Comparative Assessment of Learning Environments and Skill Diversity: An Examination of Work Life Quality in Medium- and Large-Scale Manufacturing Sectors

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Abstract: This article presents a comparative assessment of Quality of Work Life (QWL) dimensions specifically skill variety and learning environment between medium- and large-scale manufacturing industries. It examines variations in opportunities for employee growth through these dimensions. The attributes of these dimensions, namely learning organization, job rotation, job enrichment, and job enlargement, are analysed using samples from both sectors. Given the heterogeneous nature of the samples, descriptive statistics, Welch's t-test, and Welch's ANOVA are employed to test the hypotheses. The hypotheses are formulated based on demographic variables such as age, qualification, experience, and designation. The results indicate significant variations and differences between the two sectors across several attributes in different demographic classifications. Key aspects such as platforms for learning through formal and informal setups, on-the-job training, and increased responsibilities are identified as critical factors that employees seek to enhance their QWL and performance. This study contributes to the growing understanding of QWL's role in fostering employee satisfaction and improving performance by identifying adoptable strategies across both sectors. The findings offer HR practitioners and policymakers actionable insights for workforce development in the manufacturing sector.

Keywords: Quality of Work Life, Skill Variety, Learning Environment, Manufacturing Sectors.

1. Introduction

The success of an organization depends also on the Quality of Work Life (QWL) of its employees that has significant influence on their satisfaction, performance and retention (Lawler, 1982; Sirgy et al., 2012). The various factors that shape and define the experiences of employees, their attitudes towards their roles and responsibilities that encompass the employees' work environment are summed up in terms of their QWL (Lau & May, 1998; Sabonete et al., 2021). Of all the factors that are of QWL, skill variety and learning opportunities or learning ecosystems are of particular importance due to their potential to enhance employee motivation and engagement (Krieger et al., 2022a; Li et al., 2020; O'brien, 1983). The extent of the range of skills and competencies that a task demands for successful completion of a job is termed as skill variety and according to Hackman and Oldham's (1976a) Job Characteristics Model, jobs that mandate high skill variety are perceived to be more meaningful and thus leading to greater job satisfaction and lower turnover rates. Scholarly articles have showcased that employees' sense of fulfilment and their perceived value in the organization depends on increased complexity in assigned tasks and promotion of the associated skill development programs by the organization (J. Cohen, 2009a; Morgeson & Humphrey, 2006a). In addition to enhancing job satisfaction, skill diversity also fosters organizational commitment and eventually leading to continual performance improvement (Morgeson, 2002).

In order to enhance skill diversity, particularly in manufacturing sector wherein monotonous and repetitive tasks could diminish QWL, implementation of job rotation, job enrichment and job enlargement is crucial that potentiates more engaging and motivating work environment (Campion et al., 2005; Fried & Ferris, 1987). The integration of job design theories with practical modalities has displayed more effective work environments (Perry-Smith & Mannucci, 2017). However, there is

apparent differences in how these opportunities for skill diversity is offered in large and medium-scale industries, while more formal training programs with structured career paths are laid out in larger industries, medium-scale industries are characterised by more informal learning and broader responsibilities (J. R. Baldwin & Johnson, 1996a; Forrier & Sels, 2003). Comprehending these subtle differences may be of vital importance to design strategies that could improve QWL across different industry scales (De Vos et al., 2011).

Employee development that results due to apt learning ecosystem is an established convergence, and learning environment that is characterised by opportunities for skill development, knowledge sharing, on-the-job training, collaborative learning and the likes is of vital importance in enhancing QWL (Burke & Hutchins, 2007). High-quality learning environments particularly in manufacturing sector could potentiate employee well-being that propels organizational success (Anwar & Abdullah, 2021). While, Larger industries, due to greater allocation of resources, may offer dedicated and a more structured training and professional development programs (Lee et al., 2015) such as certification, training sessions, seminars or skill development programs and these propel professional development and contributes to a higher sense of accomplishment and job satisfaction amongst employees (Schuler & MacMillan, 1984). However, mentoring, job shadowing or on-the-job training that are more informal and hence interpersonally dynamic, are tools more often deployed in medium-scale industries (J. R. Baldwin & Johnson, 1996b; Lawler, 1982). A more flexible and adaptive learning environment that medium sector offers up does empower employees to chin up multiple responsibilities albeit completely being at one with it (Rose et al., 2006).

Comparative analysis between medium and large-scale manufacturing industries that are distinguished through structures and operational capabilities may leverage strategies more admissible and beneficial across different scales of organizations (Huselid, 1995). Strategies in job design, growth patterns and job satisfaction have been studied and reported in such comparative studies (Storey et al., 2010). Also, similar comparative studies have also highlighted the variation in organizations' perception in the contexts of advancements, learning opportunities and job features (Van Der Voet, 2014; Wright et al., 2001). Comparative analyses are therefore essential to understand the effect of scale of organization on employee performance and organizational innovation (Giauque et al., 2014; Guest, 2017; Koonmee et al., 2010)

This study involves comparing unequal sample sizes and variances that emanate from heterogeneous medium and large-scale industries while under demographic groups such as age, qualifications and Welch's t-tests and Welch's ANOVA are designed robustly to analyse and infer on them (Ruxton, 2006). Effect size measures like Cohen's d offers deeper insights on how the scale of an organization effect QWL by highlighting practical significance of the differences. The power of the test which is the probability of detecting an effect when its truly exists, is also crucial in ascertaining the adequacy of the sample size to detect significance of differences across various test modalities (J. Cohen, 2009b).

Advancing learning experiences for an employee and diversification of skills and competencies are key areas of interventions especially in manufacturing sector that enhances performance from employee and organizational development perspectives (J. R. Baldwin & Johnson, 1996a; Krieger et al., 2022b). Given the significance of skill variety and learning environments in shaping QWL, this research aims to provide a comparative examination of their perceived effect on QWL between large and medium-scale manufacturing sectors and elucidate how industry sizes influences the perceptions of employees and hence influences their overall QWL.

In order to examine the job design on QWL, the Job Characteristics Model of Hackman et al (1976b) remains as the foundational framework. The QWL dimensions such as skill variety, task significance, autonomy and feedback are those that influence three critical psychological states namely experienced meaningfulness, responsibility and knowledge of results. These psychological states have a bearing on job satisfaction, performance and motivation (Morgeson & Humphrey, 2006a).

The Social Exchange Theory suggests that employees reciprocate higher levels of commitment and engagement when abetted with opportunities for their skill development and learning (D. A. Baldwin, 1978). These abetments due to their potential are critical in both large and medium-sectors whereof, enhancement in QWL by organizations through skill development programs and conducive learning environments can better align employee needs with organizational goals (Farndale & Murrer, 2015)

1.1. Research Gap Identified Through Literature Review

The body of research on skill variety and learning environments though vast but in comparative studies across medium and large-scale manufacturing industries following gaps exist.

1. The review indicates a vast corpus of literature on QWL studies in large industries. However, studies examining skill variety and learning environments across both medium- and large-scale industries remain relatively scarce (Schuler & MacMillan, 1984). Additionally, most research focuses on the larger sector or overlooks differences in employee perceptions across varying scales of operations (Tsui-Auch, 2003). This highlights the need for more focused comparative studies to examine variations in QWL dimensions across organizational scales.
2. While formalized training programs and structured development opportunities are widely acknowledged as key drivers of growth in larger industrial sectors, literature provides limited insights into the impact of informal training methods—such as mentoring and on-the-job training on QWL. The role of these informal approaches in enhancing employee development and satisfaction remains underexplored, presenting a gap in the existing research (Lin & Tang, 2016).
3. Skill variety has been identified as a crucial driver of job satisfaction and motivation (S. G. Cohen, 1997; Hackman & Oldham, 1976b). However, research rarely considers the effect of industry scale on skill variety. Larger industries often emphasize efficiency through mechanized, specialized tasks, which may limit skill variety, whereas medium-scale industries tend to offer broader task diversity. Despite the potential impact of these differences on overall QWL, systematic research on this aspect remains limited (Morgeson & Humphrey, 2006b).
4. Existing array of research have inadequately considered how the demographics may temperate the relationship between skill variety, learning environments and QWL. But, different organizational scale may attract distinct demographic groups and this presents an opportunity for further examination of how individual traits interact with organizational factors that influences QWL.(Fried & Ferris, 1987). Comparative analysis conducted as part of this research therefore aims to address these gaps, examine skill variety and learning environments across large and medium sectors and add to the understanding of the impacts of scale of the organization on QWL and employee perceptions about their QWL. In addition, the potential, scope and modalities of the informal learning opportunities and demographic variables on QWL will be examined.

2. Research Objectives

1. To examine employee perceptions on the effects of skill variety dimension of QWL between medium and large-scale manufacturing industries.
2. To assess employees' job satisfaction across large and medium-scale industries resulting from formal and informal learning opportunities.
3. To review the impact of organizational size on skill variety and learning opportunities, and assesses employee perceptions of job enrichment practices in medium and large industries and suggest actions that could improve QWL.

3. Research Hypothesis

The study will test the following hypotheses:

- H 1.0: There is no significant difference in the perceived effects of learning organization between large and medium-scale manufacturing industries amongst classes such as L, M, H, U, P, S and J.
- H 2.0: There is no significant difference in the perceived effect of job rotation between medium and large-scale manufacturing industries amongst classes such as L, M, H, U, P, S and J.
- H 3.0: There is no significant difference in the perceived effect of job enrichment between medium and large-scale manufacturing industries amongst classes such as L, M, H, U, P, S and J.
- H 4.0: There is no significant difference in the perceived effect of job enlargement between medium and large-scale manufacturing industries amongst classes such as L, M, H, U, P, S and J.

4. Research Methodology

i. Research Design

Comparative cross-sectional, a quantitative approach is adopted this study to assess employee perceptions across medium and large-scale manufacturing industries about skill variety and learning

environments. Data is collected and analysed using statistical methods to identify significance of differences across industries.

ii. Population and Sampling

Employees working in large and medium-scale manufacturing industries are the target population and these industries are listed based on parameters like size, industry type and geographical location. The population of employees include those working at various levels other than the shop floor, those that could comprehend the questionnaire and register their responses and Table 1 presents the summary of population, sample drawn and responses received. Upon enquiry, care has been taken to help them comprehend the purpose and nature of the questions. To ensure that sample of employees from both medium and large scale sectors are represented, simple sampling method is adopted. The sample size is 207 employees from medium-scale industries and 236 employees from large-scale. This sample was further segregated in to various classes as presented in Table 2, to perform hypothesis testing for each class of classification to draw inferences.

Table 1: Summary population, sample drawn and responses received

S/L	Industry Scale	No. of Companies	Total No. of Employees (not including shop-floor)	No. of employees participated	% of Female
1	Large	8	2200	236	13.15
2	Medium	10	1700	207	8.2

The data indicates that large-scale industries, comprising eight companies, employ a total of 2,200 individuals (excluding shop-floor employees), with 236 participating in the study. In contrast, medium-scale industries, represented by ten companies, have a total workforce of 1,700, with 207 employees participating. Notably, the percentage of female employees is higher in large-scale industries (13.15%) compared to medium-scale industries (8.2%), suggesting that larger industries may offer more opportunities or conducive environments for female employment. This disparity could be influenced by factors such as company policies, workplace culture, job roles, or sector-specific demands, warranting further investigation into gender representation and inclusivity across different industry scales.

Table 2: Classification of respondents from large and medium-scale manufacturing industries for the purpose of Inferential Statistics.

S/L	Group Classification	Abbreviation	Sample size		Description of Classification
			Large	Medium	
1	Lower Age Group	L	59	75	Employees in the age range of 21 – 30 years are classified as under “Lower Age Group”.
2	Middle Age Group	M	109	91	Employees in the age range of 31 – 40 years are classified as under “Lower Age Group”.
3	Higher Age Group	H	68	41	Employees in the age range of 41 -55 years are classified as under “Lower Age Group”.
4	Below Post-graduation	U	135	163	Employees with qualification other than Post-graduation such as B/Sc, B.Com, BBM, BBW, B.E, Diploma, ITI, so on are classified as under “Below Post-graduation”.
5	Post-graduation and above	P	101	44	Employees with qualification of Post-graduation such as M.Tech, MBA, MCA, MSW, so on are classified as under “Post-graduation and Above”.
6	Senior	S	122	79	Employees with overall experience of more than 10 years or 5-10 years or more in the same organization with designation of manage, supervisor, deputy manager, senior manager or the like are classified as “Senior"
7	Junior	J	114	128	Employees categorized not as “Senior” are classified as under “Junior”.

The classification of employees across industry scales highlights notable demographic distinctions. In terms of age distribution, large-scale industries have a higher proportion of middle-aged (109) and higher-aged (68) employees compared to medium-scale industries (91 and 41, respectively), whereas the lower age group is more evenly distributed (59 in large vs. 75 in medium). Regarding educational qualifications, a larger number of employees in medium-scale industries fall under the "Below Post-graduation" category (163) compared to large-scale industries (135), whereas the "Post-graduation and

Above" category is more prominent in large industries (101 vs. 44 in medium). This suggests that larger industries may attract or require more highly qualified employees. In terms of experience and designation, large industries have a higher number of senior employees (122) than medium-scale industries (79), while medium-scale industries have a slightly higher number of junior employees (128 vs. 114). These variations may reflect differences in career progression opportunities, job roles, and workforce structures between the two industry scales.

iii. Data Collection Methods

A structured questionnaire is designed to measure perceived QWL based on key attributes of skill variety and learning environments. Table 3 presents the Question Statements and their mapping with Attributes of Skill Variety and Learning Environment Dimension of QWL. The questionnaire includes,

- Items related to skill variety such as learning organization, job rotation, job enrichment and job enlargement.
- Items pertaining to demographic variable such as age, gender, qualification, and designation.

Table 3: Question Statements and their mapping with attributes of Skill Variety and Learning Environment Dimension of QWL

S/L	Statement of the Question	Attribute Mapped	Attribute Abbreviation
1	A great deal of emphasis is placed on continuous education at my workplace, which helps me do my job better and sees my mistakes as chances to learn and get better.	Learning Organization	LO
3	Opportunities are provided for me to further my knowledge and skill set at my organization.	Job Rotation	JR
4	I receive sufficient on-the-job training from my employer.	Job Enrichment	JE
5	Challenges are what I am intended to overcome in order to become better.	Job Enlargement	J.En

A seven point Likert scale is used ranging from 7- Very Strongly Agree to 1-Very Strongly disagree with 4-Not Decided. (Cummins & Gullone, 2000; Lakens, 2013). Reliability of the questionnaire was measured through the Cronbach's Alpha in Microsoft Office Professional Plus 2016 version and test re-test method was used for the same.(Heiser, 2005; Hu et al., 2015). The Cronbach's Alpha obtained was 0.87. Both hard copy and digital versions of the survey were created, distributed, and responses from the intended participants were gathered between January and August of 2024. The paper version, which the employees preferred and which made the questions easier for them to grasp, was distributed to a few individuals from various businesses. After being completed, the paperwork was returned and totalled. Digital administration was used for a small number of instances, and tabulation of the results was done.

iv. Ethical Considerations

- The purpose of study was briefed to the participant and upon their consent the research instrument were administered.
- Personal information of the participants are maintained confidentially and the data were anonymized to protect participants' privacy.
- Participation is voluntary, with no obligation to continue meaning participants could withdraw at any stage.

v. Data Analysis Techniques

Descriptive statistics such as mean, standard deviation, frequency distributions are calculated for demographic variables. For inferential statistics, Welch's t-tests, Welch's ANOVA, Cohen's d and power of the tests along with degrees of freedom, mean differences and confidence intervals are computed. Significance level of 0.05 is set for all computations and Microsoft Office Professional Plus 2016 version was used for analysing the data.

5. Results and Discussions

1. Descriptive Analysis and inferences drawn for Skill Variety and Learning Environment

Table 4. Descriptive Statistics for Skill Variety and Learning Environment

Scale	Attributes	Count	Range	Mean	Standard Deviation	Response Distribution							
						Description	7	6	5	4	3	2	1
Medium	LO	207	1-7	4.31	1.55	Count	13	37	67	14	47	23	6
						%	6.28	17.87	32.37	6.76	22.71	11.11	2.90
	JR			4.40	1.65	Count	14	49	60	10	34	36	4
						%	6.76	23.67	28.99	4.83	16.43	17.39	1.93
	JE			4.41	1.73	Count	22	36	70	6	31	34	8
						%	10.63	17.39	33.82	2.90	14.98	16.43	3.86
	J.En			4.49	1.65	Count	19	44	65	8	38	28	5
						%	9.18	21.26	31.40	3.86	18.36	13.53	2.42
Large	LO	236		4.74	1.56	Count	28	54	74	15	37	26	2
						%	11.86	22.88	31.36	6.36	15.68	11.02	0.85
	JR			4.93	1.47	Count	37	50	79	17	36	17	0
						%	15.68	21.19	33.47	7.20	15.25	7.20	0.00
	JE			4.94	1.54	Count	40	54	72	13	37	20	0
						%	16.95	22.88	30.51	5.51	15.68	8.47	0.00
	J.En			5.04	1.44	Count	37	59	80	13	31	16	0
						%	15.68	25.00	33.90	5.51	13.14	6.78	0.00

Table 4 presents descriptive statistics for skill variety and learning environment dimension of QWL across medium and large-scale industries in terms of its attributes LO, JO, JE and J.En. The medium-scale industries report average responses in the range of 4.11 to 4.46 ±1.65 to 1.72 and this indicates moderate level of satisfaction and some variability in responses. Ratings are concentrated in the middle of the scale particularly around 4-5, suggesting mixed perceptions amongst its employees. The large-scale industries report higher mean scores ranging from 4.64 to 5.06 ± 1.47 to 1.61 and this indicates a generally higher satisfaction ensuing from more responses that are consistent across the workforce. The response distribution is positively skewed with a higher concentration of responses at 'agree' to 'strongly agree' levels, particularly for JE and J.En attributes. Thus indicating that in large-scale industries, employees are more likely to experience positive opportunities for skill development and learning opportunities through variety in their roles.

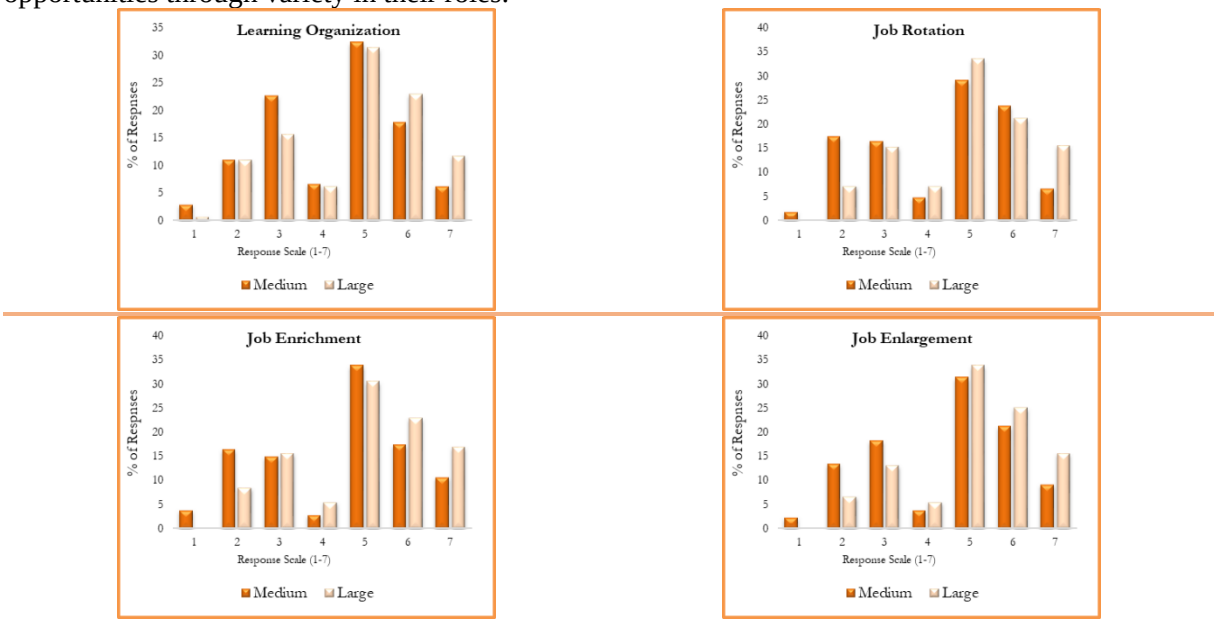

Figure 1: Skill variety response distribution in terms of its items/dimensions between medium v/s large-scale manufacturing industries

Figure 1 illustrates the differences between medium- and large-scale industries concerning skill variety attributes through a bar chart. For the learning organization (LO) attribute, responses from large-scale industries are concentrated at the higher end of the scale, peaking around scores 5 and 6, whereas medium-scale industries show a more evenly distributed response pattern, peaking at score 5. This suggests that employees in large industries tend to perceive more opportunities for training, workshops, knowledge sharing, and mentorship provided by leadership, which may contribute to a stronger learning culture. In the case of job rotation (JR), responses from both industry scales show similarities, with

large-scale industries peaking at scores 5 and 6 and medium-scale industries exhibiting a more widespread distribution centred around score 5. This pattern implies that structured job rotation is more pronounced in large-scale industries, offering employees greater exposure to diverse roles, thereby enhancing their skills and professional growth.

For the job enrichment (JE) attribute, medium-scale industries display a wider response distribution, peaking at score 5, whereas large-scale industries have a more concentrated response pattern, particularly at scores 5 and 7. This suggests that employees in larger industries may have greater access to challenging tasks, increased responsibilities, and career development opportunities, fostering stronger engagement and motivation. Similarly, for job enlargement (J.En), responses from large-scale industries are more concentrated within the 5-7 range, indicating that employees perceive greater opportunities for role expansion, decision-making, and broadening of job responsibilities. In contrast, responses from medium-scale industries are more widely distributed, with a peak at score 5, suggesting relatively fewer perceived opportunities for job enlargement. Overall, these findings indicate that large-scale industries may provide a more structured framework for employee development across various skill variety attributes compared to medium-scale industries.

ii. Inferential Statistics

Table 5: Inferential Statistics for Attributes of Skill Variety and Learning Environment Dimension of QWL under various classification.

Group	Attribute	Mean (Large, Medium)	m.d	Confidence Interval	DoF	ts (tc)	F_s (F_c)	p-value	d	Pow
L	LO	4.93, 4.31	0.63	0.989, 0.262	127.39	1.716 (1.979)	3.439 (1.458)	0.089	0.43	0.97
	JR	4.90, 4.35	0.55	0.936, 0.167	130.29	1.250 (1.978)	2.185 (1.506)	0.214	0.34	0.69
	JE	5.00, 4.25	0.75	1.164, 0.330	126.81	1.578 (1.979)	3.784 (1.523)	0.117	0.45	0.99
	J.En	5.34, 4.76	0.58	0.912, 0.246	131.29	1.664 (1.978)	3.042 (1.451)	0.099	0.40	0.93
M	LO	4.70, 4.14	0.55	0.834, 0.274	185.91	1.632 (1.973)	2.961 (1.373)	0.104	0.36	1.00
	JR	4.91, 4.43	0.48	0.760, 0.200	182.65	1.349 (1.973)	2.138 (1.380)	0.179	0.31	0.95
	JE	4.82, 4.40	0.42	0.708, 0.134	180.86	1.102 (1.973)	1.542 (1.392)	0.272	0.26	0.75
	J.En	4.92, 4.30	0.62	0.910, 0.332	178.20	1.543 (1.973)	3.209 (1.400)	0.125	0.38	1.00
H	LO	4.91, 4.54	0.38	0.735, 0.015	86.39	0.881 (1.988)	0.626 (1.532)	0.381	0.25	0.34
	JR	5.00, 4.41	0.59	0.939, 0.231	78.23	1.214 (1.991)	1.436 (1.550)	0.229	0.38	0.94
	JE	5.10, 4.73	0.37	0.733, 0.009	72.25	0.637 (1.993)	0.507 (1.586)	0.526	0.23	0.24
	J.En	4.99, 4.41	0.57	0.908, 0.233	80.56	1.368 (1.990)	1.546 (1.516)	0.175	0.40	0.97
U	LO	4.77, 4.17	0.60	0.860, 0.338	282.64	2.223 (1.968)	6.311 (1.289)	0.027	0.39	1.00
	JR	4.96, 4.40	0.56	0.803, 0.325	295.98	2.001 (1.968)	5.231 (1.299)	0.046	0.36	1.00
	JE	5.08, 4.45	0.63	0.894, 0.361	293.66	1.967 (1.968)	5.743 (1.315)	0.050	0.38	1.00
	J.En	5.07, 4.49	0.58	0.816, 0.336	295.62	2.101 (1.968)	5.610 (1.294)	0.036	0.37	1.00
P	LO	4.75, 4.55	0.21	0.502, -0.088	75.33	0.451 (1.992)	0.171 (1.456)	0.653	0.14	0.10
	JR	4.89, 4.39	0.50	0.814, 0.196	83.57	1.180 (1.989)	0.991 (1.464)	0.241	0.33	0.97
	JE	4.76, 4.25	0.51	0.804, 0.221	72.31	1.055 (1.993)	1.032 (1.460)	0.295	0.33	0.98

	J.En	5.01, 4.48	0.53	0.826, 0.239	74.51	1.147 (1.993)	1.131 (1.456)	0.255	0.35	0.99
J	LO	4.86, 4.28	0.58	0.841, 0.315	239.92	1.996 (1.970)	4.730 (1.326)	0.047	0.38	1.00
	JR	4.89, 4.28	0.61	0.902, 0.325	239.91	1.758 (1.970)	4.419 (1.356)	0.080	0.37	1.00
	JE	4.89, 4.30	0.58	0.869, 0.293	239.90	1.676 (1.970)	3.992 (1.354)	0.095	0.35	1.00
	J.En	5.20, 4.59	0.61	0.886, 0.330	239.92	1.878 (1.970)	4.679 (1.343)	0.062	0.38	1.00
S	LO	4.70, 4.46	0.24	0.534, -0.052	173.35	0.662 (1.974)	0.427 (1.389)	0.509	0.15	0.16
	JR	4.97, 4.58	0.38	0.634, 0.136	155.57	1.224 (1.975)	1.346 (1.352)	0.223	0.27	0.87
	JE	5.00, 4.58	0.42	0.689, 0.147	149.86	1.043 (1.976)	1.277 (1.389)	0.299	0.26	0.83
	J.En	4.89, 4.32	0.58	0.821, 0.333	146.77	1.707 (1.976(	2.927 (1.357)	0.090	0.39	1.00

Table 5 presents the inferential statistics of perceived effect of Skill Variety and Learning Environment in terms of its attributes LO, JR, JE and J.En on employee performance between large and medium-scale manufacturing industries for all classification.

The analysis shows higher scores for large scale across all dimensions of skill variety for Lower Age Group. Mean differences indicate better-perceived learning environments in large industries but Welch's t-tests show no statistically significant differences despite small to medium effect sizes and high-test reliability. Confidence intervals close to zero suggest the differences may not be substantial. However, Welch's ANOVA indicates significant differences. The dimension of Job Rotation, Job Enrichment and Job Enlargement also emulates the same trend. While Welch's t-tests show no statistically significant differences, Welch's ANOVA highlights significant overall variance differences, suggesting that employees in large industries perceive better opportunities for skill variety than those in medium industries. LO, JE and J.En registers as a notable parameter through Welch's ANOVA indicating statistically significant difference between large and medium scale industries than within. This suggests the potential of enhanced LO, JE and J.En dimensions in medium scale industries towards bettering performance of personnel of LAG as being more than that which is prevailing.

The analysis shows higher scores in large scale across all dimensions of skill variety amongst Middle Age Group. The Mean differences indicate better-perceived learning environments in large industries but Welch's t-tests show no statistically significant differences despite small to medium effect sizes and high test reliability. Confidence intervals close to zero suggest the differences may not be substantial. However, Welch's ANOVA indicates significant differences. The other dimensions of Skill variety such as JR, JE and J.En., also emulates the same trend. While t-tests show no statistically significant differences, Welch's ANOVA highlights significant overall variance differences and suggests that employees in large industries perceive better skill variety than those in medium industries. J.En and LO registers as a notable parameter through Welch's ANOVA indicating statistically significant difference between large and medium scale industries than within. The analysis indicates that with enhancing J.En and LO, the perceived scope of performance improvement of MAG personnel of medium scale industries is potentially more than that which exists.

The analysis indicates that the Learning Organization (LO) bears no significant difference statistically between medium and large-scale industries for Higher Age Group personnel. Despite mean differences of -0.33 and 0.38, the t-statistics of 0.676 and 0.881 are less than t-critical (1.987 and 1.988) with p-values 0.501 and 0.381. The small effect size and low power of the tests support this inference. Welch's ANOVA confirm the lack of statistically significant difference. The dimension of Job Rotation (JR) also emanates similarly indicating no significant difference. With Cohen's d of 0.38 and high reliability of the test (power, 0.94), the Welch's ANOVA also confirms no significant difference between large and medium scale industries. The dimension of Job Enrichment (JE) also yields no significant difference with mean difference of 0.37, t-statistic of 0.637, t-critical of 1.993 and p-value of 0.526. The test has small effect size (Cohen's d=0.23) and low power (0.24). Welch's ANOVA supports the absence of significant difference. The dimension of Job Enlargement (J.En), with mean difference of 0.57, with t-statistic of 1.368 being less than t-critical (1.990) and a p-value of 0.175 indicates statistically no

significant difference. The effect of the size (Cohen's d =0.40) is small to medium and the power of the test (0.97) is high. Welch's ANOVA suggests a potential but no definitive significant difference. Amongst the Higher Age Group (HAG), while mean scores for all dimensions of skill variety of large-scale industries are higher than medium scale industries, the differences are not statistically significant as is evident through both Welch's t-tests and ANOVA results. The effect sizes and power of the tests designate that the perceived differences as not substantial. Welch's ANOVA for job enlargement however indicates a slight potential for significant difference that suggests presence of some aspects where employees in large industries may perceive better opportunities for skill variety and learning opportunities amongst higher age group than to those in medium industries.

The analysis shows higher scores for large scale across all dimensions of skill variety for Below Post-graduation personnel. Mean differences indicate better-perceived learning environments in large industries but Welch's t-tests show no statistically significant differences despite small to medium effect sizes and high test reliability. Confidence intervals close to zero indicate the differences may not be substantial. However, Welch's ANOVA indicates significant differences. The dimension of Job Rotation, Job Enrichment and Job Enlargement also emulates the same trend. While Welch's t-tests show no statistically significant differences, Welch's ANOVA highlights significant overall variance differences, suggesting that employees in large industries perceive better opportunities for skill variety than those in medium industries. LO, JR, JE and J.En registers as a notable parameter through Welch's ANOVA test indicating statistically significant difference between large and medium scale industries than within amongst Below Post-graduation personnel. This analysis indicates that enhancing dimensions of skill variety and learning opportunities like LO, JR, JE and J.En may potentiate better performance of Below Post-graduation personnel.

The analysis reveals relatively higher mean scores for large scale for all dimensions of skill variety amongst Post-graduation and above personnel. It is clear that there are differences because the mean differences are 0.21, 0.24, 0.50, 0.51, and 0.53. However, Welch's t-tests do not show any statistically significant differences even though the effect size is small to medium and the test's low reliability for LO (0.10 and 0.12) and high reliability for JR, JE, and J.En. Confidence interval is close to zero for all dimensions that suggests the differences may not be substantial. However, Welch's ANOVA only indicates confirmation with Welch's t-test for all dimensions of skill variety. The inferences drawn only suggests that employees with Post-graduation in large industries do not perceive significantly better opportunities for LO, JR, JE and J.En compared to those in medium scale industries.

The analysis shows higher scores of mean differences for large scale across all dimensions of skill variety for junior. Mean differences indicate better-perceived learning environments in large-scale industries and Welch's t-tests show statistically significant differences despites small to medium effect sizes and high reliability of the tests. Confidence intervals suggests that differences exist. Welch's ANOVA test also indicates significant differences. The dimension of Job Rotation, Job Enrichment and Job Enlargement barring the mean differences, from Welch's t-tests show no significant differences. While Welch's ANOVA highlights significant overall variance differences and suggests that 'junior' employees in large industries perceive better opportunities for skill variety and learning opportunities than those in medium scale industries. Welch's ANOVA indicates that all skill variety dimensions, namely LO, JO, JE, and J.En, can improve their performance of juniors by enhancing these QWL dimensions. However, both Welch's t-tests and Welch's ANOVA tests identify LO as a dimension that requires improvement across both industry scales, as they perceive it to be crucial for improving junior employees' performance.

The analysis shows higher scores of mean differences for large scale across all dimensions of skill variety for senior, but both Welch's t-tests and Welch's ANOVA tests indicate no statistically significant differences in perception of seniors on their performance in large and medium scale manufacturing industries. The effect of the size is small and power of the tests are relatively high. Furthermore, confidence intervals includes or is close to zero for all dimensions that suggests the differences may not be substantial. The dimension of J.En, however from Welch's ANOVA test indicates that there is significant difference also, with the effect of size and high reliability of the test. The perceived effect of performance amongst seniors in large-scale industries is therefore more than that of medium scale industries and this may indicate the potential of enhancing the J.En dimension of QWL that accentuates performance.

Summary:

The analysis reveals that younger employees (Lower Age Group) in large-scale industries report higher skill variety scores across all dimensions. Although mean differences suggest better learning environments in large industries, Welch's t-tests do not show statistically significant differences, despite small to medium effect sizes. However, Welch's ANOVA identifies significant overall variance differences, particularly for Learning Organization (LO), Job Enrichment (JE), and Job Enlargement (J.En), indicating that large industries offer better skill variety opportunities. This suggests that enhancing these dimensions in medium-scale industries could improve employee performance in this age group.

For the Middle Age Group (MAG), a similar pattern emerges, with higher skill variety scores in large industries. Mean differences again indicate better learning environments, but Welch's t-tests do not confirm statistical significance. However, Welch's ANOVA highlights significant variance differences, particularly in Job Enlargement (J.En) and Learning Organization (LO), suggesting that large industries provide more opportunities for skill variety. Strengthening these dimensions in medium industries could enhance performance among MAG employees. In contrast, for the Higher Age Group (HAG), no statistically significant differences are found across skill variety dimensions, as confirmed by Welch's t-tests and ANOVA. While mean differences exist, small effect sizes and low test power indicate that variations between industry scales are minimal. This suggests that for HAG employees, factors beyond skill variety may influence perceptions of work quality and development opportunities.

2. Results of Hypothesis Testing

For the objective of testing the hypothesis, Welch's t-test, Welch's ANOVA and p-value is used in the present study. Table 6.a to 6.d presents the results of tested hypothesis. Each hypothesis is tested under classifications such as age groups (L, M and H), Qualification (B and P) and tenure and designation (J and S). The results of hypothesis testing is therefore not singularly conclusive ones rather is drawn on to conclusion in terms of each of this classification. In addition, Welch's t-test compares sample means, Welch's ANOVA compares sample variances between groups, and p-value uses 0.05 significance level to examine the hypothesis.

Table 6.a: Results of H1.0 for every classification

Hypothesis	Cat.	Decision Parameters					
		Welch's t-test	Status	Welch's ANOVA	Status	P-value	Status
H 1.0: LO	L	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	M	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	H	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	B	$t_s > t_c$	A	$F_s > F_c$	A	< 0.05	A
	P	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	J	$t_s > t_c$	A	$F_s > F_c$	A	< 0.05	A
	S	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R

For the hypothesis, examining the perceived differences in learning organization attribute between large and medium-scale sectors, in terms of Welch's t-test, for B and J classification the difference is statistically significant. In terms of Welch's ANOVA, for L, M, B and J classifications the differences are statistically significant and through assessment using p-values, for B and J classification there is statistically significant difference. As is evident, for the classification of B and J, there is statistically significant differences reported from all three tests. This indicates that in the perception of B and J class employees is medium-scale industries they desire enhancements in learning environment attribute as supposed to those in larger industries wherein the learning environments is comparatively better.

Table 6.b: Results of H2.0 for every classification

Hypothesis	Cat.	Decision Parameters					
		Welch's t-test	Status	Welch's ANOVA	Status	P-value	Status
H 2.0: JR	L	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	M	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	H	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	B	$t_s > t_c$	A	$F_s > F_c$	A	< 0.05	A
	P	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	J	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	S	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R

For the hypothesis, examining the perceived differences in job rotation attribute between large and medium-scale sectors, in terms of Welch's t-test, for B classification the difference is statistically

significant. In terms of Welch's ANOVA, for L, M, B and J classifications the differences are statistically significant and through assessment using p-values, for B classification there is statistically significant difference. As is evident, for the classification of B, there is statistically significant differences reported from all three tests. This indicates that in the perception of B class employees is medium-scale industries they desire enhancements in job rotation attributes as supposed to those in larger industries.

Table 6.c: Results of H3.0 for every classification

Hypothesis	Cat.	Decision Parameters					
		Welch's t-test	Status	Welch's ANOVA	Status	P-value	Status
H 3.0: JE	L	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	M	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	H	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	B	$t_s > t_c$	A	$F_s > F_c$	A	< 0.05	A
	P	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	J	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	S	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R

For the hypothesis, examining the perceived differences in job enrichment attribute between large and medium-scale sectors, in terms of Welch's t-test, for B classification the difference is statistically significant. In terms of Welch's ANOVA, for L, M, B and J classifications the differences are statistically significant and through assessment using p-values, for B classification there is statistically significant difference. As is evident, for the classification of B, there is statistically significant differences reported from all three tests. This indicates that in the perception of B class employees is medium-scale industries they desire enhancements in job enrichment attributes as supposed to those in larger industries.

Table 6.d: Results of H4.0 for every classification

Hypothesis	Cat.	Decision Parameters					
		Welch's t-test	Status	Welch's ANOVA	Status	P-value	Status
H 4.0: J.En	L	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	M	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	H	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	B	$t_s > t_c$	A	$F_s > F_c$	A	< 0.05	A
	P	$t_s < t_c$	R	$F_s < F_c$	R	> 0.05	R
	J	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R
	S	$t_s < t_c$	R	$F_s > F_c$	A	> 0.05	R

For the hypothesis, examining the perceived differences in job enlargement attribute between large and medium-scale sectors, in terms of Welch's t-test, for B classification the difference is statistically significant. In terms of Welch's ANOVA, for L, M, B, J and S classifications the differences are statistically significant and through assessment using p-values, for B classification there is statistically significant difference. As is evident, for the classification of B, there is statistically significant differences reported from all three tests. This indicates that in the perception of B class employees is medium-scale industries they desire enhancements in job enlargement attributes as supposed to those in larger industries.

6. Conclusions

The study highlights that employees in large-scale industries perceive better opportunities for skill variety across different age groups, with notable differences in Learning Organization (LO), Job Enrichment (JE), and Job Enlargement (J.En). While Welch's t-tests do not indicate statistically significant differences due to small to medium effect sizes, Welch's ANOVA confirms significant variance differences, particularly for Lower Age Group (LAG) and Middle Age Group (MAG) employees. This suggests that structured learning environments, job rotation, and role expansion are more prevalent in large industries, contributing to enhanced skill development and career growth.

For Higher Age Group (HAG) employees, no significant differences are found between medium- and large-scale industries in terms of skill variety dimensions. The absence of statistically significant differences, supported by low effect sizes and Welch's ANOVA results, indicates that skill variety may not be a primary differentiating factor for this group. Instead, other workplace attributes might play a more influential role in their job satisfaction and performance.

Overall, the findings suggest that medium-scale industries could benefit from adopting structured learning frameworks, mentorship programs, and job enlargement strategies to enhance employee development, particularly for younger and mid-career employees. These improvements could bridge the skill variety gap between industry scales, fostering a more engaging and productive work environment.

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