



Addressing Proficiency Gaps in Future Skills Between Employers and Learners Through Data Visualization

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Abstract

The pandemic has principally changed the way the construction industry operates. It has caused a profound shift in how we conduct our work, with a large-scale take-up of remote working and changes in our digital approach. The way we work is changing. All these impacts challenge the traditional supply chain and working practices of the construction industry negatively, resulting in price escalations, additional costs, loss of revenue, payment delays and increase in disputes and claims. This study aimed to assess the skill proficiency of learners and narrow the employers' and young engineers' perspectives on what are the future skills requirements in the construction industry in the world of digitalization. This study, which comprised two surveys entitled "Future Skills—What does the future look like for young engineers?" (for employers) and "WLA Survey in "Future Skills"—The Proficiency Analyses of Young Engineers-to-be" (for learners), was a part of the Workplace Learning and Assessment (WLA) Engagement Series for students. This research attempts to map skill proficiency of learners (or young engineers-to-be) with the future skill requirements of the employers and to make recommendations on the construction-related institutional arrangements. A quantitative approach by using online surveys as the main data collection tool was adopted. A sample of 20 WLA-participating employers and 23 WLA-participating students in construction companies was generated. In December 2021, the project team initiated two surveys to explore the expectation for the future workforce in the construction industry. Interview results covering various construction-related disciplines, including civil engineering, building studies, surveying and building technology, were analysed and illustrated using Microsoft Power BI. Content analysis with data visualizations was used to identify major themes. This study has shown that employers and students have different perceptions of skills and attributes as critical competencies for a successful workforce. On a positive note, there was a high level of satisfaction for both employers and learners in "Training Structure" and "Training and Development". This study highlighted that students did not have the appropriate level of knowledge as expected by their employers in key subject areas of the construction industry. Employers expressed a clear expectation for the roles and responsibilities of young engineers in their organizations. Areas of practice such as building information modelling (BIM), "Problem Solving", and "Presentation Skills" were highlighted as critical for the future. The competency of youngsters in achieving targeted vision and goals as well as the competency in striving for continual improvement was identified as highly relevant for the future. There was potential for young engineers to play a more active role in their organizations and to repackage their technical skill and interpersonal skill sets for anticipated future roles. The choice of the quantitative research design approach was guided by the need to capture numerical data in the construction industry of Hong Kong for the purpose of illuminating differences in perspectives among participants about future skills for WLA implementation in vocational and professional education and training (VPET). This study can help to investigate the skill proficiency gaps that employers will be looking for and how WLA can bring maximized benefits to students and companies. Based on the results, the students can be better informed about the workplace settings and be prepared for the upcoming industrial attachment or apprenticeship programme with WLA. Feedback provided by the companies can help support students' transition into the world of work. On the other hand, by understanding learners' self-perception, this adaptation made by the companies could result in what looks to be part of a longer-term change in how we work, particularly with a move to increased use of hybrid working. The

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statistical models with data visualization based on Power BI can also lead to the experimentation and inference that inform the institution's strategy.

Keywords Future skills · Skill proficiency gaps · Data visualization · Workplace learning and assessment · Vocational and professional education and training

Introduction

The skill proficiency analyses in this report represent the views of the learners and employers through the surveys. The pandemic has principally changed the way the construction industry operates. The COVID-19 pandemic has great impacts in the world and the construction industry is no exemption. In Hong Kong, the impacts of COVID-19 pandemic on the construction industry are evidenced by safety concerns regarding virus spread in construction sites and various aspects along the whole supply chain, including but not limited to material delivery delays and shortage, delays in inspection, suspension or slowing of ongoing projects and delay in the starting date for new projects, etc. All these impacts challenge the traditional supply chain and working practices of the construction industry negatively, resulting in price escalations, additional costs, loss of revenue, payment delays and increase in disputes and claims.

The way we work changed dramatically because of the important need to reduce the spread of COVID-19. It has caused a profound shift in how we conduct our work, with a large-scale take-up of remote working and changes in our digital approach. The 'new normal' where virtual environment, digital tools, artificial intelligence, and robotics are being more and more integrated in construction works is an irreversible trend catalysed by the pandemic. Building information modelling (BIM) and digital work supervision system (DWSS) also encountered their chance of wide promotion and adoption to mitigate the negative effects and remedy the downturn. Despite that these arrangements will generate positive effects is unsure, this research attempts to map skill proficiency of learners (or young engineers-to-be) with the future skill requirements of the employers and to make recommendations on the construction-related institutional arrangements implemented in Hong Kong for the new normal at the post-pandemic era. In fact, many companies rethink the way they operate and the future planning of their workforce, to ensure business continuity and the health of their employees. Through surveys sent to WLA-participating learners and employers in the construction field, between October and December 2021, we investigated the future skills match for young engineers with employers to suit the post-COVID workplace. In light of this research, the current study will provide a critical insight into the impact

of industry trends and issues, as well as an analysis of key risks and opportunities for skills match between learners (or young engineers-to-be) and employers in Hong Kong's construction industry. In view of the above backdrops, we would like to explore the following issues or questions based on literature and best practices:

- What are the similarities between employers' (i.e. expectation) and learners' (i.e. self-perception) perspectives of future skills?
- What are the discrepancies between employers' (i.e. expectation) and learners' (i.e. self-perception) perspectives of future skills?

Literature Reviews

Vocational Training Council (VTC), established in 1982, has always been at the forefront of VPET. As a statutory body, VTC exists within the Hong Kong education system to ensure that the skills of the Hong Kong workforce remain fresh and future ready. The mandate to provide VPET is vital in meeting industry needs and in fulfilling the aspirations of the quarter of a million young people and in-service workers who attend a programme every year at 1 of the 13-member institutions. To launch the Workplace Learning and Assessment (WLA) initiative in the VPET in Hong Kong, the VTC has made reference to the international best practice of the dual-track systems and the WLA model.

The dual-track VET system in Germany is a systematic integration of the merits of training in a company and education in a vocational school. It aims to strongly facilitate a successful transition of young people from school to work and to guarantee a skilled workforce underpinning a successful economy [4]. Over the course of 2–4 years, trainees spend a couple of days a week, or even blocks of several weeks at a time, at a vocational school where they acquire theoretical knowledge. At the same time, they gain practical knowledge and hands-on experience in a company or public sector institution [6]. Trainees' competence is assessed both in the school and the workplace. Employers and industry practitioners play a critical part in the delivery of workplace training and assessment design [7]. The graduates are qualified as skilled workers after passing the examination and this

qualification is recognized throughout the country. Each year about two-thirds of them manage to secure full-time employment from the same training firms upon graduation. The graduates can also articulate with bachelor or even master degrees in universities of applied sciences or other post-secondary institutes [10].

In Switzerland, the dual-track VET system is also predominant. The majority of the young people commence vocational education and training after the lower-secondary level. Trainees will have practical training (apprenticeship) on 3–4 days at a training company, and the training is supplemented by theoretical classes on 1–2 days at a vocational school [2]. Similar to the German dual VET system, workplace is one of the settings where trainees' competence is assessed through on-the-job assessment [8]. Trainees can concentrate on their profession after graduation. They can also reach successive higher levels of education through extra training. The federal vocational baccalaureate allows trainees to study for a bachelor's degree at applied universities [16].

Not only do European countries, such as Germany and Switzerland, place emphases on the workplace in vocational training and education, but also New Zealand has established a well-structured WLA system. The WLA model in New Zealand is also characterized by a mixture of on-the-job training and off-the-job training, where the former takes place in a company and the latter is conducted at a polytechnic or a technical college, so as to maximize the benefits of the complementarity between school-based and work-based learning. In this connection, assessment will be arranged in the polytechnic and/or workplace [19]. The structured provision of WLA in New Zealand is arranged and managed by the Industry Training Organizations (ITOs) that are recognized by the Associate Minister of Education (Tertiary Education) [12]. ITOs work with industries to develop assessment materials, including the unit standards. A unit standard describes what a trainee who has achieved the standard knows and can do. Each standard has a defined credit value, which reflects the level of complexity of the skills and knowledge that are recognized by the standard. To gain credits for a unit standard, trainees have to demonstrate that they are competent. Workplace assessors play a key role in supporting learners throughout the training and assessment processes. There is a systematic registration system of assessors in New Zealand.

Referencing the best practice of the German and Swiss dual-track vocational and education systems, which have been internationally recognized, and the well-established WLA model adopted in New Zealand, the VTC has developed its own WLA system to suit the local applied education environment. In accomplishing this, the VTC has cooperated with employers in developing unit standards

and assessment tasks for assessing trainees' competence against the employers' requirements. Not least is the programme curricula enhancement, which can be attained by incorporating the latest skills, knowledge and technologies required by the industry.

Under VPET, WLA is a structured pedagogical approach newly initiated by the VTC in Hong Kong. WLA, where education is integrated into the work setting, enables the integration of the school-based and work-based learning components in academic programmes, and becomes part of the curriculum requirement to enhance trainee learning motivation. Academic programmes can therefore keep abreast of the latest industry developments. Through the structured workplace assessment activities, employers can have a clear picture of the trainees' competence. The training activities can be fine-tuned based on the trainees' assessment results to enhance their performance.

WLA comes at a time when higher education institutes are urged to cope with changing demands from our emerging knowledge societies. Despite assessment being an important part of the learning process, there is limited literature on reviewing workplace assessment due to a lack of recognition of learning that takes place in the workplace [18]. Hager [5] suggests that learning is inherently contextual and the main outcome of learning is the creation of a new set of relations in an environment. Concepts include Learning as Acquisition, Learning as Participation [15], Learning as Co-construction [3], and Learning as Action [17] feature practice-based and authentic learning that are often collaborative. Workplace learning is described as a process which is informal, incidental and practice-bound, based on experience, shaped by the work tasks and context in which the learning takes place, and is shared with internal and external work teams and communities [1, 20].

Employers and industry practitioners play a critical part in the delivery of workplace training and assessment design [7]. Similar to the German dual-track system, the workplace is one of the settings where trainees' competence is assessed through on-the-job assessment [8]. In this connection, the assessment will be arranged in the polytechnic and/or workplace [19].

There is a consensus in engineering education literature that highlights the urgency to help undergraduates acquire a broad range of soft skills that facilitate employment transition and professional career development. Furthermore, several studies have already tried to understand undergraduates' perceptions of the importance of soft skills in the work context [11, 14]. Higher education engineering courses are asked to prepare efficient, autonomous and competent future engineers (Holvikivi 2007), in order to respond to labour market demands for highly qualified professionals.

Research Methods

The study was based on the quantitative approach by using online surveys as the main data collection tool. The data were analysed and illustrated using Microsoft Power BI using the quantitative research design approach.

Microsoft Power BI brings advanced analytics to the daily business decision process, allowing users to extract useful knowledge from data to solve business problems. This paper is prepared with the help of the advanced analytic capabilities of Power BI, such as data visualizations and data analysis expressions. Power BI allows us to identify outliers in our data and to determine the logic behind what constitutes an outlier.

This research made use of a selective sampling method in which the selected participants were all supervisory staff of construction-related companies who participated in WLA. There were 31 participants selected from 20 companies, including (a) building and civil engineering sites, (b) new building site contractors, (c) engineers, and (d) major estate developers. The results represent the viewpoints from various job positions and company types. All the selected participants have a work experience in the construction industry of more than 3 years with either a relevant degree or a professional qualification. They were all having supervisory job roles in their companies including project managers, surveyors, project engineers, site agents, general managers, company directors, HR managers, and commercial managers.

Companies that provided apprenticeship training, especially those participating in WLA, were selected for the research because these apprentices were receiving the most up-to-date knowledge in school as well as they are the new practitioners in the industry. As the companies have been providing apprentice training for years, they were familiar with the characteristics of these registered apprentices that were ready to serve the construction industry and eventually become young professionals by continuously developing their technical skills and knowledge. Most of the supervisory or management company participants invited for the survey were directly in charge of apprenticeship training and thus knew the characteristics of the apprentices very well. The employer survey was conducted via a pre-designed online form in September of 2021 and all feedback collected was put directly into analysis and presented in this paper. Most of them are major or well-known construction companies in Hong Kong; however, due to privacy issues and the purpose of this paper, the company information was not presented here. The results thus obtained were representative of the construction companies providing apprenticeship training in Hong Kong.

On the other hand, we have also collected the viewpoints of the 23 registered apprentices studying part-time

construction-related higher diploma programmes provided by VTC in 2022 through the online-form survey to answer a set of pre-designed questions which was similar to that for the employers. Higher diploma apprentices were selected for the studies because they were more mature and had better educational backgrounds compared with diploma apprentices. The results obtained were then compared with that of the employers to see if there were any similarities or discrepancies in the feedback between the employers and the apprentices. The findings are presented in the next section.

This report aims to provide descriptions of the recent development of the industry by reference to some data visualization obtained. The findings and recommendations focus mainly on the employers' perspectives. However, as this was not a full manpower survey, the findings and recommendations only reflect the viewpoints of major construction companies in Hong Kong providing apprenticeship training. Since the data collected was a snapshot of a period without reference to any historical data, this can serve as reference information for general, indicative, and reference purposes only.

Results and Discussion

The Attributes

The results presented here clearly show that "Problem Solving" is something that is very much still expected in the workplace, and "Presentation Skills" is something that organizations will look for in the future. One-third of decision makers say that the most important competency for youngsters is to achieve targeted vision and goals, while over a quarter of respondents feel that the competency to strive for continual improvement is essential as well.

Category A: The Attributes

See Tables 1, 2 and 3.

Training Structure

The pandemic has not resulted in training freezes and a majority (90%) of the employers indicated that training was provided during the normal working day. However, we did see a higher proportion of relatively short training periods with less than 10 days.

Category B: The Training Structure

See Tables 4, 5 and 6.

Table 1 The most crucial attributes for young professionals

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	Work ethic (with a scaled score #: 68)	Problem solving
Rank No. 2	Problem solving (with a scaled score #: 64)	Work ethic
Rank No. 3	Customer service (with a scaled score #: 62)	Technical skills

A scaled score weights the sub-groups "Cutting-edge", "Competitive", "Emerging" and "Lagging" with a ratio of 4, 3, 2 and 1, respectively

Table 2 The main soft/interpersonal skills young professionals lack

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	Presentation skills (with a scaled score #: 69)	Presentation skills
Rank No. 2	Leadership (with a scaled score #: 69)	Problem solving
Rank No. 3	Decision making AND time management (with a scaled score #: 71)	Teamwork/collaboration

A scaled score weights the sub-groups "Cutting-edge", "Competitive", "Emerging" and "Lagging" with a ratio of 4, 3, 2 and 1, respectively

Table 3 The most important competency of young professionals

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	To achieve targeted vision and goals (with a scaled score #: 73)	To achieve targeted vision and goals
Rank No. 2	To strive to continually improve (with a scaled score #: 70)	To strive to continually improve
Rank No. 3	To feel a sense of belonging in the company (with a scaled score #: 67)	To generate the most visible and remarkable results AND To meet deadlines

A scaled score weights the sub-groups "Cutting-edge", "Competitive", "Emerging" and "Lagging" with a ratio of 4, 3, 2 and 1, respectively

Table 4 The probation period

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
1 month	76%	94%
3 months	24%	6%

Table 6 Day(s) of training to entry level of professionals during the probation period

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	21–30 days	1–10 days
Rank No. 2	1–10 days	21–30 days
Rank No. 3	Above 90 days	51–90 days

Table 5 Training during a normal working day

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Yes	86%	90%
No	14%	10%

respondents would consider this type of training. Young professionals appear to be open to their learning and development opportunities (over 80%). Among different training programmes, "Technical Training" takes up the largest portion (40%) from the employers' perspective.

Training and Development

The evidence suggests that "on-the-job" training will persist so as to develop young talent as almost two-thirds of

Category C: Training and Development

See Tables 7, 8 and 9.

Table 7 The form of training to entry-level professionals

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	A formal, structured programme that has set achievement targets and clear expectations	A formal, structured programme that has set achievement targets and clear expectations
Rank No. 2	At desk/"on-the-job" training by peers and managers	At desk/"on-the-job" training by peers and managers
Rank No. 3	Not applicable	Not applicable

Table 8 Confidence of the young professionals to ask for training

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Yes	71%	84%
No	29%	16%

of IT/digital skills because of rapid technology changes. To retain talent, "Good Salary", "Advancement Opportunity" and "Provision of Training" have similar importance in improving employees' performance and job satisfaction at the workplace.

Category D: Technical and Technology

See Tables 10, 11, 12 and 13.

Technical and Technology

The survey results confirm that building information modelling (BIM) has now become the mainstream. However, the challenge is to maintain young employees with high proficiency with BIM software across the sector. 40% said that young professionals do not acquire the required level

Implications

This study has shown that employers and learners have different perceptions of skills and attributes as a critical competency for a successful workforce. According to

Table 9 Type of the most important training programmes to the entry level of professionals

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	Technical training	Technical training
Rank No. 2-4	Diversity training AND orientation training AND soft-skills training	Diversity training AND compliance training AND onboarding training

Table 10 The main technical skills young professionals lack

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	Professional writing (with a scaled score #: 19)	Building information modelling/revit training
Rank No. 2	Sense of quantum measure and cost/rate analysis (with a scaled score #: 20)	Communication Skill
Rank No. 3	Contract administration/management (with a scaled score #: 23)	Measurement skills/take-off skills from drawing for construction works

A scaled score weights the sub-groups "Cutting-edge", "Competitive", "Emerging" and "Lagging" with a ratio of 4, 3, 2 and 1, respectively

Table 11 IT or computer skills required for young engineers

	Learners' perspective (i.e. self-perception)	Employers' perspectives (i.e. expectation)
Rank No. 1	Microsoft office (with a scaled score #: 55)	BIM software
Rank No. 2	AutoCAD (with a scaled score #: 53)	Microsoft office
Rank No. 3	Revit (with a scaled score #: 49)	AutoCAD

A scaled score weights the sub-groups "Cutting-edge", "Competitive", "Emerging" and "Lagging" with a ratio of 4, 3, 2 and 1, respectively

Table 12 The root cause of a lack of IT/digital skills for young engineers

	Learners’ perspective (i.e. self-perception)	Employers’ perspectives (i.e. expectation)
Rank No. 1	Technology changes too quickly for training programmes to stay up to date	Technology changes too quickly for training programmes to stay up to date
Rank No. 2	Not taught at higher diploma/undergraduate level	Not taught at higher diploma/undergraduate level AND employers do not adequately invest in IT/digital skills training
Rank No. 3	Employers do not adequately invest in IT/digital skills training	N.A

Table 13 Top prioritized improvements for employees’ performance and job satisfaction at the workplace

	Learners’ perspective (i.e. self-perception)	Employers’ perspectives (i.e. expectation)
Rank No. 1	Work/life balance	Good salary
Rank No. 2	Good salary	Advancement opportunity AND training are provided
Rank No. 3	Opportunity for further studies	N.A

this study, employers valued problem-solving as the most important future skill. Despite the fact that our research found the importance of problem-solving skills, it was not ranked as high in importance on the learners’ side as expected. The difference has led our research to argue that, in an HK context, employers have favourable attitudes towards self-directed learning, while employees attempt to develop their skills through on-the-job training or supervised learning at work. Sharing a similar thought, Hwang and Oh [9] affirmed that problem-solving ability was significantly positively correlated with self-directed learning, and self-directed learning directly affected problem-solving ability. Oyibe et al. [13] also proved that self-directed learning promotes critical thinking in students, as it allows them to fully explore their creative and imaginative sides.

For the categories “Training Structure” and “Training and Development”, the majority of employers and students reported a similar preference for placement structure and training plan. Employer and student preferences in the training period, intensity, duration, intention for training and the relevant training programmes coincided, so these were not an obstacle to the employers’ or students’ engagement in this area. At commercial level, a well-planned training and development strategy remains most popular than that of a personalized one due to the resources allocation and overall effectiveness. On the other hand, at individual level, a preference for “Training Structure” and “Training and Development” are rather consistent, because the current practices can greatly meet employees’

skill development expectations. However, due to the ‘new normal’ where digitalization is being more and more integrated in construction works, our research recommends a constant monitoring on the updates of “Training Structure” and “Training and Development” so as to timely response to unexpected changes.

The enhancement of student technical skills and technology through work placements and training were considered essential. This study highlighted that students had a significant perspective difference about the main technical skills which young professionals lack. Some students felt that they did not have the required level of knowledge in professional writing and other key technical areas (including sense of quantum measure and cost/rate analysis and contract administration/management, etc.). A majority of learners appraised most of their technical skills between the 26th percentile and 50th percentile, implying that all these emerging capabilities may put learners at risk for workplace success. The apparent lack of technical skills and understanding required further investigation to ensure employer satisfaction with students in the workplace.

In terms of engaging students and learning design, education institutions should collaborate with industry experts to train young talents with multiple skills to handle the various works that are in demand by the industry. The institutions should collaborate with the trade associations to organize upgrading courses and webinars for in-service practitioners to upgrade their technical knowledge and skills in the latest development of new technologies related to the sector. More importantly, various education institutions should work together to train BIM talents to meet the market demand.

On the other hand, employers should try their best to attract young entrants by offering attractive salary and package with job security as well as good recognition of their performance. However, maintaining work–life balance seemed to be more important to retain and to motivate the new generation in the workplace. While guidance and supervision from mentors in the workplace can certainly reduce their anxieties in their first few years of adaptation and retain their talents in the sector, an emphasis on the opportunity for further studies (rather than the opportunity for advancement) should be given. Students desire to become a professional engineer enhance their competitiveness by taking initiatives

to upgrade their knowledge and technical skills related to the industry. They should also improve their communication and presentation skills with employers and customers and establish a good working attitude with professionalism.

Conclusions and Ways Forward

The lack of a consistent dialogue and mismatched values between employers and learners were found. The COVID-19 pandemic slowed down construction projects at the beginning of the year 2020. However, training is needed and is a way for employees to master skills. Based on the survey, the results of employers and learners were collected. Among the seven different types of training, technical training was considered as the most important training course across both groups with a high percentage (larger than 35%), and the rest of training courses were relatively minor (all less than 13%). Among the content of technical training courses, “BIM/Revit training” and “Measuring skills/taking-off skills from drawing for construction works” are the most lacking skills from the employers’ point of view. However, from the learners’ point of views, “BIM/Revit training” and “Measuring skills/taking-off skills from drawing for construction works” are reversely ranked no.2 and no.7 respectively, implying that learners less perceive themselves lacking such skills relatively. Similarly, with the rapid development of today’s society, the demand for BIM talents has extremely increased, and its demand is more than that of Microsoft Office from the employers’ perspectives. BIM becomes the most needed skill in the survey for employers, but not necessarily for the learners. However, both groups agree that the top root cause is the rapid development of technology. In addition to studying technical training, the survey also explores what skills are needed for future skills among soft skills. Among the eight required soft skills, employers and learners share a common selection for their top pressing need, namely presentation skills. To enhance this skill, vocational institutes may discuss how these soft skills can be trained along with other technical trainings.

As for the duration, arrangement and other information of the training, the survey found that more than 85% of employers think that they need to arrange training and learners think that they desire to get training, and both agreed that it is necessary to conduct a formal, structured

program that has set achievement targets and clear expectations. More than 75% of the respondents, including employers and learners, think that the training should be within 30 days, and the probation period should be 3 months. This means that there is enough time to provide training for the learners during the probation period. After the first phase of training is completed, the employers and learners can have time to review the effectiveness of the training. This survey found that more than 70% of the employers and learners are confident in making training requests. Institutes may discuss further on what follow-up arrangements or suggestions can be made with the companies after the training is completed.

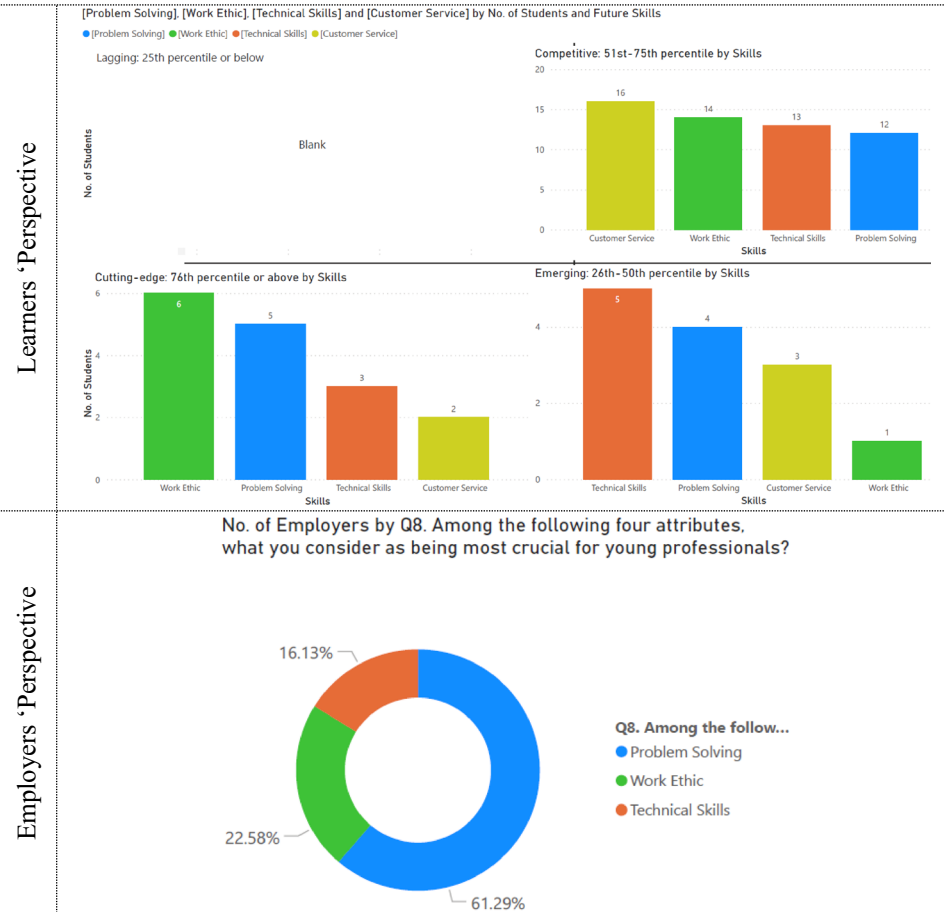
Moreover, training is a tool that can improve talents, and it can be an element that can be added to future skills in a forward-looking manner. The survey found that training and advancement opportunities are not necessarily the best way to improve employees’ performance and job satisfaction at workplace as the employers consider. Salary may be a major factor, but not top prioritized by the learners to improve employees’ performance and job satisfaction the most. Interestingly, work/life balance and opportunity for further studies enlighten how the ways companies to enhance employees’ performance and job satisfaction at workplace.

Like all research, the present research is not without some limitations. First, the research only examined a small group of VTC students. Students from different programmes in engineering discipline might generate different results about the needs and expectations in terms of knowledge and skills in the construction industry in Hong Kong. Second, the method that was employed to compare might skew the results as well. The study relied solely on the perceptions of employers and students gathered from online survey. Selective scopes of studies might have greatly influenced the results. The directions of studies and observations of researcher could influence a lot. Despite these limitations, previous research has not explored the impact of COVID-19 pandemic has on the skill proficiency of learners to narrow the employers’ and young engineers’ perspectives on future skills requirements in the construction industry in the era of digitalization. Therefore, this study provided rich information about how narrowing proficiency gaps in future skills might be used associated with VTC’s policies and initiatives integration.

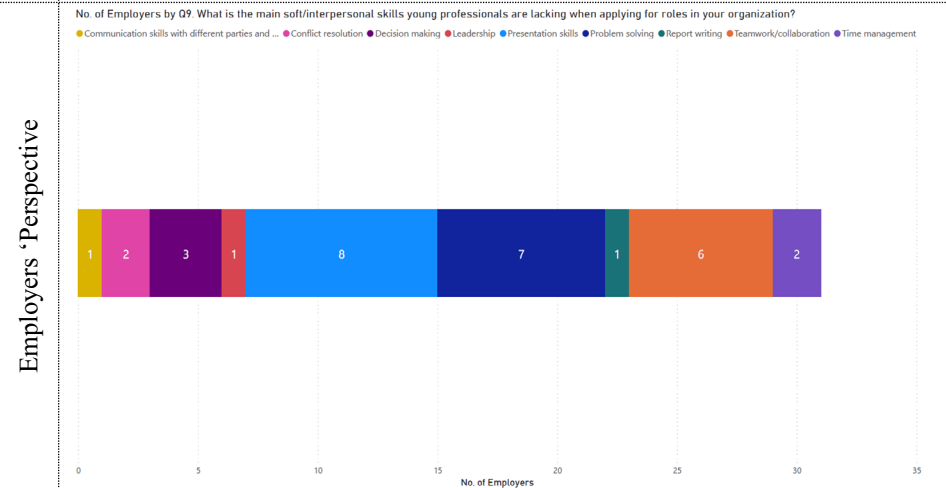
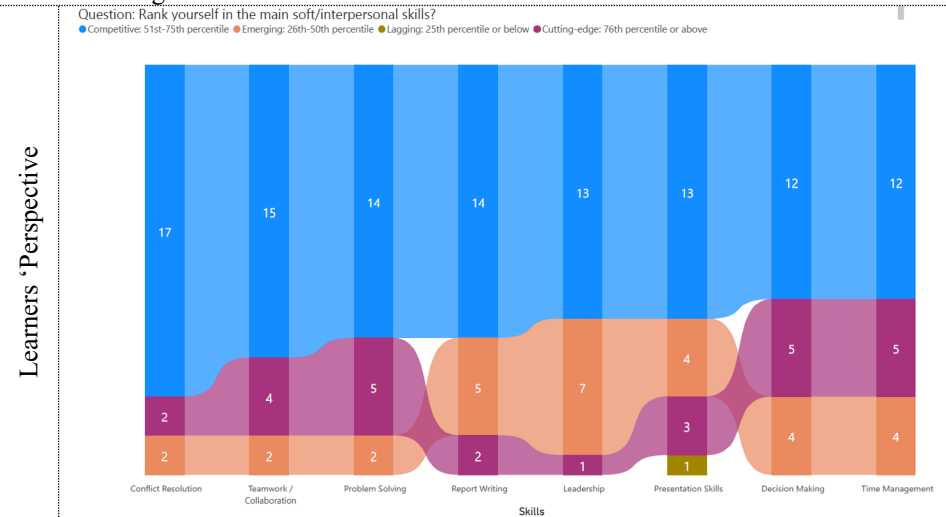
Appendices

Appx.1—Results Statistics of Learners and Employers Regarding “The Attributes”

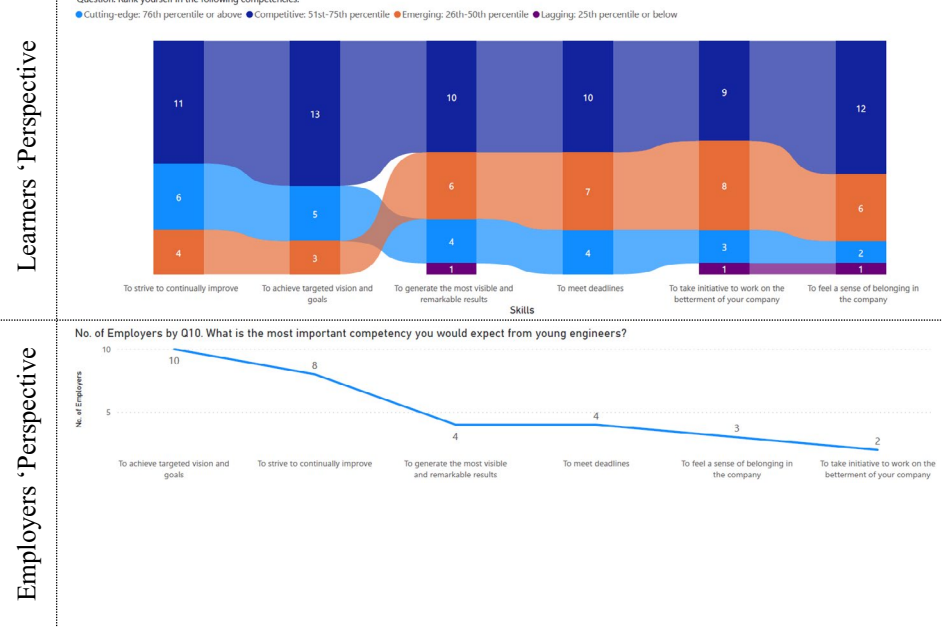
The most crucial attributes among a) Technical Skills, b) Work Ethic, c) Problem Solving, and d) Customer Service for young professionals.



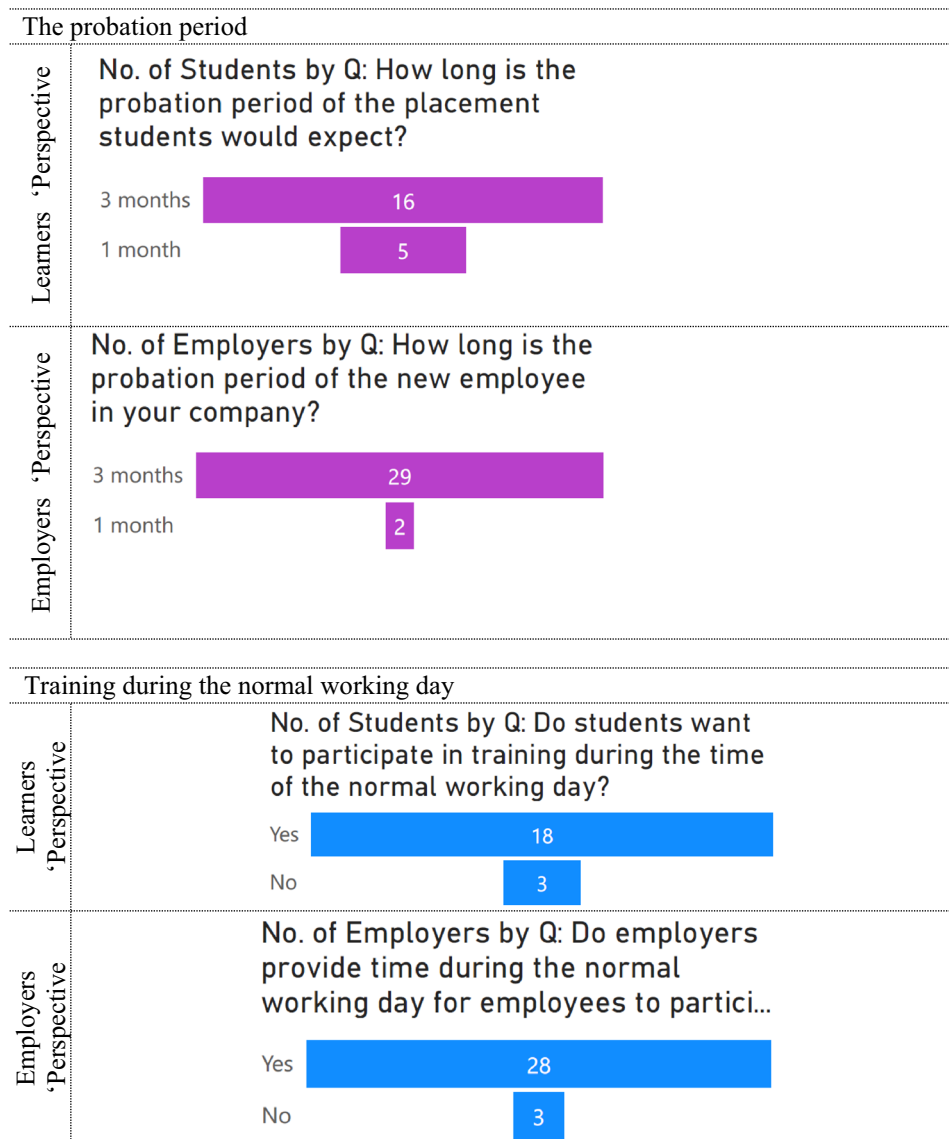
The main soft/interpersonal skill young professionals are lacking when applying for roles in an organization.

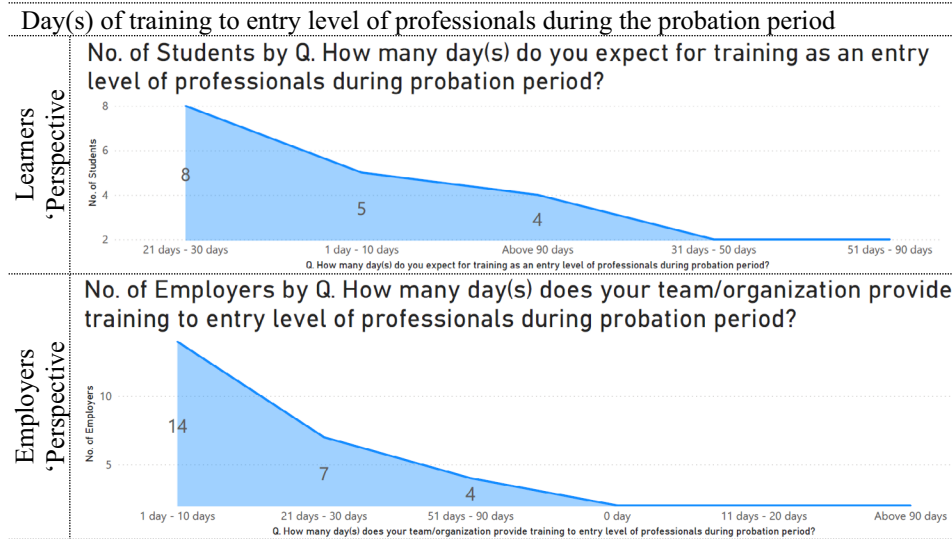


The most important competency from young professionals

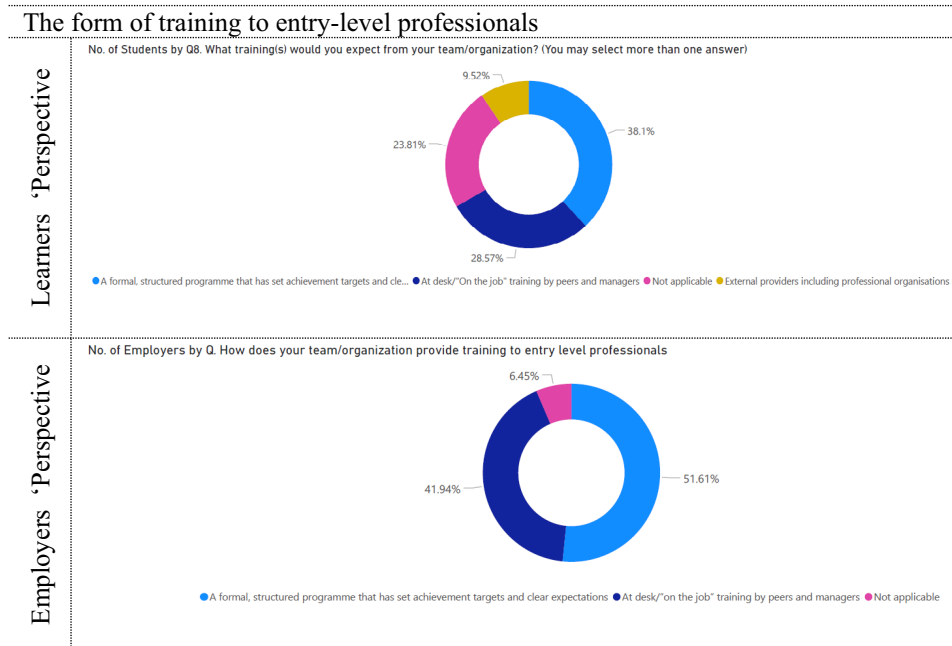


Appx.2—Results Statistics of Learners and Employers Regarding “Training Structure”

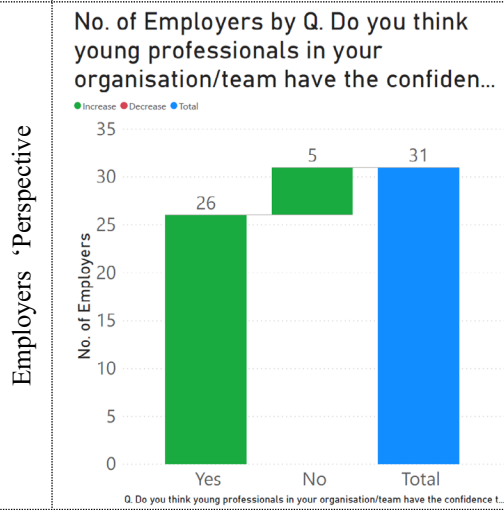
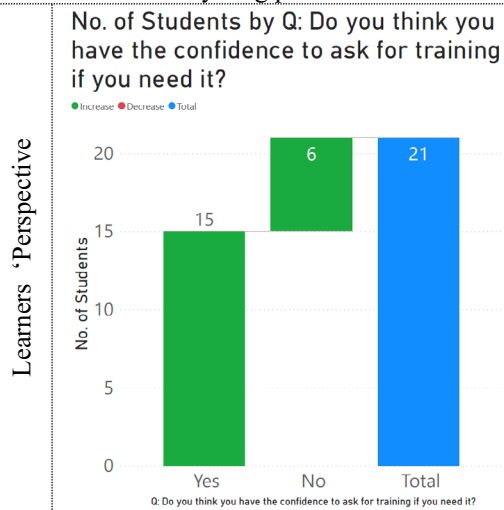




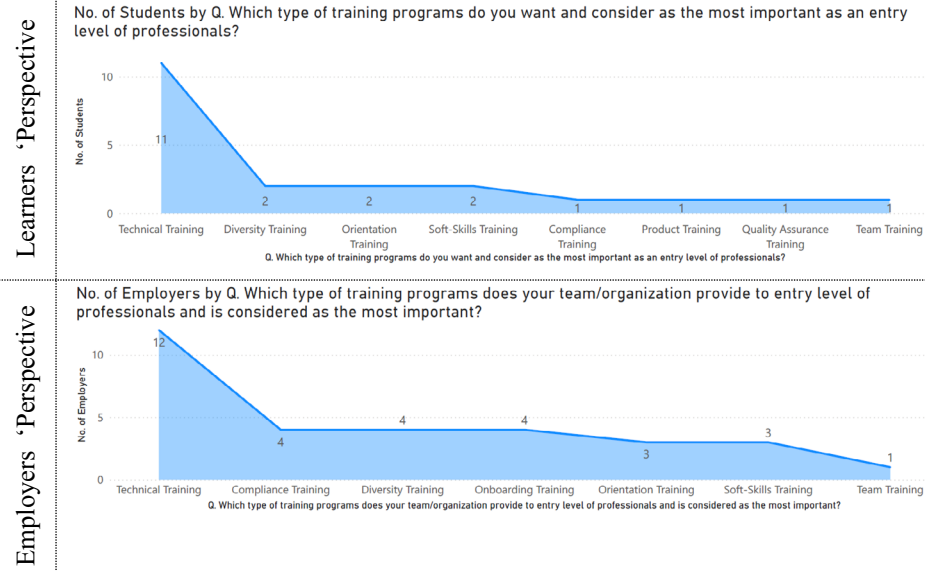
Appx.3—Results Statistics of Learners and Employers Regarding “Training and Development”



Confidence of the young professionals to ask for training

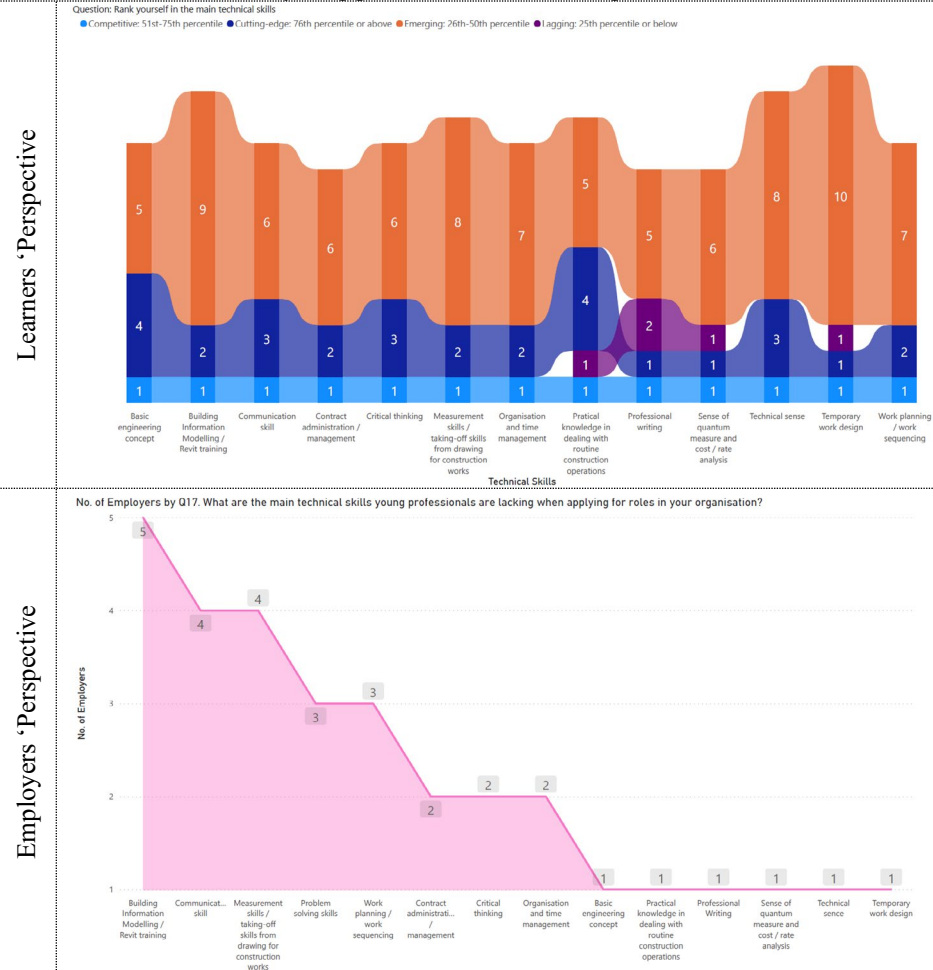


Type of the most important training programs to the entry level of professionals

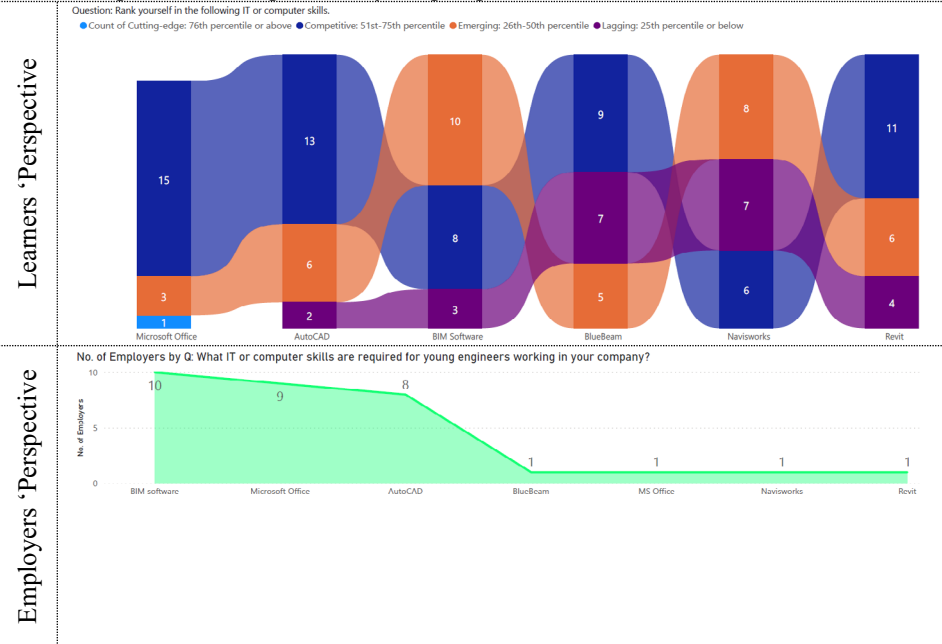


Appx.4—Results Statistics of Learners and Employers Regarding “Technical and Technology”

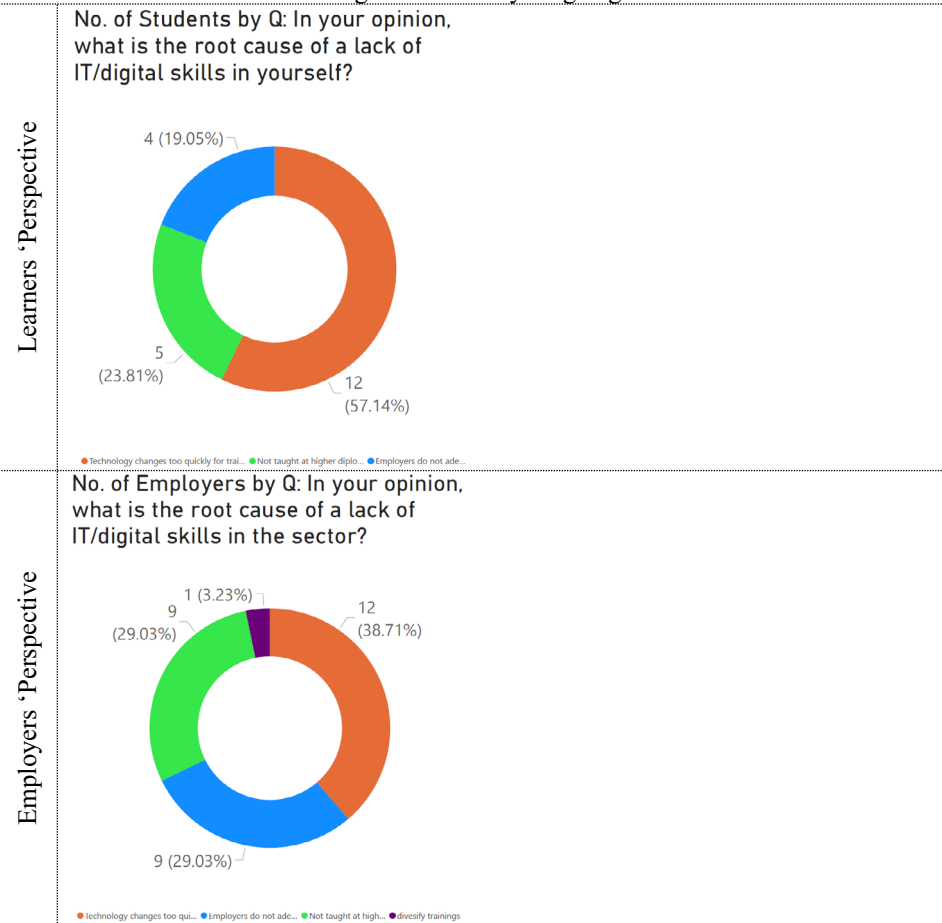
The main technical skills young professionals are lacking



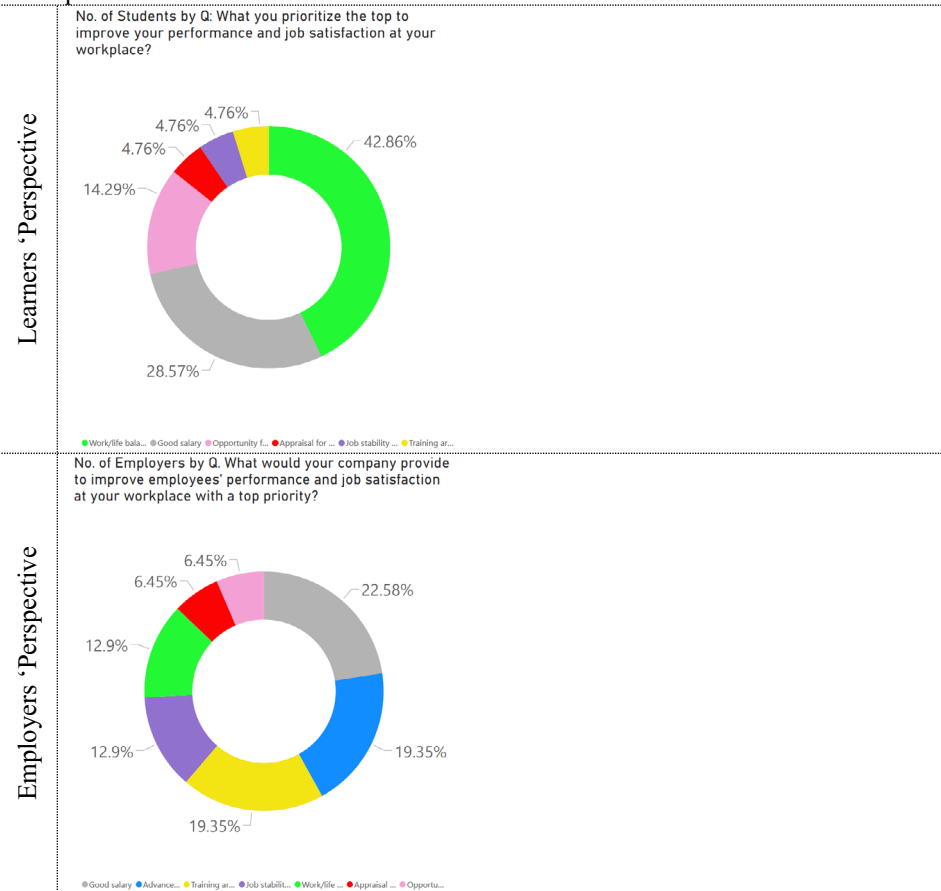
IT or computer skills required for young engineers



The root cause of a lack of IT/digital skills for young engineers



Top prioritized improvements for employees' performance and job satisfaction at your workplace



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Data availability The authors confirm that the data supporting the findings of this study are available within the article and its appendices. Raw data that support the findings of this study are available from the corresponding author, upon reasonable request.

Declarations

Conflict of Interest The authors have no conflicts of interest to declare.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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