
Responses	1	2	3	4	5
Percentage (%)	0	0	1	5	94
c) The mentorship positively impacted my personal and professional development during my NSS engagement.					
Responses	1	2	3	4	5
Percentage (%)	0	2	3	4	91

which contributed to a conducive environment. Notably, a substantial 90% indicated that NSS activities were well integrated into the formal curriculum or co-curricular activities, emphasizing the institutional commitment to holistic learning experiences. Turning to the NSS Leadership and Mentorship dimension, an impressive 88% of respondents agreed that NSS leaders effectively guided and inspired meaningful engagement. Regarding mentorship, a substantial 94% expressed satisfaction with the mentorship provided during their NSS engagement, underscoring the importance of guidance. Encouragingly, 91% believed that mentorship had a positive impact on their personal and professional development, highlighting the valuable role mentors play in shaping well-rounded individuals.

B. Measurement Model Analysis Results

The assessment of the measurement model involves evaluating both convergent and discriminant validity. Convergent validity is confirmed through the scrutiny of factor loadings, average variance extracted (AVE), composite reliability (CR), and Cronbach's α . The results, as presented in Table 3, demonstrate that all factor loadings exceed the established threshold of 0.70 (Hair et al., 2017).

Table 3: Summary of Measurement Model

Construct	Items	Factor loading	AVE	CR	Cronbach's α
NSS Engagement (NSEO)	NSEO1	0.808	0.710	0.806	0.796
	NSEO2	0.870			
	NSEO3	0.849			
Communication Skills (CS)	CS1	0.887	0.731	0.809	0.811
	CS2	0.916			
	CS3	0.753			
Teamwork Acumen (TA)	TA1	0.755	0.784	0.865	0.856
	TA2	0.944			
	TA3	0.943			
Leadership Prowess (LP)	LP1	0.781	0.793	0.864	0.865
	LP2	0.940			
	LP3	0.941			
Adaptability (AD)	AD1	0.717	0.659	0.748	0.737
	AD2	0.854			
	AD3	0.856			
Overall Development of Social Skills (ODSS)	ODSS1	0.950	0.811	0.880	0.879
	ODSS2	0.795			
	ODSS3	0.948			

Table 4: Summary of Fornell-Larcker

	NSEO	CS	TA	LP	AD	ODSS
NSEO	0.842					
CS	0.473	0.855				
TA	0.472	0.827	0.885			
LP	0.548	0.414	0.423	0.891		
AD	0.519	0.620	0.670	0.556	0.812	
ODSS	0.486	0.613	0.623	0.507	0.578	0.901

Similarly, the CR scores, and Cronbach's α all above 0.70, align with desirable standards (Sarstedt et al., 2020). The AVE, with a benchmark of 0.50, is well met as evidenced in Table 3. Thus, the cumulative findings affirm the establishment of convergent validity. Additionally, the assessment of discriminant validity follows the Fornell & Larcker (1981) criterion, which juxtaposes the square root of average variance extracted (AVE) against correlation coefficients among constructs. If the square roots of AVE exceed the correlation coefficients of other constructs discriminant validity is established. As shown in Table 4, all square roots of AVE (indicated in bold) surpass the correlation coefficients of other constructs. This outcome affirms that the measurement model attains discriminant validity according to the Fornell-Larcker criterion. As depicted in Fig. 2, the PLS Path model, created using Smart PLS software after performing the PLS algorithm calculations, showcases the relationships among the independent variable (NSS engagement outcome), the dependent variable (overall development of social skills), and the mediating variables (communication skills, teamwork acumen, leadership prowess, and adaptability).

C. Testing of Hypotheses through Structural Model

In Partial Least Squares Structural Equation Modeling (PLS-SEM), the structural model depicts the relationships between latent constructs, illustrating how they interact and influence each other. It's assessed by analyzing path coefficients that indicate the strength and direction of these influences. The assessment involves t-statistics, standard deviation (SD), and standard beta (β) values. The structural model is utilized to test the study's hypotheses. The outcomes of the total effects are presented in Table 5. The Partial Least Squares (PLS) method was applied to assess the proposed relationships. Hypotheses H1, H2, H3, and H4 examine the relationships between NSS engagement outcome (NSEO) and the respective mediators (communication skills - CS, teamwork acumen - TA, leadership prowess - LP, adaptability - AD). H1 investigating the impact of NSS engagement outcome (NSEO) on communication skills (CS), yielded a substantial beta coefficient of 0.473 (SD = 0.062), accompanied by a robust significant t-value of 7.594, unequivocally supporting its acceptance. Similarly, H2, which explored the influence of NSS engagement outcome (NSEO) on teamwork acumen (TA), demonstrated a significant beta coefficient of 0.472

(SD = 0.065) and a noteworthy t-value of 7.225, providing compelling evidence for its acceptance. Hypothesis H3, probing the relationship between NSS engagement outcome (NSEO) and leadership prowess (LP), exhibited a remarkable beta coefficient of 0.548 (SD = 0.062) and an impressive t-value of 8.803, firmly establishing its acceptance. Likewise, H4 investigating the NSS Engagement outcome (NSEO) effect on adaptability (AD), revealed a noteworthy beta coefficient of 0.519 (SD = 0.058) and a substantial t-value of 8.929, solidifying its acceptance. Transitioning to the relationships between individual skills and the overall development of social skills (ODSS), H5 through H8, the results consistently underscored their significance. Communication skills (H5) exhibited a meaningful positive impact ($\beta = 0.231$, SD = 0.101, $t = 2.276$), while teamwork acumen (H6) showcased a parallel contribution ($\beta = 0.234$, SD = 0.112, $t = 2.088$). Further, leadership prowess (H7) and adaptability (H8) also demonstrated noteworthy influences ($\beta = 0.229$, SD = 0.060, $t = 3.838$; $\beta = 0.151$, SD = 0.080, $t = 1.894$), further validating the acceptance of these hypotheses.

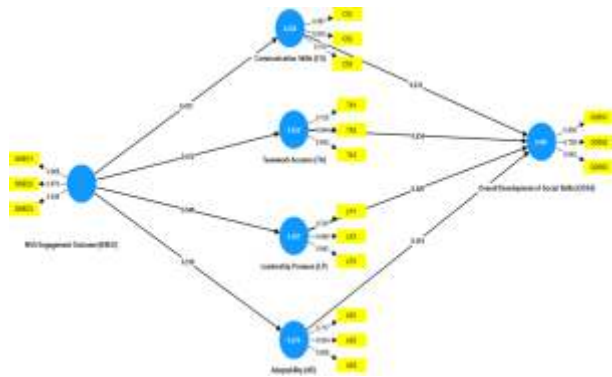


Fig. 2: PLS Path Model

Table 5: Summary of Total Effects

Hypotheses	Relationship	Beta (β)	Standard Deviation (SD)	t-value	Decision
H1	NSEO \rightarrow CS	0.473	0.062	7.594**	Accepted
H2	NSEO \rightarrow TA	0.472	0.065	7.225**	Accepted
H3	NSEO \rightarrow LP	0.548	0.062	8.803**	Accepted
H4	NSEO \rightarrow AD	0.519	0.058	8.929**	Accepted
H5	CS \rightarrow ODSS	0.231	0.101	2.276**	Accepted
H6	TA \rightarrow ODSS	0.234	0.112	2.088**	Accepted
H7	LP \rightarrow ODSS	0.229	0.060	3.838**	Accepted
H8	AD \rightarrow ODSS	0.151	0.080	1.894**	Accepted

**Significant at p-value<0.05

1. Mediation Analysis

The intricate relationships between NSS engagement outcomes (NSEO), mediated by specific

social skills, and their collective impact on overall social development (ODSS) were rigorously scrutinized through a comprehensive mediation analysis. The results of the mediation analysis are presented in Table 6. The findings unveil compelling insights that enhance our understanding of the interplay between these pivotal constructs. These mediating pathways, highlighted by partial mediation—where mediating variables partially explain the relationship between independent and dependent variables—offer a nuanced understanding of how NSS engagement outcome influences the overall development of social skills. Partial mediation occurs when the mediating variable only partially explains the relationship between the independent variable and the dependent variable. In this situation, the mediating variable plays a role in the relationship, but other factors at play also contribute to the overall effect (Nitzl et al., 2016). H9 reveals the role of communication skills (CS) as a partial mediator ($\beta = 0.109$, SD=0.053, $t = 2.068$), while H10 portrays teamwork acumen (TA) in a similar light ($\beta = 0.110$, SD=0.058, $t = 1.914$), leadership prowess (LP) step into the spotlight in H11 ($\beta = 0.126$, SD=0.038, $t = 3.318$), and adaptability (AD) shine in H12 ($\beta = 0.078$, SD=0.043, $t = 1.803$), all displaying partial mediation. Collectively, these results reveal that NSS engagement's influence on the overall development of social skills is not a direct path but rather a dynamic process mediated by specific social skills. This dynamic interplay enriches our understanding of how these skills collectively contribute to shaping the overall development of social skills among engineering graduates.

Table 6: Summary of Mediation Analysis (Specific Indirect Effects)

Hypotheses	Relationship through Mediator	Indirect Effects		t-value	Decision
		Beta (β)	Standard Deviation (SD)		
H9	NSEO \rightarrow CS \rightarrow ODSS	0.109	0.053	2.068**	Accepted
H10	NSEO \rightarrow TA \rightarrow ODSS	0.110	0.058	1.914**	Accepted
H11	NSEO \rightarrow LP \rightarrow ODSS	0.126	0.038	3.318**	Accepted
H12	NSEO \rightarrow AD \rightarrow ODSS	0.078	0.043	1.803**	Accepted

**Significant at p-value<0.05

2. Total Indirect Effects

Examining the comprehensive impact of NSS engagement outcome (NSEO) on the overall development of social skills (ODSS), our study uncovers significant indirect effects that intricately shape graduates' holistic growth (See Table 7). H13:

NSEO -> ODSS pathway reveals a substantial total

$$\text{Final rating} = 173.7178 * \text{newrating} + 1500 \quad (13)$$

$$\text{Final rating deviation} = 173.7178 * \text{new rating deviation} \quad (14)$$

indirect effect ($\beta = 0.424$, $SD = 0.055$), strongly supported by a t-value of 7.658. This compelling evidence underscores the profound role of NSS engagement in fostering graduates' multifaceted social development.

Table 7: Summary of Total Indirect Effects

Hypotheses	Relationship	Beta (β)	Standard Deviation (SD)	t-value	Decision
H13	NSEO -> ODSS	0.424	0.055	7.658**	Accepted

**Significant at p-value<0.05

Note: Calculations Performed through the bootstrapping process

5. Discussion & Implications OfThe Study

The findings of this study provide valuable insights into the intricate relationship between NSS engagement and the development of social skills among engineering graduates. The exploration of hypotheses H1 to H4 underscored the significant positive impact of NSS engagement outcomes on specific social skills, namely communication skills, teamwork acumen, leadership prowess, and adaptability. These results align with past results of studies performed by Khasanzyanova (2017), Jasti & Pavani (2021) & Hansen et al. (2007) that emphasize the role of experiential learning, such as volunteering and community engagement activities, in fostering these crucial competencies. The subsequent examination of hypotheses H5 to H8 further illuminated the role of individual social skills and overall social skill development. The findings indicated that communication skills, teamwork acumen, leadership prowess, and adaptability each positively impacted the overall development of social skills. The mediation analysis, encompassing hypotheses H9 through H12, unveiled an intriguing pattern. It showcased that each of the intermediary factors, including communication skills, teamwork acumen, leadership prowess, and adaptability, assumes the role of a partial mediator in connecting NSS engagement outcome to the development of overall social skills. This intricate web of relationships highlights the interplay of these specific skills as channels through which NSS engagement exerts its influence on the broader construct of overall social skill development. Finally, hypothesis H13 unveiled a direct linkage between NSS engagement outcome and the comprehensive enhancement of

social skills. This underlines the pivotal role of NSS engagement in shaping a well-rounded skill set that goes beyond individual competencies to encompass a broader and more nuanced social skill development. Collectively, these findings not only emphasize the positive impact of NSS engagement on individual social skills but also reveal the complex interconnections among these skills and their cumulative effect on overall social skill development.

In light of the favorable results observed in both the measurement and structural model, with all hypotheses being accepted, the study unfolds profound managerial implications. Educational institutions are prompted to strategically integrate NSS engagement into their academic framework, amplifying the development of essential social skills among students. This infusion empowers graduates with a versatile skill set, enhancing their employability and readiness for dynamic professional environments. Employers stand to benefit by recognizing NSS engagement as a crucial indicator of candidates' well-rounded competence. By valuing such experiences, they can cultivate a workforce adept at effective communication, teamwork, leadership, and adaptability, thereby fostering an environment conducive to innovation and growth. On a broader scale, policymakers are encouraged to bolster community service initiatives, acknowledging their role in nurturing active citizenship and societal betterment. Embracing NSS engagement aligns with the aspiration for a socially responsible generation, equipped with the capacity to address complex challenges and contribute positively to the collective well-being. The seamless interplay between NSS engagement and the enhancement of social skills paints a compelling narrative of personal, professional, and societal advancement. As the study's results ripple through educational, corporate, and policy realms, they beckon a future where individuals and organizations thrive, woven together by the transformative magic of NSS experiences.

6. Conclusions

In conclusion, this comprehensive study illuminates the transformative power of NSS engagement in shaping the multifaceted landscape of social skill development among engineering graduates. Through meticulous analysis and empirical evidence, we have uncovered intricate relationships between NSS engagement, specific social skills (communication skills, teamwork

acumen, leadership prowess, and adaptability), and their collective impact on overall social skills development. The results unequivocally validate the hypotheses proposed, demonstrating the significant positive influence of NSS engagement on individual social skills and, consequently, on the holistic social development of graduates. This study underscores NSS engagement's pivotal role in nurturing adaptable, communicative, and effective leaders and team players, who are well-equipped to contribute meaningfully to both their professional pursuits and the broader society. The implications of these findings ripple through the realms of education, workforce readiness, community empowerment, and policy advocacy. As this study takes its place within the larger body of knowledge, it invites further exploration into the dynamic interplay between NSS engagement, social skills, and holistic development.

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