

# Exploratory Study on the Impact of Internship Experiences on Critical Core Skills (CCS)

Kim Syn. Kerk

School of Business, Republic Polytechnic, Singapore  
vincent\_kerk@rp.edu.sg

## ABSTRACT

This exploratory study investigates the impact of internship experiences on the development of Critical Core Skills (CCS) among tertiary students in Singapore, with a focus on both STEM and non-STEM disciplines. As workforce demands shift towards greater emphasis on soft skills, the study aims to assess whether internships significantly enhance students' perceived competencies in adaptability, communication, problem-solving, and other essential skills as outlined by SkillsFuture Singapore. Utilizing a mixed-method sequential explanatory design, the research involved 134 students from four academic schools who completed self-assessment surveys before and after their internship programs. Quantitative analyses, including paired sample t-tests and ANOVA, examined changes in 16 CCS competencies, while correlation analyses linked perceived skill importance to observed growth. Qualitative data from post-internship focus group discussions with selected students provided deeper insights into key enablers of soft skills development. Findings revealed significant improvements in CCS, particularly among STEM students who initially reported lower self-assessments of soft skills. Perceived skill relevance to internship tasks strongly correlated with skill development, notably in adaptability, communication, and transdisciplinary thinking. Interestingly, dimensions such as digital fluency and global perspective showed weaker correlations, suggesting underutilization in internship settings. Four enablers—autonomy and choice, relevance of tasks, broad exposure, and supportive workplace culture—were identified as critical drivers of growth through qualitative analysis. The study underscores the vital role of experiential learning in bridging the gap between academic preparation and workforce expectations. It advocates for more intentional internship designs that integrate task relevance and supportive environments to foster holistic development. These insights offer valuable implications for educators, policymakers, and industry partners aiming to optimize internship programs to better prepare graduates for the evolving demands of the modern workplace.

**Keywords:** Higher Education, STEM Internship, Soft Skills, Workplace Learning

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## 1. Introduction

As the demand for talent continues to grow globally, educational institutions face increasing pressure to equip students not only with technical expertise but also with essential soft skills necessary for success in the modern workforce. Critical Core Skills (CCS), encompassing competencies such as adaptability, communication, problem-solving, and collaboration, are vital for addressing complex challenges and fostering innovation in Science, Technology, Engineering and Mathematics (STEM) industries. This study investigates the extent to which internships contribute to the development of CCS among STEM and non-STEM students, exploring the differences in perceived skills before and after the internship experience. By identifying the key drivers of soft skills growth, the findings aim to inform educators, policymakers, and industry partners on how to enhance internship programs to better prepare graduates for the workforce.

## 2. Literature Review

Soft skills are broadly defined as a set of observable transferable behaviours that can be applied across sectors, functional areas and job roles. To be more precise, they are character traits, attitudes, and behaviours – rather than technical aptitude or knowledge (Robles, 2012, p.457). In today’s competitive labour market, individuals who demonstrate a combination of soft and hard skills are seen as talents in demand. Hence, it is important to complement your soft skills with technical skill sets to become an all-rounded individual. This is despite that soft skills can be more challenging to acquire and measure than hard skills (Balcar, 2016). In a similar study done in the U.S. on college graduates’ readiness for work, employers have stated that they are “not prepared” for real world challenges (Hart Research Associates, 2016). It was found that the graduates are missing not technical skills, but soft skills such as leadership, problem solving, communication and teamwork capabilities. Besides attributing the lack of soft skills to inadequate training or exposure to these skills, there are also research that shows that the reason for this lack is due to a decline in social capital, as indicated by graduates’ decreased involvement in social, civic and religious organizations (Andreas, 2018).

There are various research on how soft skills are developed, with roots from various learning theories. There are strong evidence that the specific experiences of learners shape these developments. For example, in experiential learning, communication and leadership skills of 104 MBA student trainees had improved through outdoor team building training (Ginting et al., 2020). In problem-based learning used to teach foreign language, soft skills development through role playing scenarios and tasks were found to have improved a wide array of students’ soft skills (Medvedeva et al., 2022). Mindset is also very important to acquiring new skills as biasness against new ways of doing things and thought process, resisting changes, thinking about the negatives can reduce one’s motivation to put in the required effort to develop the skills one intends (Peter & Gomez, 2019).

While there are significant research on the positive effect of internship on employment, career indicators and even some on study outcomes (Binder et al., 2015), there are surprisingly little research on how internship’s effect on soft skills development. In a synthesis of existing research on internship, Narayanan et al. (2010) admitted that there is minimal guidance on what constitutes an “effective” internship. In their exploration of the determinant of a successful internship, internship was conceptualized as a transfer of learning and knowledge and the “success” of an internship hinges on the three process (Antecedents, Processes and Outcomes). This study explores the relationship between process variables to outcome variables in particular, CCS development (see Figure 1)

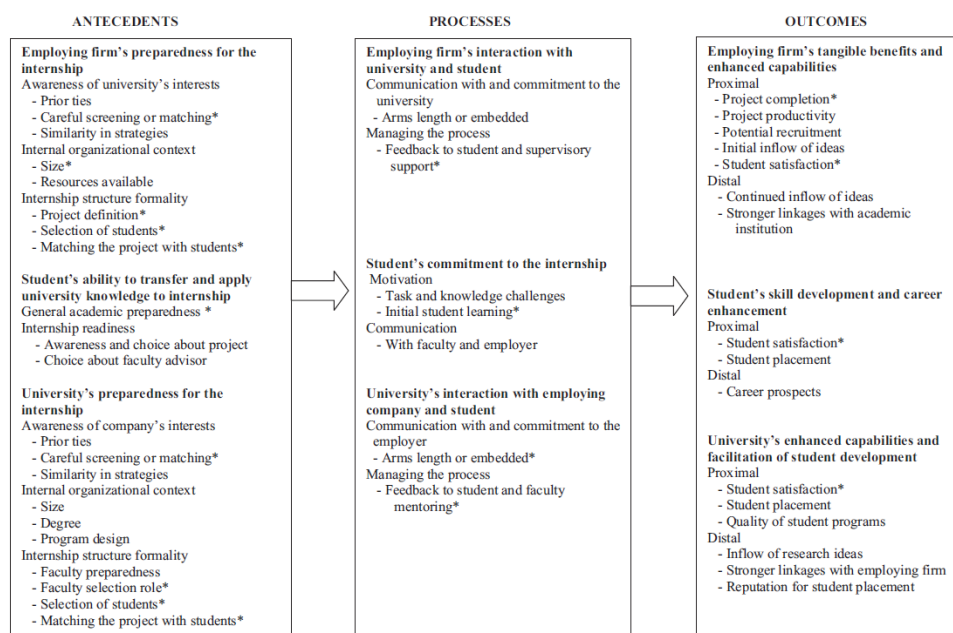


FIGURE 1

Internship Model. (Items marked by an asterisk have corresponding measures in the empirical model.)

Figure 1: Internship Model

In the Singapore context, CCS is a set of transferable soft skills deemed to be essential for workers in the workforce. These were reformulated in August 2019 and they currently comprise a total of sixteen competencies grouped into three clusters of skills that workplaces deem most essential (“Skills Demand for the Future Economy 2023/24 Report,” n.d.). Refer to the CCS dimensions below:



Figure 2: CCS Dimensions

### 3. Objectives of Study

This study seeks to find out whether there are any changes in perceived soft skills level of students after an internship experience. The study also investigates whether there are any differences in changes of perceived soft skills level (if any) of STEM and non-STEM students. Finally, the study tries to uncover any enablers of soft skills development such as perceived importance of skills.

### 4. Method

This study employed a mixed-method sequential explanatory design to examine the impact of internship experiences on the development of CCS among students. The research aimed to assess changes in perceived soft skills levels before and after the internship period, while also exploring the underlying factors contributing to these changes through qualitative analysis.

#### 4.1. Participants and Sampling

A total of 134 students participated in the study, comprising 91 from STEM disciplines (Science, Technology, Engineering, and Mathematics) and 43 from non-STEM fields. Participants were selected from four schools: the School of Engineering (SEG), the School of Information Technology (SOI), the School of Management and Communication (SMC), and the School of Hospitality and Leisure (SHL). The study period spanned from September 2023 to February 2024, during which students engaged in their industry internship programs.

#### 4.2. Data Collection

Students completed a self-assessment survey at the beginning and end of their internships. The survey evaluated 16 CCS competencies categorized into three clusters: Staying Relevant, Interacting with Others, and Thinking Critically. Each competency was rated on a 5-point Likert scale (1 – Not confident at all, 5 – Very confident). The instruments were developed in a previous study by SkillsFuture Singapore (Bi et al., 2023). In the post internship survey, students also rated the importance of each skill in relation to their specific internship role, using the same 5-point Likert scale. A reliability test using Cronbach’s Alpha was conducted, confirming high internal consistency across the 16 competency scales. To gain deeper insights into possible enablers of soft skills

development, 12 students were selected for post-internship focus group discussions. Selection criteria were based on students who reported the highest perceived growth in soft skills.

### 4.3. Data Analysis

Paired Sample T-Test was conducted to measure the difference in students' perceived CCS levels before and after the internship. The analysis was performed separately for STEM and non-STEM cohorts to identify significant within-group changes. To compare the changes in CCS between STEM and non-STEM students, an ANOVA was applied. This test determined whether the differences in perceived skill growth between the two cohorts were statistically significant. A correlation analysis was performed to explore the relationship between the perceived importance of specific CCS competencies and the actual change in those skills post-internship. This analysis aimed to identify which competencies were most strongly influenced by their perceived relevance to the internship role. Transcripts from the FGDs were analyzed using thematic coding to identify key patterns contributing to skill development.

## 5. Results

The distribution of responses both before and after IIP are normally distributed with no anomaly. Cronbach Alpha test was done to determine the validity of the 16 scales used to measure the 16 dimensions across 3 clusters with each scale comprising of 3 items. It was found that the items were highly reliable. No items were found to yield significantly higher test result if removed.

*Table 1. Distribution of responses*

	<b>Cronbach's Alpha</b>	<b>Cronbach's Alpha on Standardized Items</b>	<b>N of Items</b>
<i>Adaptability</i>	.871	.875	3
<i>Building Inclusivity</i>	.808	.815	3
<i>Collaboration</i>	.769	.772	3
<i>Communication</i>	.772	.776	3
<i>Creative Thinking</i>	.858	.858	3
<i>Customer Orientation</i>	.863	.863	3
<i>Decision Making</i>	.914	.914	3
<i>Develop People</i>	.896	.898	3
<i>Digital Fluency</i>	.854	.855	3
<i>Global Perspective</i>	.861	.861	3
<i>Influence</i>	.829	.832	3
<i>Learning Agility</i>	.818	.819	3
<i>Problem Solving</i>	.867	.868	3
<i>Self-Management</i>	.807	.808	3
<i>Sense Making</i>	.840	.844	3
<i>Transdisciplinary</i>	.893	.895	3

Between the STEM and non-STEM cohort, there are more significant increases in soft skills among students from the STEM disciplines compared to their non-STEM counterparts (Refer to Table 1: Changes in soft skills before and after internship). This could be due to the overall initial higher self-perception of soft skills among non-STEM students. As a result, the perceived benefit of the internship experience seemed to be higher among STEM students. Non-STEM students reported a higher level of building inclusivity, communication and creative thinking skills compared to the STEM students.

Table 2: Changes in soft skills before and after internship (\* $p < 0.05$ , \*\* $p < 0.01$ )

<b>Staying Relevant - Dimensions</b>	<b>Mean Changes</b>	<b>STEM</b>	<b>Non-STEM</b>
Adaptability1	0.29**	0.37**	0.12
Adaptability2	0.23*	0.30*	0.09
Adaptability3	0.34**	0.34*	0.33*
Digital Fluency1	0.14	0.10	0.23
Digital Fluency2	0.22	0.27	0.12
Digital Fluency3	0.13	0.19	0.00
Global Perspective1	0.10	0.18	-0.07
Global Perspective2	0.10	0.21	-0.12
Global Perspective3	0.16	0.21	0.07
Learning Agility1	0.18	0.31*	-0.09
Learning Agility2	0.04	0.01	0.12
Learning Agility3	0.09	0.09	0.09
SelfManagement1	0.22*	0.24*	0.19
SelfManagement2	0.22	0.25	0.14
SelfManagement3	0.04	0.02	0.07
<b>Interacting with Others - Dimensions</b>	<b>Mean Changes</b>	<b>STEM</b>	<b>Non-STEM</b>
Building Inclusivity1	0.04	0.04	0.02
Building Inclusivity2	0.18*	0.12	0.30*
Building Inclusivity3	-0.10	-0.08	-0.14
Collaboration1	0.19	0.14	0.30
Collaboration2	0.07	0.01	0.19
Collaboration3	0.07	0.08	0.05
Communication1	0.15	0.05	0.35*
Communication2	0.25*	0.25	0.26
Communication3	0.13	0.08	0.23
CustomerOrientation1	0.14	0.15	0.12
Customer Orientation2	0.17	0.18	0.16
Customer Orientation3	0.34**	0.36*	0.30
Develop People1	0.16	0.16	0.16
Develop People2	0.18	0.24	0.05
Develop People3	0.16	0.16	0.16
Influence1	0.28**	0.40**	0.02
Influence2	0.26**	0.31**	0.16
Influence3	0.23*	0.25*	0.19
<b>Critical Thinking - Dimensions</b>	<b>Mean Changes</b>	<b>STEM</b>	<b>Non-STEM</b>
Creative Thinking1	0.11	0.10	0.14
Creative Thinking2	0.14	0.04	0.35*
Creative Thinking3	0.18	0.16	0.21
Decision Making1	0.21	0.27*	0.07
Decision Making2	0.22*	0.31*	0.05
Decision Making3	0.19	0.29*	-0.02
Problem Solving1	0.26**	0.30*	0.19
Problem Solving2	0.17	0.15	0.21
Problem Solving3	0.25*	0.29*	0.19
Sense Making1	0.23*	0.21	0.28
Sense Making2	0.29**	0.32*	0.23
Sense Making3	0.24*	0.24*	0.23
Transdisciplinary1	0.21*	0.24*	0.14
Transdisciplinary2	0.22*	0.21	0.23
Transdisciplinary3	0.13	0.16	0.05

Perceived soft skill changes (difference score between the before and after internship self-assessment) were compared with the perceived importance of these soft skills to their internship role to see whether there is any correlation. It was found that even though the correlation between the variables

was significant across many soft skills dimensions, the strength of relationship varies. Under the “Staying Relevant” cluster, the perceived importance of the soft skill “Adaptability” in their internship role correlates most to the positive changes in this particular skill at the end of their internship. It also correlates moderately strongly to the changes across the greatest number of dimensions under this cluster (refer to Figure 3). All three perceived importance of “Adaptability” correlates moderately strong to the changes in building a personal image or reputation (**SelfManagement1**), indicating the learnt skill of personal branding as the importance of being seen as adaptable increased in an internship role. There is no strong correlation between the perceived importance of “Digital Fluency”, “Global Perspective”, “Learning Agility” and “Self-Management” in their corresponding change at the end of the internship period.

Under the skill cluster of “Interacting with Others” (refer to Figure 4), the importance of building inclusivity in the internship role correlates moderately strong with the greatest number of soft skills under this cluster followed by communication skills. The importance of “Customer Orientation” and “Developing People” did not seem to have a strong correlation with the corresponding change at the end of the internship period.

Under the skill cluster of “Creative Thinking”, the importance of creative thinking for the internship role correlates moderately strongly with the greatest number of soft skills under this cluster (refer to Figure 5). The perceived importance of all the dimensions under this cluster have a moderately strong correlation with the corresponding change of these dimensions at the end of the internship period. Out of all the changes of the dimensions at the end of the internship, the dimension of “Exploring solutions or ideas from outside your normal area of work or expertise” under “Transdisciplinary Thinking” correlates with the perceived importance of almost all of the dimensions under this cluster. This suggests that the concept of transdisciplinary thinking might capture aspect of multiple dimensions. For example, for a student to gain the skill of transdisciplinary thinking, he/she might first need to apply creative thinking to think of new ways of doing work outside of their usual discipline, make some decisions by determining the new criteria for evaluation and solve a problem that might be unfamiliar to them etc.

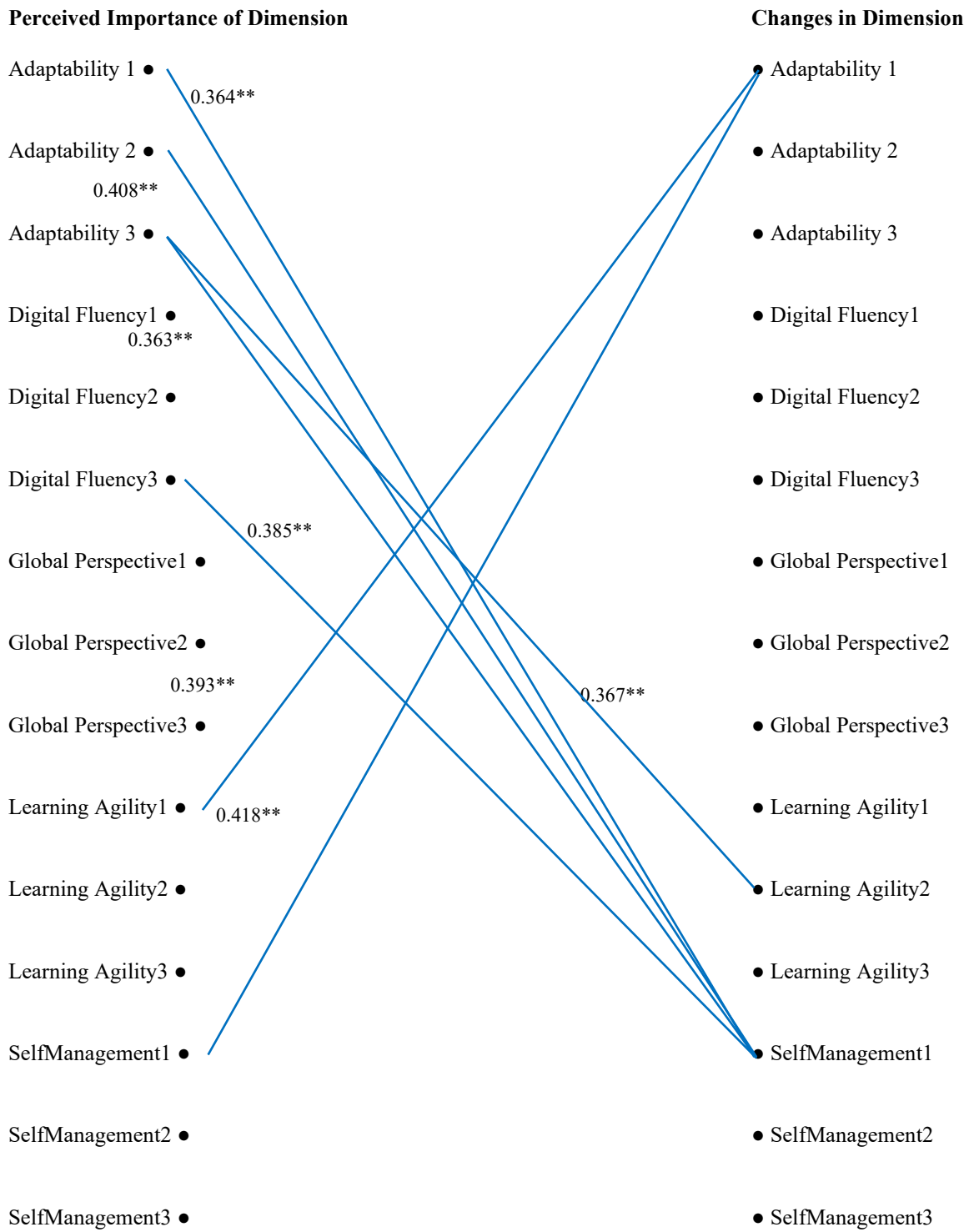


Figure 3: Correlation between perceived importance and change of dimensions for “Staying Relevant” (note: only  $p < 0.01$  and coefficient above 0.35 are highlighted)

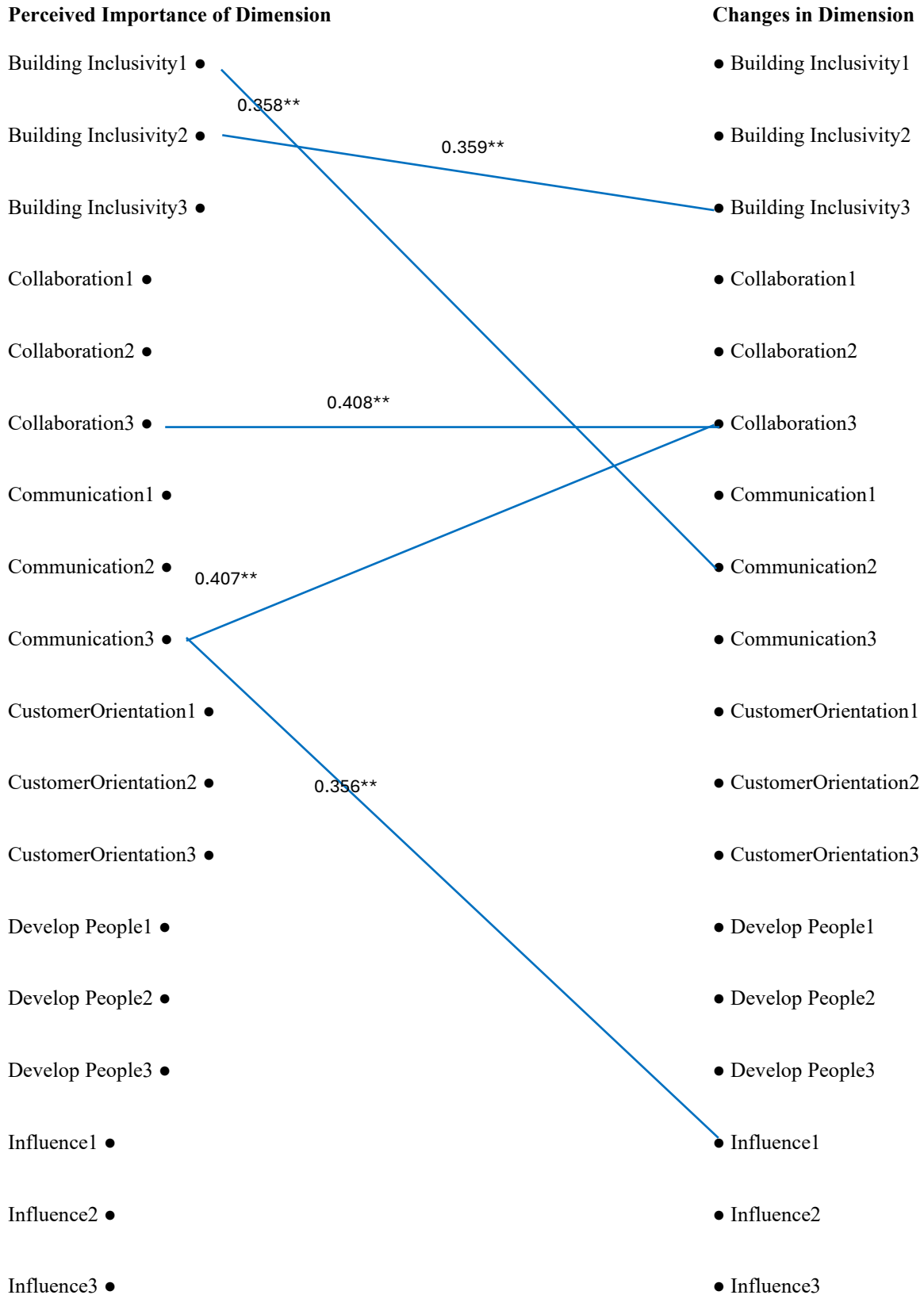


Figure 4: Correlation between perceived importance and change of dimensions for “Interacting with Others” (note: only  $p < 0.01$  and coefficient above 0.35 are highlighted)

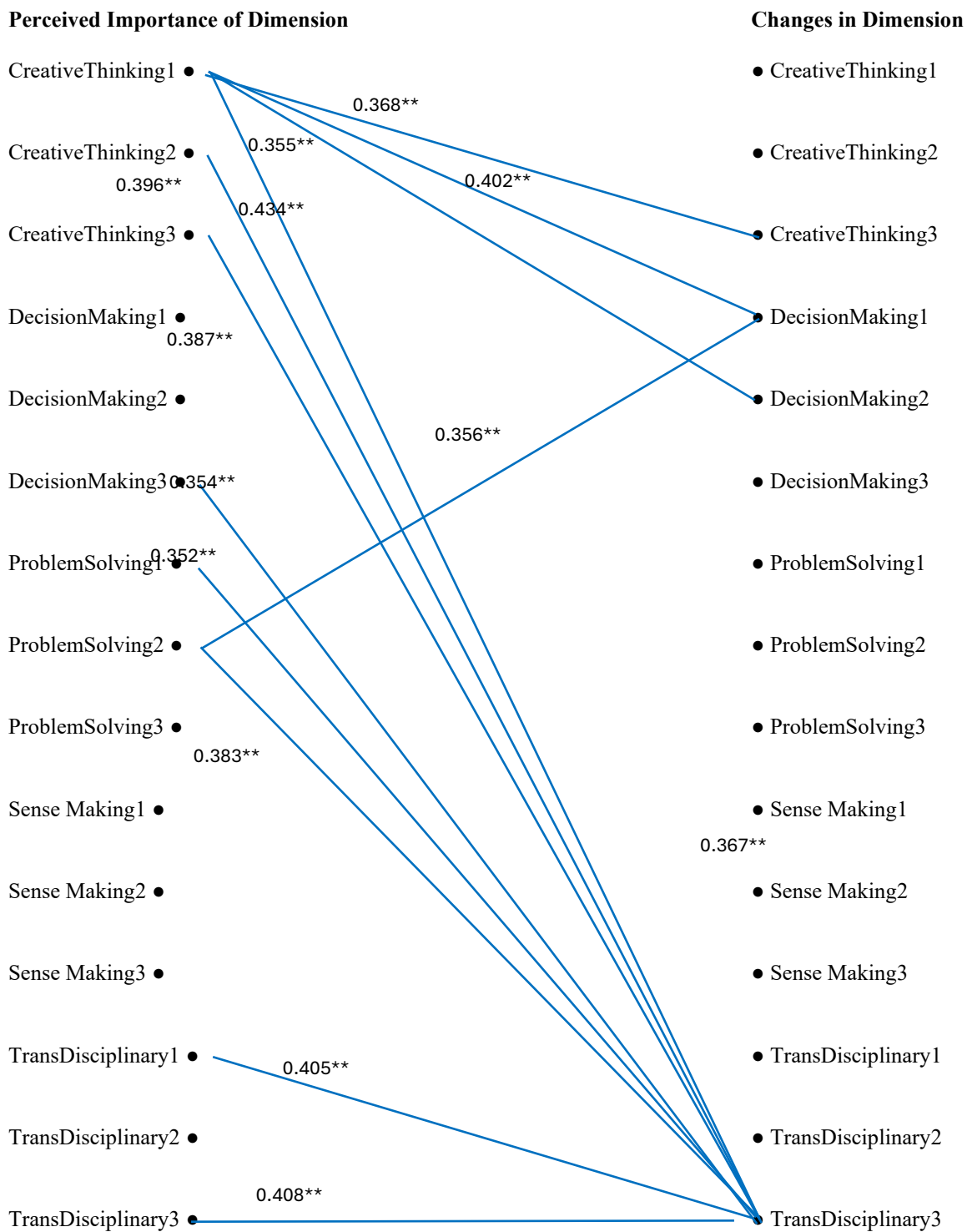


Figure 5: Correlation between perceived importance and change of dimensions for “Critical Thinking” (note: only  $p < 0.01$  and coefficient above 0.35 are highlighted)

4 major themes emerged from the analysis of the interviews with these students post internship. It was found that having “**Autonomy and Choice**”, having some “**Work Requirements**” that were seen to be important for the interns, “**Exposure**” to a broader scope of work and having a “**Supportive**

**Culture**” are common for students experiencing a higher perceived level of soft skills at the end of the internship. The 4 findings from the qualitative analysis are:

- Finding 1: All the respondents mentioned that they do not have a structure learning or induction program. However, many were given the autonomy to do and learn the task that they are more interested in
- Finding 2: In line with the quantitative findings, the importance placed by the internship company on specific skillset (such as communication) are likely to affect their growth in these areas.
- Finding 3: It is important for interns to see the importance and relevance of what they are doing for the company. Exposure to other job functions will help them to gain a deeper understanding of their role within the company.
- Finding 4: Work culture that supports an open communication style had encouraged the interns to learn and try without fear of failing. These supports them in their growth professionally

## 6. Conclusion

The findings of this study highlight the significant role of internships in fostering the development of Critical Core Skills (CCS) across students from diverse academic backgrounds. While STEM students demonstrated greater overall improvements in key soft skills such as adaptability, influence, and sense-making, the results indicate that both STEM and non-STEM students benefited from their internship experiences. Notably, non-STEM students exhibited higher self-perceived soft skills prior to their internships, contributing to smaller but still meaningful gains in areas such as adaptability, communication, inclusivity, and creative thinking. Across the entire cohort, the most substantial growth was observed in dimensions related to adaptability, influence, sense making and transdisciplinary thinking, reflecting the evolving nature of modern workplaces that require cross-functional collaboration and flexibility. The positive changes in soft skills align with the perceived importance of these competencies in students' internship roles, suggesting that practical application and relevance drive skill development.

Interestingly, the study also revealed that certain skills, such as digital fluency and global perspective, showed less pronounced growth across both groups. These could be due in part that many of the interns are deployed in small and medium enterprises (SMEs) and many might still be relying on basic tools rather than advanced digital platforms like data visualisation, artificial intelligence, automation or digital collaboration tools. Balcar (2016) also argues that employers often assume that digital skills are pre-existing or native to the current age category of interns and thus do not prioritize further digital upskilling during internships. The same could be said about global perspective as many of the firms operate in a domestic setting where exposure to global clients, market or teams is minimal. This may point to the need for more structured opportunities during internships to engage with emerging technologies and global challenges.

The qualitative component, derived from focus group discussions with selected students, identified four critical enablers of soft skills development: autonomy and choice, task relevance, broad exposure, and supportive workplace cultures. The findings underscore the pivotal role of internships in fostering holistic development among students, bridging the gap between technical knowledge and interpersonal competencies essential for success in dynamic professional environments. Overall, the results underscore the value of experiential learning in bridging the gap between academic knowledge and workforce demands. The study advocates for more intentional internship designs that emphasize task relevance, autonomy, and supportive workplace environments to maximize student development. These insights serve as a foundation for enhancing educational strategies and better aligning internship programs with the competencies required for success in a rapidly changing professional landscape.

Some of the limitations of this study includes the reliance on self-assessment surveys. These might introduce the potential for response bias, as students may overestimate or underestimate their skills. Additionally, while Cronbach's Alpha confirmed the reliability of the CCS measurement instruments, further analysis through exploratory or confirmatory factor analysis could provide deeper insights into the dimensionality and validity of the competencies measured. Future research should also consider longitudinal studies to track the sustained impact of internships on skill development over time.

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