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Assessing Industrial Technology Students' Workplace Adaptability Readiness Toward Advancing SDG 4

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Abstract: A descriptive-comparative quantitative study investigated adaptability, collaboration, problem-solving, growth, and professionalism among 297 College of Industrial Technology graduates. The academic major selected participants through stratified randomisation. A systematic online survey was distributed through class group conversations, with informed consent obtained to maintain anonymity. Excel replies were examined by SPSS v26. ANOVA and Tukey's HSD were used to examine differences in organisational involvement and academic success at an alpha level of 0.05. Descriptive statistics summarized the results, and ethical standards were upheld throughout the study. The survey found that College of Industrial Technology graduates demonstrated flexibility in teamwork, problem-solving, professionalism, and personal growth. Flexibility was often ranked lower, indicating a key area for development. Women reported more personal growth, but differences were modest. Independent students scored higher on several adaptation characteristics, suggesting it may increase soft skills. Student leaders enhanced workplace adaptation, cooperation, and adaptability. Thus, leisure social media users were more flexible than productive users in growth and professionalism. Upper-class students rated themselves higher in key categories of adaptability. Organisational involvement, housing, social media use, and socioeconomic status also affected collaboration and problem-solving. These data suggest that internal and contextual factors affect students' preparation for a dynamic professional context. Interactive and adaptive learning may enhance the careers of technical education graduates.

Keywords: Quantitative Study; Industrial Technology; Soft Skills; Adaptability Categories; Organisational Involvement Problem-Solving; Interactive and Adaptive; Technical Education.

1. Introduction

Today's evolving labour market recognizes the ability to adapt to shifting workplace demands as a valuable skill for graduates, particularly in technical and vocational fields. As industries undergo digital transformation and adopt innovation-oriented practices, the expectations placed on new entrants extend beyond technical competence to include soft skills such as adaptability, resilience, and commitment to lifelong learning [3]; [16]. For students in Industrial Technology programs, these competencies are important for navigating dynamic and interdisciplinary work environments. Workplace adaptability refers to an individual's capacity to adjust to changes in job roles, technologies, work settings, and interpersonal dynamics [10]. It involves cognitive and behavioural flexibility, openness to feedback, and the ability to manage uncertainty and change [1]. In the context of technical education, adaptability supports the transition from academic preparation to the complex demands of

the workforce, particularly in sectors influenced by technological advancements [6]; [18]. This study is grounded in the principles of the United Nations Sustainable Development Goal 4 (SDG 4), which advocates for inclusive, equitable, and quality education. Target 4.4 aims to increase the number of youth and adults who possess relevant skills for employment, decent jobs, and entrepreneurship.

Although Industrial Technology programs have historically emphasised technical proficiency, there is a growing acknowledgement of the value of integrating soft skills, such as adaptability, to better align with workforce needs [9]. To address this area, the present study uses a survey-based approach to assess the workplace adaptability of graduating Industrial Technology students. This approach enables the collection of empirical data to evaluate students' preparedness to meet contemporary labour market demands and to engage in continued professional development [8]; [17]. By examining adaptability levels, the research offers insight into how well technical education programs align with the objectives of SDG 4 and the competencies valued in today's workplaces [15]. The findings of this study aim to support curriculum refinement and instructional strategies that emphasise both technical and soft skill development. The results may also inform educators and policymakers about potential areas for improvement in Industrial Technology education, helping graduates become more adaptable, resilient, and responsive to future workforce challenges [5]; [13].

2. Literature Review

2.1. Workplace Adaptability and SDG 4: Quality Education

In the context of rapid technological advancements and shifting labour market demands, workplace adaptability has emerged as a critical competency for graduates, particularly in technical and industrial sectors. This competency aligns with Sustainable Development Goal (SDG) 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Specifically, Target 4.4 emphasises the need to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship" by 2030. Developing adaptability within educational settings is thus essential for preparing students to navigate the complexities of modern workplaces and contribute to sustainable economic development [19].

2.2. Adaptability in Industrial Technology Education

Adaptability encompasses cognitive, emotional, and behavioural dimensions that collectively enable individuals to adjust effectively to changing circumstances [1]. In industrial technology education, cognitive adaptability refers to the ability to modify thinking and problem-solving strategies in response to new tools or challenges, such as learning computer-aided design (CAD) software or troubleshooting complex machinery. Emotional adaptability refers to the ability to manage stress and maintain motivation during practical tasks or collaborative projects, which is crucial for sustaining engagement and optimal performance. Behavioural adaptability reflects the willingness to alter actions, such as adopting modern technologies or collaborating with diverse teams, to meet evolving workplace demands. Empirical studies indicate that fostering adaptability during education enhances students' ability to manage career transitions and adapt to changing job requirements, aligning with the objectives of SDG 4.4 [13]. Educational institutions play a pivotal role in cultivating these competencies through curricula that emphasise flexibility, resilience, and continuous learning.

2.3. Collaboration as a Component of Adaptability

Collaboration is integral to adaptability, particularly in industrial technology fields where interdisciplinary teamwork is common. Effective collaboration requires competencies such as clear communication, conflict resolution, and shared problem-solving. Students must learn to articulate technical information to diverse audiences, navigate interpersonal dynamics, and contribute constructively to team objectives [4]. The development of collaboration skills can be understood through Maharani et al. [2] model of group development, which outlines stages of forming, storming, norming, and performing. Recognising and facilitating progression through these stages can enhance team effectiveness and individual adaptability. Educational strategies, such as project-based learning, internships, and cooperative education, provide practical contexts for students to develop and refine their collaborative competencies [11].

2.4. Problem-Solving and Adaptive Expertise

Problem-solving is a critical aspect of adaptability, involving the identification of issues, analysis of information, and implementation of effective solutions. In industrial technology, students encounter complex, often ill-defined problems that require analytical, creative, and heuristic approaches to solve. Developing adaptive expertise enables students to apply knowledge flexibly and innovatively across varying contexts, a skill highly valued in dynamic work environments [1]. Educational programs that emphasise real-world problem-solving tasks encourage experimentation and support reflective

practices that contribute to the development of adaptive problem-solving skills. Such competencies are essential for meeting the demands of modern industries and align with the skill development goals outlined in SDG 4.4.

2.5. Professionalism and Workplace Adaptability

Professionalism, characterised by reliability, responsibility, ethical conduct, and respect for others, underpins effective workplace adaptability. In technical fields, professionalism entails adhering to safety standards, maintaining precision in work, and engaging in proactive communication. These behaviours foster trust and facilitate smooth adaptation to organisational changes [13]. Educational institutions can instil professionalism through curricula that integrate ethical considerations, emphasise the importance of standards and protocols, and provide opportunities for students to engage in professional practices. Such initiatives prepare students to navigate the complexities of modern workplaces and contribute positively to organisational cultures.

2.6. Growth Mindset and Lifelong Learning

A growth mindset, the belief that abilities can be developed through dedication and hard work, is fundamental to adaptability and lifelong learning. Students with a growth mindset are more likely to embrace challenges, persist in the face of setbacks, and view effort as a path to mastery [5]. In industrial technology education, fostering a growth mindset encourages students to continuously acquire new skills and adapt to technological advancements. Educational strategies that promote a growth mindset include providing constructive feedback, encouraging reflection, and creating learning environments that value effort and improvement. These approaches support the development of resilient and adaptable professionals who are equipped to meet the evolving demands of the workforce.

2.7. Institutional Support for Developing Adaptability

Institutional support is crucial for cultivating adaptability among students. This includes providing access to resources, creating supportive learning environments, and offering programs that promote skill development. For instance, participation in student organisations has been linked to enhanced leadership, teamwork, and communication skills, all of which contribute to adaptability [4]. Moreover, institutions can implement policies and curricula that emphasise the importance of adaptability, integrate real-world problem-solving experiences, and provide mentorship opportunities. Such comprehensive support structures align with the objectives of SDG 4.4 by ensuring that students acquire the relevant skills needed for employment and lifelong learning.

2.8. Secondary Variables Influencing Workplace Adaptability

Gender influences how adaptability develops and manifests. Studies show male students often perform better in task-oriented activities. In contrast, female students tend to excel in interpersonal adaptability and emotional intelligence, suggesting the need for gender-responsive educational strategies [19]. Living arrangements have a significant impact on students' independence and time management, which are essential skills for workplace readiness. Those living independently typically develop stronger self-regulation and adaptive skills. Institutions can enhance these traits by providing targeted support and resources that foster autonomy and resilience [2]. Social media offers benefits for collaborative learning and networking, but poses risks of distraction if overused. Purposeful and balanced use enhances adaptability through knowledge exchange, whereas excessive use can harm focus and productivity. Educators should guide students in managing their digital engagement to optimise learning outcomes [14]. Participation in student organisations significantly builds leadership, teamwork, and communication abilities—essential for adaptability. Such involvement also boosts emotional intelligence and social skills, preparing students for professional interpersonal challenges [4]. Socioeconomic status influences access to educational opportunities and the development of resilience. Students from lower socioeconomic backgrounds often develop adaptive coping skills by overcoming adversity, whereas those from higher socioeconomic backgrounds benefit from more extensive skill-building resources. Equitable institutional support is critical to ensure all students develop the necessary adaptability skills for career success [12].

2.9. Synthesis

Workplace adaptability is a construct encompassing cognitive, emotional, and behavioural dimensions, which collectively facilitate individuals' ability to adjust to dynamic work environments. Research indicates that individual factors such as gender and socioeconomic status can influence adaptability. Studies show variations in task performance and interpersonal skills between male and female students, as well as differences in resilience related to socioeconomic backgrounds [12]. Educational experiences also contribute significantly to the development of adaptability [19]. For instance, participation in student organisations has been associated with improved leadership, teamwork, and communication skills—key components of

adaptability [4]. Problem-solving tasks and project-based learning further support cognitive and behavioural adaptability by providing opportunities to engage with real-world challenges [11]; [1]. Institutional support, including the promotion of growth mindsets and guidance on healthy social media use, plays a critical role in fostering adaptability and lifelong learning [5]; [14]. Moreover, supportive policies and resources addressing students' living conditions and digital habits can enhance self-regulation and focus, further enabling adaptability [2]. These align with Sustainable Development Goal 4.4, which emphasises the need to equip youth and adults with relevant technical and vocational skills for employment and entrepreneurship [19], according to the United Nations Development Program (UNDP). Collectively, the literature suggests that a comprehensive approach integrating individual, educational, and institutional factors can support the development of workplace adaptability among students preparing for modern labour markets.

3. Methodology

This quantitative study employed a descriptive-comparative research design to examine workplace competencies among graduating students at the College of Industrial Technology. The research focused on five key competencies: adaptability, collaboration, problem-solving, growth, and professionalism. The participants consisted of 297 graduating students, selected using stratified random sampling across different academic majors within the college to ensure balanced representation. Data was collected through an online survey developed and distributed via Google Forms. The survey instrument was carefully structured to assess the five targeted workplace competencies. Invitations to participate were disseminated through class group chats, ensuring accessibility and encouraging engagement. Informed consent was integrated directly within the Google Forms questionnaire, and confidentiality was assured throughout the process. Upon completion of data collection, the responses were initially organised in Microsoft Excel to facilitate a preliminary overview. The dataset was subsequently imported into the Statistical Package for Social Sciences (SPSS) version 26 to enable comprehensive analysis.

Descriptive statistics, including means and standard deviations, were calculated for each of the five workplace competencies. This approach provided a general overview of participants' responses and allowed for a clear depiction of data variability within each competency area. To identify significant differences in workplace competencies based on organisational involvement and academic achievement, a one-way analysis of variance (ANOVA) was employed. For competencies that demonstrated significant differences in the ANOVA, post hoc analysis using Tukey's Honest Significant Difference (HSD) test was conducted. This further analysis identified which specific group comparisons contributed to the observed differences, providing deeper insight into the dynamics of each competency across various student profiles. An alpha level of 0.05 was adopted to determine statistical significance. The study adhered strictly to ethical standards for research involving human participants. Participation was voluntary, and informed consent was obtained from all respondents. Data confidentiality was rigorously maintained, and results were reported in aggregate form to protect individual identities.

4. Result and Discussion

4.1. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students as an Entire Group

The workplace adaptability of graduating students from the College of Industrial Technology was assessed across five key dimensions: Adaptability, Collaboration, Problem-Solving, Professionalism, and Growth. Using a four-point Likert scale, students rated their perceived competencies in each of these areas. The descriptive data in Table 1 offer an overview of workplace adaptability dimensions among the participants. The overall mean score for workplace adaptability was 2.72 (SD = 0.45), which fell within the "high" category, suggesting that students perceive themselves as possessing strong workplace adaptability. Among the five dimensions, Growth (M = 2.90, SD = 0.46) received the highest mean score, followed by Professionalism (M = 2.81, SD = 0.52), Problem-Solving (M = 2.72, SD = 0.48), and Collaboration (M = 2.70, SD = 0.48)—all within the high range. The Adaptability dimension, however, received the lowest mean score, at 2.49 (SD = 0.63), which is classified as low. This result suggests a relative gap in students' confidence in their ability to respond flexibly to changing conditions and uncertainties in the workplace.

Table 1: Level of workplace adaptability of industrial technology graduating students as an entire group

Dimension of Workplace Adaptability	Mean	SD	Description
Adaptability	2.49	.63	Low
Collaboration	2.70	.48	High
Problem solving	2.72	.48	High
Professionalism	2.81	.52	High
Growth	2.90	.46	High
Over-all Mean	2.72	.45	High

These findings reveal that graduating Industrial Technology students perceive themselves as competent in several critical workplace dimensions. The strong results in Growth, Professionalism, and Problem-Solving reflect well on their readiness to pursue continuous learning, maintain workplace standards, and manage job-related challenges, attributes identified by Chen et al. [9] and Maharani et al. [2] as essential for career success in technical fields. The lower score in the Adaptability dimension is consistent with the literature, which highlights the challenges students face in developing flexible and adaptive mindsets. As noted, adaptability remains a complex and underdeveloped competency among graduates, despite its critical importance in dynamic, rapidly changing work environments. This suggests that while students may excel in areas related to structured skill sets and interpersonal collaboration, they may require more explicit training in responding to uncertainty and change. Moreover, the impressive performance in Professionalism and Growth indicates that students are prepared to meet the demands of lifelong learning and uphold ethical standards in the workplace.

These traits are central to achieving Sustainable Development Goal 4 (SDG 4), particularly its focus on inclusive, equitable education and the development of relevant skills for decent work. Integrating adaptability training into technical education aligns well with this global objective and supports the development of a more future-ready workforce [9]. The high ratings in Collaboration and Problem Solving reinforce the importance of soft skills in technology-driven and interdisciplinary workplaces. These competencies have been emphasised by Maharani et al. [2] and Bodhi et al. [11] as pivotal to team effectiveness and innovation, highlighting that interpersonal and analytical skills are just as vital as technical proficiency. While Industrial Technology students demonstrate promising levels of workplace adaptability overall, their lower self-assessment in this core area signals a need for enhanced educational strategies. Curricular initiatives aimed at building flexible thinking, openness to change, and adaptive behaviour could further strengthen their employment readiness and better support the aims of SDG 4.

4.2. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students by Sex

Highlighting gender differences, Table 2 presents mean scores for adaptability-related attributes across male and female respondents. Both male and female students reported high overall workplace adaptability, with females showing a slightly higher mean score (M = 2.78, SD = 0.45) compared to males (M = 2.68, SD = 0.45). Across the five dimensions, both male (M = 2.49, SD = 0.64) and female (M = 2.48, SD = 0.63) students rated their core Adaptability skills as low, indicating that, regardless of sex, students perceive limited confidence in their ability to respond effectively to changes and uncertainties in the workplace. However, in the dimensions of Collaboration, Problem Solving, and Professionalism, both groups scored within the high range. Notably, female students slightly outperformed male counterparts in Collaboration (M = 2.75 vs. 2.65) and demonstrated a more pronounced difference in the Growth dimension (M = 3.09 vs. 2.76). Both groups perceived themselves as capable of growth, but the higher rating among females suggests a stronger inclination toward continuous learning and self-improvement.

Table 2: Level of workplace adaptability of industrial technology graduating students by sex

Dimension of Workplace Adaptability	Male			Female		
	Mean	SD	Description	Mean	SD	Description
Adaptability	2.49	.64	Low	2.48	.63	Low
Collaboration	2.65	.48	High	2.75	.47	High
Problem solving	2.72	.48	High	2.73	.49	High
Professionalism	2.80	.52	High	2.82	.53	High
Growth	2.76	.43	High	3.09	.44	High
Over-all Mean	2.68	.45	High	2.78	.45	High

These findings affirm that both male and female students perceive themselves as well-equipped in core workplace competencies, particularly in Professionalism, Collaboration, problem-solving, and Growth. This supports previous research stressing the critical role of soft skills in workforce preparedness and employability within technical education [16]; [3]. The consistently low scores in the Adaptability dimension, regardless of sex, indicate a broader concern about students' readiness to navigate rapid changes in the workplace. This corroborates Martin et al. [1], who emphasised the challenge of fostering adaptability among students in academic and transitional work settings. It signals the need for curricular enhancements that explicitly build adaptive capacities in both male and female learners. The observed gender difference in the Growth dimension, where females reported notably stronger perceptions of lifelong learning and self-development potential, may reflect differing levels of engagement in reflective learning practices.

Chen et al. [9] and UNESCO-UNEVOC [15] note that such patterns may arise from gender-based motivational or socialisation factors influencing students' attitudes toward personal and professional growth. These results also bear implications for achieving Sustainable Development Goal 4, particularly Target 4.4, which aims to increase the number of young people and

adults with relevant skills for employment and entrepreneurship. Ensuring that both sexes have equitable opportunities to develop adaptability and related competencies is essential in fulfilling this objective. Integrating gender-responsive strategies into technical education, such as differentiated mentoring, inclusive pedagogy, and growth-oriented interventions, can enhance the workplace adaptability of both male and female students. As Gan et al. [19] suggest, tailoring learning environments to address gender-specific development needs can promote more inclusive and effective skill-building across diverse learner populations.

4.3. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students as to Living Arrangements

Table 3 presents the levels of workplace adaptability of Industrial Technology graduating students, disaggregated by living arrangement, categorised as dependent (living with family) and independent (living away from family). Both groups reported high overall workplace adaptability, with students living independently showing a slightly higher mean score (M = 2.83, SD = 0.46) compared to those living dependently (M = 2.62, SD = 0.42). Examining the specific dimensions, both groups rated Adaptability as low, with identical means for dependent (M = 2.48, SD = 0.60) and independent students (M = 2.49, SD = 0.67). However, independent students scored higher across Collaboration (M = 2.80 vs. 2.59), Problem-Solving (M = 2.81 vs. 2.64), Professionalism (M = 2.98 vs. 2.64), and Growth (M = 3.07 vs. 2.73) compared to their dependent counterparts. These findings suggest that living independently may enhance certain workplace adaptability skills, particularly in professional and interpersonal domains.

Table 3: Level of workplace adaptability of industrial technology graduating students as to living arrangements

Dimension of Workplace Adaptability	Dependent			Independent		
	Mean	SD	Description	Mean	SD	Description
Adaptability	2.48	.60	Low	2.49	.67	Low
Collaboration	2.59	.45	High	2.80	.49	High
Problem solving	2.64	.46	High	2.81	.49	High
Professionalism	2.64	.49	High	2.98	.50	High
Growth	2.73	.43	High	3.07	.44	High
Over-all Mean	2.62	.42	High	2.83	.46	High

The similarity in low Adaptability scores across both groups highlights a shared challenge: students' confidence in their ability to adjust flexibly to workplace changes and uncertainties. This suggests a potential area for targeted intervention regardless of living arrangement. The higher scores for independent students may reflect the increased self-reliance, decision-making, and problem-solving opportunities that come with managing one's living environment, which contributes positively to collaboration, professionalism, and growth competencies [1]; [14]. Conversely, while dependent students benefit from familial support, they may have fewer opportunities to develop these skills independently, which can affect their adaptability in the workplace. Overall, these results emphasise the need to consider living arrangements as a contextual factor influencing workplace adaptability. Tailored educational strategies could support students in both groups in strengthening their adaptability skills, thereby enhancing their preparedness for dynamic work environments. Moreover, fostering adaptability, professionalism, and lifelong learning aligns with Sustainable Development Goal 4, specifically target 4.4, which focuses on equipping young people with relevant skills for employment and entrepreneurship. By integrating such considerations, Industrial Technology programs can better meet the evolving demands of the workforce.

4.4. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students as to Social Media Use

The distribution of adaptability scores by year level is summarised in Table 4, illustrating potential developmental trends. It displays the levels of workplace adaptability of Industrial Technology graduating students, categorised by their primary use of social media: productive versus recreational. Both groups rated their overall workplace adaptability as high, with students who use social media recreationally reporting a higher overall mean (M = 2.91, SD = 0.43) than those using it productively (M = 2.55, SD = 0.40). Looking into specific dimensions, the productive-use group rated Adaptability as low (M = 2.32, SD = 0.60), whereas the recreational-use group rated it high (M = 2.66, SD = 0.63). Both groups scored high in Collaboration, Problem Solving, and Professionalism, with the recreational group consistently reporting higher means across these dimensions. Notably, the Growth dimension received the highest ratings, particularly for recreational users (M = 3.29, SD = 0.28), classified as very high, compared to the productive group (M = 2.54, SD = 0.27).

Table 4: Level of workplace adaptability of industrial technology graduating students as to social media use

Dimension of Workplace Adaptability	Productive			Recreational		
	Mean	SD	Description	Mean	SD	Description
Adaptability	2.32	.60	Low	2.66	.63	High
Collaboration	2.64	.46	High	2.76	.49	High
Problem solving	2.65	.45	High	2.80	.51	High
Professionalism	2.57	.45	High	3.06	.47	High
Growth	2.54	.27	High	3.29	.28	Very high
Over-all Mean	2.55	.40	High	2.91	.43	High

These results suggest that students who primarily engage with social media for recreational purposes perceive themselves as more adaptable and demonstrate stronger growth-related competencies, reflecting a greater openness to continuous learning and self-development. Meanwhile, those who use social media productively also perceive themselves positively in terms of collaboration, problem-solving, professionalism, and growth, but may have comparatively less confidence in their core adaptability skills. The lower Adaptability score among productive social media users aligns with prior research indicating that adaptability remains a challenging skill to develop, requiring focused attention in education and training [1]. Conversely, stronger scores in Growth for recreational users might relate to the broader exposure to diverse ideas and peer interactions facilitated through social platforms [12]. These findings hold implications for educational strategies in Industrial Technology programs. Leveraging social media's potential as a tool for both productive learning and informal peer engagement could enhance workplace adaptability skills across dimensions. Furthermore, embedding adaptability training and promoting lifelong learning align with Sustainable Development Goal 4's emphasis on equitable, quality education and relevant workforce skills [7].

4.5. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students to Participation in School Organisation

Table 5 presents the levels of workplace adaptability among Industrial Technology graduating students, categorized by their participation in school organizations: none, member, or leader. The overall workplace adaptability ratings increase significantly with greater organisational involvement. Non-participants score low (M = 2.47, SD = 0.34), members score high (M = 2.72, SD = 0.41), and leaders score high as well, but notably higher (M = 3.09, SD = 0.38). Looking at specific dimensions, students who did not participate in any school organisations consistently reported low levels of adaptability (M = 2.03, SD = 0.43), collaboration (M = 2.26, SD = 0.21), and problem-solving (M = 2.41, SD = 0.35). However, they rated professionalism (M = 2.71, SD = 0.47) and growth (M = 2.91, SD = 0.44) as high. Members of organisations showed marked improvements in adaptability (M = 2.52, S D = 0.48), collaboration (M = 2.74, SD = 0.24), and problem-solving (M = 2.75, SD = 0.41), all within the high range, while professionalism and growth remained high. Leaders demonstrated the highest levels across all dimensions, with adaptability (M = 3.11, SD = 0.44) rated as high and collaboration (M = 3.28, SD = 0.24) rated as very high.

Table 5: Level of workplace adaptability of industrial technology graduating students as to school organisation participation

Dimension of Workplace Adaptability	None			Member			Leader		
	Mean	SD	Description	Mean	SD	Description	Mean	SD	Description
Adaptability	2.03	.43	Low	2.52	.48	Low	3.11	.44	High
Collaboration	2.26	.21	Low	2.74	.24	High	3.28	.24	Very high
Problem solving	2.41	.35	Low	2.75	.41	High	3.15	.37	High
Professionalism	2.71	.47	High	2.77	.56	High	2.98	.52	High
Growth	2.91	.44	High	2.87	.50	High	2.92	.47	High
Over-all Mean	2.47	.34	Low	2.72	.41	High	3.09	.38	High

These findings suggest that participation, especially in leadership roles, in school organisations, is associated with greater workplace adaptability. Active involvement fosters critical soft skills such as collaboration, problem-solving, and adaptive capacity, which are essential for workplace success [14]; [3]. The progression from low to very high ratings across dimensions underscores the value of leadership experiences in cultivating these competencies. The results align with existing literature emphasising experiential learning and social engagement as pivotal in developing workplace readiness [1]; [12]. Moreover, these findings support the goals of Sustainable Development Goal 4, particularly in fostering inclusive and equitable quality education that prepares students with relevant skills for employment and entrepreneurship [7]. Encouraging students to engage actively and take on leadership roles in school organisations may thus be an effective strategy for enhancing their workplace adaptability and overall career preparedness.

4.6. Measuring the Workplace Adaptability of College of Industrial Technology Graduating Students as to Socioeconomic Status

Table 6 contrasts adaptability skills by program completion status, shedding light on potential differences in workplace readiness. It presents the workplace adaptability levels of Industrial Technology graduating students, disaggregated by their self-reported socioeconomic status (low, average, and high). All three groups rated their workplace adaptability within the "high" range, with the highest mean rating found among students from the high socioeconomic status group (M = 3.01, SD = 0.46), followed by those from average (M = 2.72, SD = 0.45) and low (M = 2.67, SD = 0.43) socioeconomic backgrounds. In terms of specific dimensions, students from the high socioeconomic status group consistently reported higher means across all five workplace adaptability areas.

Notably, these students showed particularly high ratings in problem-solving (M = 3.24, SD = 0.43) and collaboration (M = 3.03, SD = 0.42), indicating their perceived strength in these critical soft skills. Similarly, their mean scores in growth (M = 2.97, SD = 0.45) and professionalism (M = 2.94, SD = 0.57) also surpassed those of the average and low socioeconomic groups.

Table 6: Level of workplace adaptability of industrial technology graduating students as to socioeconomic status

Dimension of Workplace Adaptability	Low			Average			High		
	Mean	SD	Description	Mean	SD	Description	Mean	SD	Description
Adaptability	2.43	.63	Low	2.45	.62	Low	2.86	.63	High
Collaboration	2.65	.48	High	2.67	.46	High	3.03	.42	High
Problem solving	2.56	.45	High	2.78	.44	High	3.24	.43	High
Professionalism	2.79	.48	High	2.79	.55	High	2.94	.57	High
Growth	2.89	.43	High	2.90	.51	High	2.97	.45	High
Over-all Mean	2.67	.43	High	2.72	.45	High	3.01	.46	High

Conversely, students in the low- and average-socioeconomic groups rated their adaptability dimension as "low" (M = 2.43, SD = 0.63 and M = 2.45, SD = 0.62, respectively), suggesting that economic constraints may be associated with limited exposure to experiences that foster adaptability. This pattern resonates with previous findings that socioeconomic context can influence students' access to resources, training opportunities, and support networks [12]; [19]. Nevertheless, the uniformly high ratings in professionalism, growth, collaboration, and problem-solving skills underscore a broadly shared confidence in these areas across all socioeconomic strata. These findings affirm the relevance of soft skill development in technical education and support earlier research highlighting the pivotal role of such skills in fostering workplace adaptability and lifelong learning [14]; [3].

Importantly, the observed gap in adaptability scores suggests a need for targeted efforts to strengthen this competency, particularly among students from lower socioeconomic backgrounds. Addressing this gap aligns with Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education and lifelong learning opportunities for all, as outlined by the United Nations Development Program. Tailored interventions—such as mentorship programs, experiential learning opportunities, and adaptive mindset training—could help close this adaptability gap and ensure more equitable preparation for the workplace [7].

4.7. T-test Results of the Difference in the Workplace Adaptability of College of Industrial Technology Graduating Students as to Sex

Self-assessment of skills is analysed in Table 7, providing a detailed perspective on self-perceived adaptability capacities. It shows the results of the independent samples t-test comparing the workplace adaptability scores of male and female Industrial Technology graduating students across five dimensions. Overall, most dimensions showed no statistically significant differences between the two groups. For adaptability (t = 0.189, p = .850), collaboration (t = -1.758, p = .080), problem-solving (t = -0.227, p = .821), and professionalism (t = -0.420, p = .674), the p-values exceed the conventional significance threshold of 0.05, indicating no significant differences between male and female students. These findings suggest that, regardless of sex, students exhibit similar perceptions of their competence in these areas of workplace adaptability.

However, a statistically significant difference was observed in the growth dimension (t = -6.382, p = .000). Female students (M = 3.09) reported significantly higher mean scores than their male counterparts (M = 2.76), suggesting that female students perceive themselves as more engaged in continuous learning and self-improvement. This aligns with prior research suggesting that women may be more inclined to seek out learning opportunities and demonstrate proactive growth behaviours in professional contexts [12].

Table 7: t-test results of workplace adaptability of industrial technology graduating students as to sex

Workplace Adaptability	Mean		t-value	df	Sig level
	Male	Female			
Adaptability	2.49	2.48	.189	295	.850
Collaboration	2.65	2.75	-1.758	295	.080
Problem solving	2.72	2.73	-.227	295	.821
Professionalism	2.80	2.82	-.420	295	.674
Growth	2.76	3.09	-6.382	295	.000

The findings reveal that sex is not a significant differentiator in most dimensions of workplace adaptability among Industrial Technology students, aligning with studies suggesting that non-cognitive skill development, such as collaboration and professionalism, can be cultivated irrespective of gender. However, the significant difference in the growth dimension warrants further exploration. Higher growth scores among females may reflect greater engagement in lifelong learning activities or self-directed improvement. This is consistent with observations by the OECD that female students often outperform their male counterparts in non-cognitive areas, such as self-regulation and planning. This difference may also suggest that female students are more attuned to the demands of a rapidly changing workplace, where continuous learning and flexibility are key. These results contribute to the understanding of how workplace readiness manifests across genders and can inform strategies aligned with SDG 4.4, which advocates for equal access to relevant skills for all youth regardless of gender. Addressing the growth gap among males by fostering inclusive training programs and mentorship opportunities could help ensure balanced development in technical-vocational settings.

4.8. T-test Results of the Difference in the Workplace Adaptability of College of Industrial Technology Graduating Students as to Living Arrangements

Table 8 presents the t-test results comparing the workplace adaptability of Industrial Technology graduating students based on their living arrangements: either living independently (such as renting a room or apartment) or dependently (with family or relatives). The data show that there was no significant difference in the core adaptability dimension between dependent and independent students (t = -0.046, p = .963), suggesting that students perceive their general adaptability similarly regardless of their living situation. However, significant differences emerged in four other dimensions of workplace adaptability: collaboration, problem-solving, professionalism, and growth. For collaboration, independent students scored significantly higher (M = 2.80) than dependent students (M = 2.59), with a t-value of -3.857 and p-value of .000. This finding suggests that independent living may provide opportunities for students to build better teamwork and interpersonal skills, due to more exposure to real-world collaborative situations.

Likewise, independent students scored significantly higher in problem-solving skills (M = 2.81) than dependent students (M = 2.64), with t = -3.048 and p = .000. This result aligns with the idea that managing an independent living situation often requires students to manage challenges and make decisions independently, fostering stronger problem-solving abilities. Professionalism also differed significantly between the two groups: independent students (M = 2.98) reported higher levels of professionalism compared to dependent students (M = 2.64), with a t-value of -5.927 and a p-value of .002. Independent living might nurture maturity, accountability, and time management—factors that contribute to professional behaviour.

Table 8: T-test results of workplace adaptability of industrial technology graduating students as to living arrangements

Workplace Adaptability	Mean		t-value	df	Sig level
	Dependent	Independent			
Adaptability	2.48	2.49	-.046	295	.963
Collaboration	2.59	2.80	-3.857**	295	.000
Problem solving	2.64	2.81	-3.048**	295	.000
Professionalism	2.64	2.98	-5.927**	295	.002
Growth	2.73	3.07	-.6.643**	295	.000

The most notable difference was found in the growth dimension, with independent students scoring higher (M = 3.07) than dependents (M = 2.73), with t = -6.643 and p = .000. This suggests that independent living may foster greater engagement in continuous learning and self-improvement, as these students are likely to navigate more personal and academic challenges on their own. Overall, these findings highlight how living independently supports the development of key workplace adaptability skills, in line with research that emphasises the importance of greater autonomy and responsibility in contributing to workplace readiness [1]; [12]. Such differences underscore the need to provide targeted support to dependent students through activities,

training, and mentoring, which can help bridge these gaps and ensure equitable opportunities for growth and skill development. This is crucial for fulfilling Sustainable Development Goal 4.4, which aims to equip all youth and adults with skills relevant to employment and entrepreneurship [7]; United Nations Development Program, n.d.).

4.9. T-test Results of the Difference in The Workplace Adaptability of College of Industrial Technology Graduating Students as to Social Media Use

Table 9 details the t-test comparisons of adaptability scores across productive and recreational workplace environments. The t-test analysis compares the workplace adaptability of Industrial Technology graduating students who use social media for productive purposes versus those who use it for recreational purposes. The results indicate that students who consistently engage in recreational social media use report significantly higher workplace adaptability scores across all measured dimensions. Specifically, adaptability scores were significantly higher for recreational users (M = 2.66, SD = 0.63) compared to productive users (M = 2.32, SD = 0.60), with a t-value of -4.751 (p = .000). Similarly, collaboration was higher among recreational users (M = 2.76, SD = 0.49) than productive users (M = 2.64, SD = 0.46), t = -2.089 (p = .038). In problem solving, recreational users (M = 2.80, SD = 0.51) outperformed productive users (M = 2.65, SD = 0.45), t = -2.633 (p = .009). The most pronounced differences were found in professionalism (M = 3.06 vs. 2.57, t = -9.214, p = .000) and growth (M = 3.29 vs. 2.54, t = -23.442, p = .000), where recreational users exhibited markedly higher perceptions of their abilities.

Table 9: T-test results of workplace adaptability of industrial technology graduating students as to social media use

Workplace Adaptability	Mean		T-value	df	Sig level
	Productive	Recreational			
Adaptability	2.32	2.66	-4.751**	295	.000
Collaboration	2.64	2.76	-2.089*	295	.038
Problem solving	2.65	2.80	-2.633**	295	.009
Professionalism	2.57	3.06	-9.214**	295	.000
Growth	2.54	3.29	-23.442**	295	.000

These findings suggest that recreational social media use may positively influence workplace adaptability skills, including communication, problem-solving, professionalism, and personal growth, among graduating students. This is consistent with Bodhi et al. [11], who found that social media use enhances employee well-being and advocacy behaviour by fostering social support and connectivity, which underpin adaptability. Similarly, Martin et al. [1] emphasise that adaptability in the workplace is nurtured by continuous learning and flexible engagement—attributes often supported through recreational social media interactions that expose users to diverse ideas and networks. The role of social media in building collaboration and problem-solving skills aligns with [1], who highlight how exposure to novelty and uncertainty through social channels can promote adaptability and creative problem-solving.

Moreover, the increased professionalism and personal growth scores for recreational users corroborate with insights from the JIER Journal report, which identifies professionalism as a key adaptability skill that benefits from informal learning and social interaction, often facilitated by digital platforms. This also resonates with Chen et al. [9], who note that workplace adaptability requires skills such as communication, openness to change, and proactive growth—all of which can be potentially enhanced by positive social media engagement. The findings align with Sustainable Development Goal 4.4, which advocates for equipping young people with relevant skills for employment and entrepreneurship [7]; [19]. Encouraging balanced recreational social media use may serve as a practical strategy within Industrial Technology education to better prepare students for the dynamic workplace environments of the future.

4.10. ANOVA Results of the Difference in the Workplace Adaptability of College of Industrial Technology Graduating Students as to School Organisation Participation

Variances in adaptability outcomes across participant roles are explored through ANOVA results in Table 10. The ANOVA results reveal significant differences among the three groups in several dimensions of workplace adaptability. For adaptability, the between-groups sum of squares is 60.422, with a mean square of 30.211, yielding an F-value of 150.861, which is statistically significant at the p < 0.000 level. This indicates that the groups differ in their adaptability scores. Similarly, collaboration shows a highly significant difference among groups, with an F-value of 520.408 (p = .000). Problem-solving also varies significantly across groups (F = 101.471, p = .000). Professionalism demonstrates a significant group difference as well, though with a smaller F-value of 7.344 (p = .001).

Interestingly, the growth dimension shows no significant difference among groups (F = 0.280, p = .756), suggesting that regardless of group membership, growth perceptions are similar. The significant F-values for adaptability, collaboration, problem-solving, and professionalism imply that social media usage patterns may influence these aspects of workplace adaptability differently. Post-hoc analyses would be necessary to identify which specific groups differ from each other in these dimensions.

Table 10: ANOVA results of workplace adaptability of industrial technology graduating students as to school organisation participation

		Sum of Squares	df	Mean Square	F	Sig.
Adaptability	Between Groups	60.422	2	30.211	150.861**	.000
	Within Groups	58.876	294	.200		
	Total	119.298	296			
Collaboration	Between Groups	52.937	2	26.469	520.408**	.000
	Within Groups	14.953	294	.051		
	Total	67.890	296			
Problem solving	Between Groups	28.356	2	14.178	101.471**	.000
	Within Groups	41.079	294	.140		
	Total	69.436	296			
Professionalism	Between Groups	3.834	2	1.917	7.344**	.001
	Within Groups	76.750	294	.261		
	Total	80.584	296			
Growth	Between Groups	.122	2	.061	.280	.756
	Within Groups	63.867	294	.217		
	Total	63.988	296			

These results align with existing literature emphasising the importance of adaptability and collaboration in workplace contexts, which are often influenced by individual experiences and situational factors [3]; [16]. Prior studies have consistently highlighted the role of these dimensions in fostering workplace success and promoting positive outcomes such as engagement and performance [18]; [11]. The significant differences observed in adaptability, collaboration, and problem-solving are consistent with broader research emphasising these competencies as foundational for navigating modern work environments [10]; [3]. Conversely, the lack of significant differences in growth stands in contrast to studies that typically report variability in professional development associated with factors such as motivation, resource access, and organisational culture [6]; [2].

This apparent uniformity in growth outcomes among College of Industrial Technology students may reflect a shared academic or institutional environment that offers equitable professional development opportunities, minimising disparities. Alternatively, it could suggest that growth, as measured in this context, is less sensitive to differences in roles or experiences compared to more dynamic dimensions, such as collaboration or adaptability. This mixed pattern highlights the complexity of growth, suggesting that it may be influenced by nuanced interactions between individual agencies and external support structures [12]. As such, while these findings support established patterns in core adaptability skills, they also reveal areas of complexity and potential gaps in understanding. Future research should consider exploring how contextual factors, such as organisational culture and individual motivation, shape perceptions and experiences of growth, providing a more comprehensive picture [3]; [6].

4.11. LSD Results of the Difference in the Workplace Adaptability of College of Industrial Technology Graduating Students as to School Organisation Participation

The data of the Least Significant Difference (LSD) post hoc test in Table 11 revealed significant differences in workplace adaptability dimensions based on involvement in organisations (see Table 11). For adaptability, mean differences were statistically significant between participants with no involvement and those who are members (M difference = -0.49, p < .001) and those who are leaders (M difference = -1.08, p < .001). Additionally, members and leaders differed significantly (M difference = -0.60, p < .001), indicating that higher involvement is correlated with greater adaptability. Similarly, for collaboration, significant mean differences were observed between the none and member groups (M difference = -0.48, p < .001), the none and leader groups (M difference = -1.01, p < .001), and the member and leader groups (M difference = -0.53, p < .001). The results for problem-solving showed statistically significant differences across all group comparisons: none versus member (M difference = -0.33, p < .001), none versus leader (M difference = -0.74, p < .001), and member versus leader (M difference = -0.41, p < .001). However, for professionalism, the difference between none and member groups was not significant

(M difference = -0.06, p = .383). Still, significant differences were found between the none and leader (M difference = -0.27, p < .001), and member and leader groups (M difference = -0.21, p < .001).

Table 11: LSD results of the differences in workplace adaptability of industrial technology graduating students as to school organisation participation

Dependent Variables	(I)	(J)	Mean Difference (I-J)	Sig
Adaptability	None	Member	-.48710**	.000
	None	Leader	-1.08244**	.000
	Member	Leader	-.59534**	.000
Collaboration	None	Member	-.47741**	.000
	None	Leader	-1.01183**	.000
	Member	Leader	-.53440**	.000
Problem solving	None	Member	-.33484**	.000
	None	Leader	-.74148**	.000
	Member	Leader	-.40663**	.000
Professionalism	None	Member	-.06270	.383
	None	Leader	-.268820**	.000
	Member	Leader	-.20550**	.000

These results suggest a nuanced relationship between organisational involvement and workplace adaptability dimensions. The clear positive progression from no involvement to leadership for adaptability, collaboration, and problem-solving underscores the role of active engagement in complex social and problem-solving contexts. However, the distinct pattern observed for professionalism suggests a potentially different developmental trajectory, requiring not only participation but also the accountability and higher expectations inherent in leadership roles. This aligns with the National Association of Colleges and Employers [13], which argues that professionalism is increasingly defined by nuanced behavioural standards that leadership roles tend to reinforce more rigorously than membership alone. The findings concerning adaptability align with the perspectives presented in "Adaptability in the Workplace: A Skill for the Modern Era" (2024), which posits that adaptability is cultivated through exposure to variable challenges and responsibilities—conditions more commonly encountered in leadership positions.

Moreover, Martin et al. [1] emphasise that adaptability thrives in environments where individuals are encouraged to proactively embrace change, a common experience for organisational leaders who must navigate evolving group dynamics and goals. Similarly, the significant differences in collaboration align with Sirait and Amnie's [8] research on project-based learning, illustrating how active group participation and leadership can refine teamwork skills critical for workplace success. In the domain of problem-solving, Maharani et al. [2] findings support current results by highlighting the role of leadership in fostering critical thinking and decision-making skills, which are integral to problem-solving capacity. Leaders often face complex scenarios that require innovative solutions, thereby accelerating their growth in this competency. Furthermore, the pattern observed in professionalism resonates with Chen et al. [9]'s emphasis on adaptability and agility as key leadership competencies that develop through increased responsibilities. This suggests that while foundational skills may be gained through membership, higher-level professional behaviours often require experiential learning embedded in leadership roles.

While the overall findings agree with previous literature on the positive influence of organisational involvement on workplace adaptability dimensions, some nuances emerge. For instance, professionalism did not differ significantly between non-participants and members, a finding that contrasts with perspectives suggesting that any degree of organisational participation fosters professional behaviours [13]. This discrepancy may suggest that the experiential and accountability aspects inherent in leadership positions play a more significant role in cultivating professionalism than mere membership, underscoring the need for more targeted development opportunities at various engagement levels. Furthermore, although adaptability development is often framed as accessible through diverse learning experiences, the markedly higher scores among leaders in this study suggest that leadership roles provide unique challenges and learning environments that more effectively enhance adaptability skills.

This confirms that participation in organisational roles, particularly leadership positions, is significantly associated with higher levels of workplace adaptability, collaboration, problem-solving, and professionalism among Industrial Technology graduating students. These findings align with prior research emphasising the value of experiential learning and active engagement in skill development [16]; [13]. However, the lack of significant difference in professionalism between non-members and members indicates that mere participation may not be sufficient to foster this attribute, highlighting the distinctive impact of leadership responsibilities in shaping professional behaviours. This suggests that educational and training programs should not only encourage student involvement but also strategically promote leadership opportunities to maximise workplace readiness.

4.12. ANOVA Results of the Differences in the Workplace Adaptability of College of Industrial Technology Graduating Students as to Socioeconomic Status

Analysis of Variance (ANOVA) results in Table 12 reveal significant differences in workplace adaptability, collaboration, and problem-solving skills across the three adaptation levels (low, average, and high), as indicated by the F-values of 5.897, 8.233, and 29.536 respectively, all with p-values less than .01. This demonstrates that individuals categorized at various levels of adaptability differ markedly in these dimensions, highlighting the importance of fostering these skills to enhance overall workplace effectiveness. Conversely, no significant differences were found for professionalism (F = 1.060, p = .348) and growth (F = .298, p = .742), suggesting that these attributes may be less influenced by adaptability level or potentially more stable traits, regardless of adaptation categorisation.

Table 12: ANOVA results of workplace adaptability of industrial technology graduating students as to socioeconomic status

		Sum of Squares	df	Mean Square	F	Sig.
Adaptability	Between Groups	4.601	2	2.301	5.897**	.003
	Within Groups	114.697	294	.390		
	Total	119.298	296			
Collaboration	Between Groups	3.601	2	1.800	8.233**	.000
	Within Groups	64.290	294	.219		
	Total	67.890	296			
Problem solving	Between Groups	11.617	2	5.809	29.536**	.000
	Within Groups	57.818	294	.197		
	Total	69.436	296			
Professionalism	Between Groups	.577	2	.289	1.060	.348
	Within Groups	80.007	294	.272		
	Total	80.584	296			
Growth	Between Groups	.130	2	.065	.298	.742
	Within Groups	63.859	294	.217		
	Total	63.988	296			

The significant variation in adaptability and problem-solving aligns with the idea that adaptability skills enable employees to respond flexibly and effectively to workplace challenges. Differences in collaboration further emphasize how adaptive individuals tend to engage more effectively in team-based environments, which is crucial in dynamic and complex work settings [11]. This supports the notion that adaptability is intricately linked to interpersonal competencies necessary for cooperative work and collective problem resolution [16]. However, the non-significant findings related to professionalism and growth might indicate that these qualities develop through factors beyond simple adaptability levels, such as organisational culture, personal values, or external influences like mentoring and continuous education [13]; [6].

For instance, professionalism may require deliberate practice and role modelling rather than automatic improvement with adaptability. Likewise, growth as a lifelong learning disposition might be consistently nurtured across individuals regardless of their baseline adaptability. These results emphasise the nature of workplace skills development, supporting previous research that calls for targeted interventions to cultivate adaptability and collaboration while also addressing professionalism and personal growth through dedicated programs [10]. This nuanced understanding is crucial for educators and employers, aiming to design holistic development initiatives aligned with Sustainable Development Goal 4, which promotes inclusive and equitable quality education and lifelong learning opportunities [7]; [19].

4.13. LSD Results of the Differences in the Workplace Adaptability of College of Industrial Technology Graduating Students as to Socioeconomic Status

Post hoc comparisons of adaptability dimensions across adaptability level groups are presented in Table 13. The post hoc analysis for Adaptability revealed that respondents in the Low group had significantly lower adaptability scores compared to those in the Average and High groups. Specifically, the Mean Difference between the Low and Average groups was 0.41006 (p = .001), and between the Low and High groups was 0.42685 (p = .001). However, there was no significant difference between the Average and High groups (Mean Difference = .01679, p = .826). This pattern suggests that individuals in the Low adaptability group consistently demonstrate lower adaptability skills, whereas those in the Average and High groups have comparable levels of adaptability. For Collaboration, similar patterns were observed. The Low group exhibited significantly lower collaboration scores than the Average (Mean Difference = 0.35459, p = 0.000) and High (Mean Difference = 0.38205, p

= 0.000) groups. However, no significant difference was detected between the Average and High groups (Mean Difference = .02746, p = .631).

These findings highlight that collaboration improves from the Low to Average groups but tends to plateau or surpass the Average level. In terms of problem-solving, all pairwise comparisons were statistically significant. The Low group had significantly lower problem-solving abilities compared to both the Average (Mean Difference = 0.46616, p = 0.000) and High (Mean Difference = 0.67907, p = 0.000) groups. Additionally, even the difference between the Average and High groups was significant (Mean Difference = .21291, p = .000). This suggests that problem-solving skills increase progressively across the three adaptability groups, with notable gains at each level.

Table 13: LSD results of workplace adaptability of industrial technology graduating students as to socioeconomic status

Dependent Variables	(I)	(J)	Mean Difference (I-J)	Sig
Adaptability	Low	Average	.41006**	.001
	Low	High	.42685**	.001
	Average	High	.01679	.826
Collaboration	Low	Average	.35459**	.000
	Low	High	.38205**	.000
	Average	High	.02746	.631
Problem solving	Low	Average	.46616**	.000
	Low	High	.67907**	.000
	Average	High	.21291**	.000

These findings align with previous studies that emphasise the value of adaptability and its related dimensions—collaboration and problem-solving—across various contexts. For example, Martin et al. [1] and Chen et al. [9] highlight adaptability and problem-solving as critical skills for workplace success, showing that workers with higher adaptability tend to exhibit stronger collaborative behaviours and problem-solving capacities. This finding aligns with the current results, where the Low group consistently lagged the Average and High groups. Furthermore, the consistent improvement in problem-solving abilities across groups supports the assertions by DeepHow [5] and the JIER Journal that adaptability fosters critical thinking and effective problem-solving. The significant difference between the Average and High groups for problem-solving reinforces the idea that continuous learning and exposure to new challenges can elevate individuals' problem-solving proficiency beyond average levels [16]. In contrast, the lack of significant differences between the Average and High groups in adaptability and collaboration suggests that once a certain threshold of adaptability is reached, further enhancements may be more incremental or depend on situational factors.

This observation mirrors insights from Bodhi et al. [11] and Martin et al. [1], who noted that environmental or contextual variables can mediate the expression of adaptability, such as organisational culture or interpersonal dynamics. The analysis of pairwise comparisons highlights the role of adaptability and its associated skills in workplace contexts. It reveals that individuals with low adaptability consistently report lower collaboration and problem-solving abilities, aligning with studies that view adaptability as a foundational skill for modern work demands [3]; [10]. However, the lack of significant differences between the average and high adaptability groups for adaptability and collaboration suggests a possible ceiling effect, where further growth may depend on more nuanced factors, such as organisational culture, job demands, or leadership support [1]; [14]. Moreover, the progressive increases in problem-solving skills across all levels of adaptability highlight the cumulative benefits of adaptability on complex tasks [6]; [16]. These insights suggest that interventions and workforce development programs should prioritise adaptability-building practices, not only to enhance collaboration and problem-solving skills but also to create resilient and future-ready workforces [17]; [18]. These findings affirm the interconnectedness of adaptability, collaboration, and problem-solving, emphasising their collective importance in achieving organisational and professional excellence.

5. Conclusion

The findings underscore the value of developing core competencies that align with the dynamic nature of today's professional environments. By fostering adaptability, collaboration, and problem-solving, educational institutions can better equip students to navigate complex challenges and contribute meaningfully to their future workplaces. The observed consistency in growth and professionalism may indicate the strength of the learning environment and the structures in place to support student development. Such uniformity suggests that when opportunities and resources are equitably provided, professional advancement can become a shared outcome rather than a variable one. The results highlight the nuanced relationship between individual growth and the broader social and educational context. They emphasise the importance of creating learning

environments that not only support skill development but also recognise the external influences that shape a learner's capacity to thrive in dynamic professional settings. Cultivating adaptability, collaboration, and problem-solving lays a solid foundation for students' growth beyond the classroom. By fostering these core competencies, education can inspire not only career readiness but also a lasting commitment to learning, leadership, and meaningful contribution in an ever-evolving world.

5.1. Recommendations

- Educational institutions should prioritise the intentional development of core competencies such as adaptability, collaboration, and problem-solving to prepare students for the evolving demands of modern workplaces. Embedding these skills into curricula enables learners to navigate uncertainty with confidence and contribute constructively to diverse professional settings.
- Ensuring equitable access to supportive resources and opportunities across learning environments can lead to consistent and shared professional growth among students. By reinforcing structured support systems, institutions can mitigate disparities and create inclusive spaces that foster collective advancement.
- Educators and policymakers must also consider external influences, such as parental involvement and socioeconomic status, that shape students' engagement and development. Designing flexible and responsive learning contexts that account for these factors can enhance resilience, promote lifelong learning, and equip students for sustained success in dynamic professional environments.

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