# The Effectiveness of Industrial Training during Covid- 19 Pandemic: Perspective of Undergraduate Students of Mechanical Engineering

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**Abstract**: A post-training survey was conducted to all students of Bachelor of Engineering (Hons) Mechanical programme in Universiti Teknologi MARA (UiTM) who completed their industrial training in 2020. The aim of the survey was to overview the effectiveness of industrial training in the perspective of students. This study also was carried out to investigate the effect Covid-19 pandemic on the preparation of companies and students' perception of their own performance before and after the industrial training. The survey was conducted via online involving 166 respondents. The questions included multiple-choice, 5-score Likert scale and open-ended questions. The results show that the majority of the respondents were satisfied with their selection of placement and achievement during the training with the highest mean Likert score of 4.65. The analysis on the self-evaluation of performance before and after industrial training also revealed a significant increase in generic skills especially personal attitude and professionalism aspects. The finding of this work also concludes that the pandemic has no severe impact on the effectiveness of industrial training in the perspective of the students. This finding will be considered for the development of guidelines of Industrial Training course to fit the demands during the pandemic.

**Keywords**: Industrial Training, Mechanical Engineering, Performance, Survey

## 1. Introduction

Industrial Training (IT) is a mandatory course for all students in the Bachelor of Engineering (Hons) Mechanical programme in Universiti Teknologi MARA (UiTM) Shah Alam. It covers 160 hours of Student Learning Time (SLT) which is equivalent to four (4) credits. In fulfillment of the requirements of the Engineering Accreditation Council (EAC), a minimum duration of IT is eight (8) weeks and need to be carried out before the final year (EAC, 2012) and it should be done during the

semester break. The Industrial Training course covers eight (8) course outcomes (CO)s as given in Table 1. The CO includes knowledge, skills and attitudes.

**Table 1**. Eight Course Outcome (CO)s of Industrial Training Course

| | |
|---|---|
| CO1 | Apply the theoretical and practical aspects of mechanical engineering to solve complex engineering problems. |
| CO2 | Design solutions for complex engineering problems of the given task(s) by with minimum supervision |
| CO3 | Display the reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| CO4 | Demonstrate the importance of professional engineering solutions in societal and environmental contexts and recognize the need for sustainable development |
| CO5 | Display the right attitudes and professionalism to increase their employability potential. |
| CO6 | Demonstrate effective communication on complex engineering activities, not only with engineers but also the community at large. |
| CO7 | Organize work effectively in an organization as an individual and as a member or leader in teams and multidisciplinary settings. |
| CO8 | Identify the need for long life learning such as soft skills and discipline and engage in independent and lifelong learning activities |

Industrial training plays a role as a transition platform between students and the real working environment. For engineering students especially, it fosters engineering students to the real working experience and enhances their enthusiasm to be an engineer (Ayarkwa et al., 2012; Phang et al., 2013). It also has been proven to support the employability of students. Students who attended industrial training are seen to have better soft skills and readiness to enter the career world. Employers need employees with not only good technical skills, but also with non-technical skills such as teamwork, work ethic, communication and leadership (Azmi et al., 2019).

The importance of industrial training has been discussed and proven in not only Malaysia but almost all countries in this world. Many countries have made it compulsory for undergraduate students to attend industrial training before graduating. In a developed country like the United States of America (USA) for example, engineering students have to attend industrial training in order to ensure that they acquire skills that are embedded in the Accreditation Board for Engineering and Technology (ABET). Industrial training courses have been an integral part of many university programmes in the USA for more than 100 years (Discoll, 2006) . Graduates and undergraduates attend industrial training work effectively in a team to acquire professional experience and life-long learning technologies (Haag et al., 2006). In Japan, although there are not many universities that require their students to undergo industrial training, informal industrial activities such as on-job-training have been around for quite some time (Orr et al., 2011). African countries like Ghana also require the Mechanical Engineering students to undergo industrial attachments and Work Experience Learning (WEL). This takes place during the long break of the second semester for not less than three (3) months. The university supervisors work in tandem with the supervisors in the industries for effective hands-on training of the students.

The effectiveness of industrial training in various universities all over the world also has been well documented. The reports suggest that industrial training does provide students with the real working environment and capability to practice the theories that have been learned in the classrooms (Ayarkwa et al., 2011, Datuk and Melintang, 2019). Generic skills that are important for all engineering students can be obtained from industrial training (Yuzainee et al., 2011). The training may enhance self-confidence to join the real job later after graduating (Datuk and Melintang, 2019). Industrial training

has also been proven to improve the employability rate of graduates.

However, many things have changed since the World Health Organisation (WHO) declared Covid-19 disease as a pandemic on the 11th of March 2020. The global pandemic has given a massive adverse impact to many industries including tertiary education. Number of research on the effect of the pandemic on tertiary education has significantly increased in 2020 and 2021. In 2021, it is interesting to see that numerous researchers have started to investigate the acceptance of students on the transformation of learning method in university which mostly has become Online Distance Learning (ODL) (Rahiem, 2021, Saidi et al., 2021, Saidalvi et al., 2021). Study has shown that the university's students in many regions of the world suffered a high level of anxiety due to the pandemic (Jiang et al., 2021, Wong et al., 2021, Sundarasen et al., 2020). Nonetheless, one of the issues that has not been discussed in many works is the challenges that have been faced by interns since the pandemic started. The nature of work for mechanical engineers requires involvement in hands-on activities, it is therefore very important to ensure that the students are able to do industrial training at the workplace. Some of the students also experience last minute cancellation of placement due to the pandemic. In fact, many organisations were either temporarily stopped or limit the intake of interns in the year 2020. The stress among interns and the impact to their learning process in industry are something that should be taken into serious consideration.

This survey designed for this work was answered by students of Faculty of Mechanical Engineering, UiTM, who have completed their industrial training between 22nd July 2020 to 30th Sept 2020. These students went through industrial training for a period of 8 to 12 weeks during the semester break. The students got placement in various organisations including government and private agencies all over Malaysia. The students have performed their industrial training in their respective working areas and not via work from home (WFH) with a strict Standard Operation Procedure (SOP) that has been enforced by the Malaysian government (Covid-19: Management Guideline for Workplaces). This paper assesses the effectiveness of industrial training during the Covid-19 pandemic in perspective of students undergoing the industrial training and studies the commitment of industries in providing training to the interns.

## 2. Methodology

A survey was designed to gauge students' perception of the placement company and self-evaluate their performance before and after training. It was formulated similar to several previous works on the effectiveness of industrial training (Osman et al., 2016, Lim & Mustafa, 2013, Mat et al., 2011,). In this work, the survey consisted of multiple-choice, 5-score Likert scale and open-ended questions. Likert scale is one of the widely used methods to measure the degree of psychological phenomena (Singleton & Bruce, 2005). The survey was distributed in a form of an online link to all students who had undergone industrial training in 2020 via Google Form. It was also included in the process flow of Industrial Training for 2020.

The questions included details of companies, the students' perspective on their industrial training experiences, as well as the generic performance before and after going for industrial training. The Likert scale ranges from 1 to 5, where score '1' = strongly disagree, score '2' = disagree, score '3' = neutral, score '4' = agree, and score '5' = strongly agree were used for all questions on satisfaction on the industrial training experiences. For generic performance before and after questions the Likert scale range used was from 1 to 5, where the score '1' = Very dissatisfied, '2' = Dissatisfied, '3' = Neutral, '4' = Satisfied and '5' = Very satisfied. An open-ended question at the end of the survey was to obtain any view from the students on industrial training. Participation is on a voluntary basis.

## 3. Results and Discussion

The link of Google Form for the survey was distributed to all 454 students undergoing Industrial Training from July to October 2020. Out of the 454 students, 168 or 36.6% were retrieved and used in the analysis. This response rate is considered as an acceptable rate needed for a reliable analysis.

### 3.1 Information on industrial training placement of respondents

Table 1 summarises the distribution of location of companies by state across Malaysia. More than half (57.8%) of respondents did their industrial training in Selangor. It is then followed by Johor at 13.3%. This distribution is slightly different compared to the previous years before the pandemic. There is an increasing number of students doing industrial training outside the Klang Valley areas. This is because, majority of the students were in their hometown. They went back to their hometown when the Movement Control Order (MCO) started on March 18, 2020. And since the teaching and learning activities were conducted completely through online distance learning (ODL), most of them never came back to Shah Alam even after the control order was lifted in June 2020. Due to this reason, most of them prefer to do their industrial training near their home.

**Table 2**. Distribution of placement by state

| State | Percentage (%) |
|---|---|
| Johor | 13.3 |
| Kedah | 2.4 |
| Kelantan | 3.0 |
| Kuala Lumpur | 3.6 |
| Melaka | 3.0 |
| Perak | 3.6 |
| Perlis | 1.2 |
| Putrajaya | 3.0 |
| Sabah | 0.6 |
| Sarawak | 3.6 |
| Selangor | 57.8 |
| Terengganu | 4.8 |

Fig. 1 presents the type of organisation of the industrial training placement for all respondents. Majority of 58.4% respondents did their industrial training in local private companies, followed by government/ government-linked company (GLC) organisations of 24.1% and the rest in multinational private companies. This is the common distribution of industrial training placement for the programme every year. It is therefore believed that industries related to mechanical engineering are not significantly affected by the pandemic.

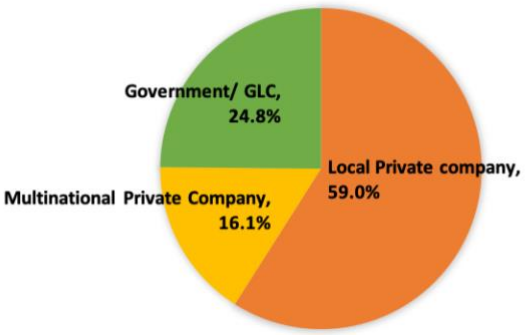


**Fig. 1** Distribution of industrial training placement by type of organisation

Fig. 2 shows the period of industrial training of respondents. 'Other' in the chart indicates more than 10 weeks of training. Based on the requirements set by EAC, the minimum length of industrial training course is 8 weeks (Engineering Program Accreditation Manual, 2018). Of the 166 respondents, the majority had undergone industrial training for more than 10 weeks. In another survey conducted and distributed to organisations around Malaysia, the majority of them stated that the most adequate duration for industrial training is 10 weeks or more for more effective training. Over the years, most of the students in this programme attend their industrial training for a duration of 10 or more weeks. Only a small number of students have undergone industrial training for 8 weeks, mostly due to health problems or special request to go for industrial training during short-term break. Most of the students who went through training for 8 weeks are students who had difficulty in finding placements due to the pandemic, thus they started their training later than the other students. A small number of students have undergone industrial training for 8 weeks, mostly due to health problems or special requests to go for industrial training during short-term break. Most of the students who went through training for 8 weeks are students who had difficulty in finding placements due to the pandemic, thus they started their training later than the other students.

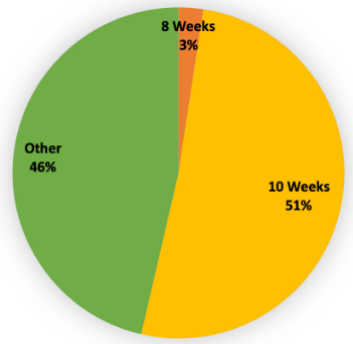


**Fig. 2** Duration of Industrial Training of respondents

It is interesting to note that of the 166 respondents, 83.1% received a monthly monetary allowance for their industrial training. This value can be considered as normal as most government organisations in Malaysia do not provide any allowance for interns. Fig. 3 shows the rate of allowance received by the student-respondents. Majority of 73% were given an allowance between RM100-RM500, while only 5% received above RM1000. This amount is the typical allowance received by students in the programme in these few years.

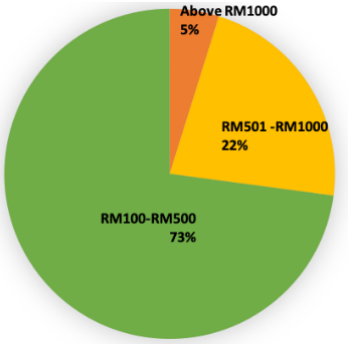


**Fig. 3** Monthly allowance received by respondents.

### 3.2 Satisfaction of industrial training experiences

Table 2 represents the mean Likert scale and the standard deviation (SD) recorded from nine (9) questions on industrial training experiences as in the list. The mean value was calculated from the average values of the Likert scale of 1 to 5. The mean score range is between 4.10 to 4.65 which suggests that most of the students are satisfied with the industrial experiences they obtained from the training. The satisfaction included the experiences provided by the organisations.

**Table 2**. The mean analysis of student-respondents' perceptions on their industrial training experiences

| **Respondents' perceptions** | **Mean** | **SD** |
|---|---|---|
| This experience gave me a realistic preview of this career field. | 4.43 | 0.73 |
| As a results of my internship, I have a better understanding of concepts, theories, and skills in my course of study. | 4.28 | 0.71 |
| My major and career aspirations seemed to fit well with my Industrial Training placement. | 4.10 | 0.93 |
| I was given adequate training or explanation of projects. | 4.22 | 0.84 |
| I had regular meetings with my supervisor and received constructive, on-going feedback. | 4.27 | 0.80 |
| I was provided levels of responsibility consistent with my ability and was given additional responsibility as my experience increased. | 4.26 | 0.79 |
| The work I performed was challenging and stimulating. | 4.10 | 0.89 |
| I had a good working relationship with my co-workers. | 4.65 | 0.59 |
| I feel that I am better prepared to enter the world of work after this experience. | 4.22 | 0.82 |

The respondents were also asked whether they would recommend the company for industrial training placement. This information can give information on the suitability of the organization for the next placement. As can be seen in Fig. 4, more than 80% of respondents think that they would recommend the organisation for industrial training. This also shows that most of the student-respondents were satisfied with their placement of industrial training.

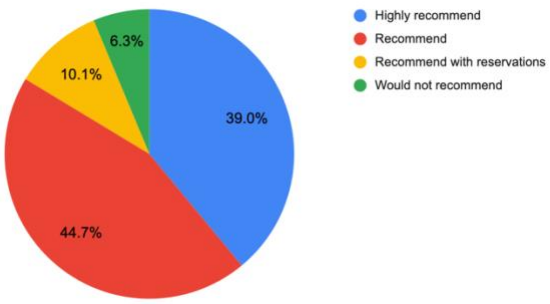


**Fig. 4** Respondents' perception of the suitability of the company for next placement

20.8% of student-respondents have even been offered a permanent position in the company after industrial training completion. This indicates that the industries in Malaysia are still recruiting new employees in the field of mechanical engineering even in the pandemic situation. Unfortunately, there is no data recorded in the faculty to make a comparison to this value. Due to this reason, it is difficult to identify whether this outcome is related to the pandemic situation. However, based on the economic condition in the country, there is a possibility that it may be associated with the constraints that many companies are facing in operating cost due to the pandemic.

### 3.3 Perception of generic performance before and after undergoing IT

In the second part of the survey, student-respondents were asked to self-perceived their performance before and after undergoing industrial training on 12 generic performances. The list of the generic performances are listed in Table 3. The Likert scale ranges from 1 to 5 for 'Very Dissatisfied' to 'Very Satisfied'.

The finding on the student-respondents' perceptions before industrial training is shown in Figure 5. The outcome was made based on the mean analysis of Likert scales of all 12 responses. In general, most of the respondents rate their generic skills as neutral (scale 3) before attending the training. These student-respondents were neither satisfied nor dissatisfied with their performance before the training. The neutral scale is commonly related to the sense of 'undecided', 'unsure' or the respondents are not yet able to express a definite opinion (Raaijmakers et al., 2000, Chyung et al., 2017). Maurer and Pierce suggested that Likert scale is also a method to measure self-efficacy (Maurer and Pierce, 1998). It can therefore be proposed that the students were not confident with their performance before the training. It is however difficult to ascertain whether this can be associated with the pandemic. Note that student-respondents have had about 4-month ODL since the announcement of RMO at the end of February 2020.

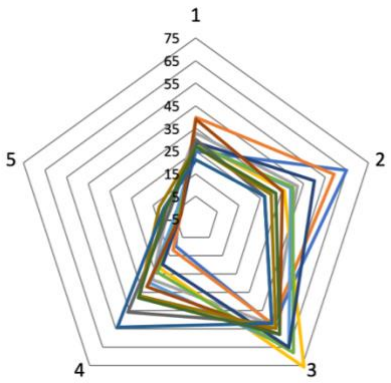


**Fig. 5** Mean analysis of generic performance before Industrial Training

The mean analysis of each generic performance after industrial training is shown in Figure 6. In general, it can be anticipated that most of the respondents are satisfied that the industrial training has imparted them with the skills and abilities needed. This shows that the pandemic has not distracted the students in giving full commitment during training. It also demonstrates that the tight SOP in the working areas is not a constraint for the students to learn during training nor limit the organisations to provide proper training.

Nevertheless, it is also interesting to note that there is a very small percentage (less than 1%) of student-respondents who thought that almost all of their generic performance remained low with no or very little improvement. This 1% may have been those who contributed to the 6.3% of respondents who did not suggest the organisation for industrial training presented in Figure 4. Some of the reasons that may contribute to this complete disagreement are improper training planning provided by the organisations or could also be due to high pressure that has been endured by the student during training. High levels of stress at the workplace may lead to low performance and less interest among interns (Khairuddin, 2015). In addition, Ayarkwa et al. reported that some of the challenges that students encountered during industrial training are inadequate supervision and unprofessional tasks (Ayarkwa et al., 2011). Thiel and Hartely (1997) discussed how the syndrome of 'intern making the photocopy' of not giving interns any meaningful tasks will setback the purpose of industrial training. Some other related issues that may relate to lower performance of interns are working environment, allowance, working hours, (Toncar and Cudmore, 2000, Datuk and Melintang, 2019). Nonetheless, it is believed that this has no relationship with the pandemic situation.

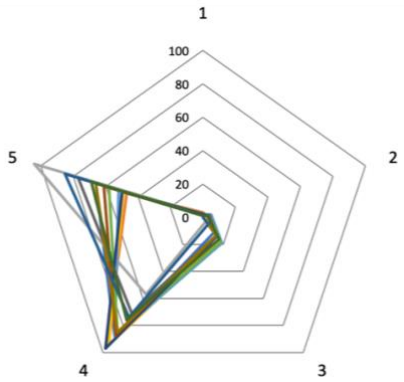


**Fig. 6** Mean analysis of generic performance after industrial training

To further investigate the effectiveness of industrial training from student-respondent perception, the generic performances have been divided into three (3) aspects: personal attitude, communication and professionalism. Table 4 shows the classification of generic performance questions in the survey into the three (3) aspects. Discussion on the generic performance of student-respondents hereafter will be divided into these three (3) aspects.

**Table 4** Division of generic performance by different aspects

| Aspect | Generic Performance |
|---|---|
| Personal attitude | The awareness of the need for continuous learning |
| | Time management |
| | Ability to make decisions |
| | Self-confidence |

| | |
|---|---|
| Communication | Oral presentation skills |
| | Written communication |
| | Ability to communicate ideas |
| Professionalism | The ability to apply knowledge |
| | The ability to solve technical problem |
| | Ability to work independently |
| | Ability to work in group |
| | Able to work under stress |

Fig. 7 represents the comparison between the mean Likert scale of the three (3) aspects of personal attitude, communication, and professionalism. In general, the perceptions of all aspects raised after the industrial training perceive that the confidence levels of the majority of respondents have increased. The performance aspects of professionalism and personal attitude recorded the highest mean Likert scale.

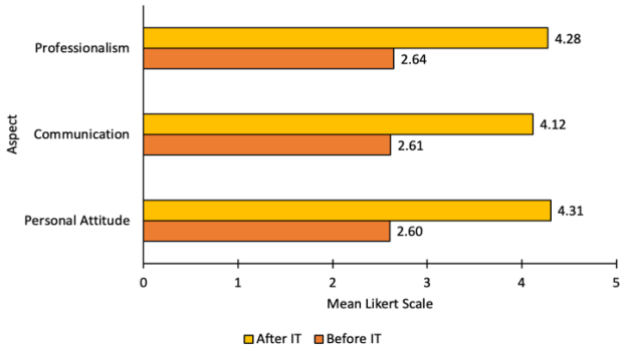


**Fig. 7** The mean Likert scale for three aspects before and after industrial training

In order to learn the change of perception before and after training, score gap analysis has been carried out. The score gap is the difference between the mean Likert scale before and after industrial training in percentage. These score gap values are used to measure the effectiveness of industrial training from the perspective of students. The score gap of student-respondents' satisfaction of their performance by the three aspects is plotted in Fig. 8. The outcome showed that respondents' perception on their personal attitude and professionalism performances improved by 65.5% and 61.8% respectively after the industrial training. In general performance of student-respondents in the communication aspect also recorded improvement but with the lowest percentage of 57.7%.

Interestingly, this outcome is almost similar to many works reported earlier by other researchers. The survey conducted by Karunaratne and Parera (2019) in University of Sri Jayewardenepura showed that industrial training is effective in enhancing personal and enterprise skills of accounting students. The context of enterprise skill used in the work is the same as the definition of professionalism in this work. (Karunaratne and Parera, 2019). On the other hand, Ayarkwa et al. (2011) found that the students have less satisfaction with their communication performance compared to others after the industrial training. The results however are lower than the report by Osman where there was 89-95% of increment on the civil engineering students perceptions after completion of industrial training in 2008 (Osman et al., 2008). It can be summarised that mainly, the perception of students on their generic performance during industrial training was not affected by the pandemic as it shows a similar trend with many findings reported earlier.

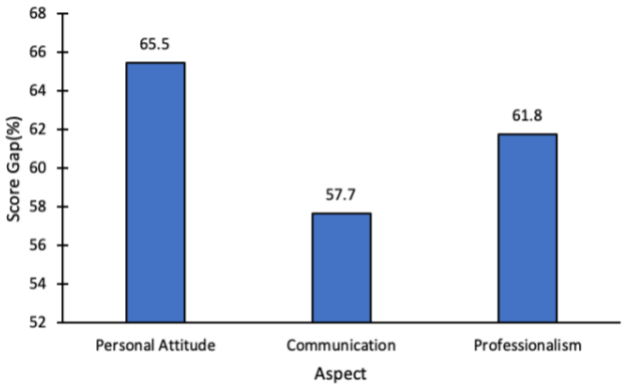


**Fig. 8** Score gaps of student-respondents' satisfaction on their performance

### 3.4 Relationship between respondents' satisfaction with the duration of training

The relationship between respondents' satisfaction on the personal attitude, communication and professionalism aspects, and duration of training has also been analysed. The score gap analysis of personal attitude, communication, and professionalism aspects by duration of training from 8 to more than 10 weeks is shown in Fig. 9. These results suggest that the perceptions of student-respondents on their performance are higher when the duration of training is 10 weeks and more. A shorter duration of training may have limited the chances of the students to get longer projects thus lesser opportunities to learn. This has also been discussed by Khairuddin (Khairuddin, 2015) on the report on stress among interns in Malaysia where one of the reasons was due to the fact that they are not given more jobs during training. This may have reduced the perception of performance for student-respondents who attended 8-week training. In Section 3.1 it has been discussed that the 8-week training has some correlation with the pandemic situation. Thus, it can also be said that the pandemic does have a trivial effect on the performance of students who had undergone industrial training.

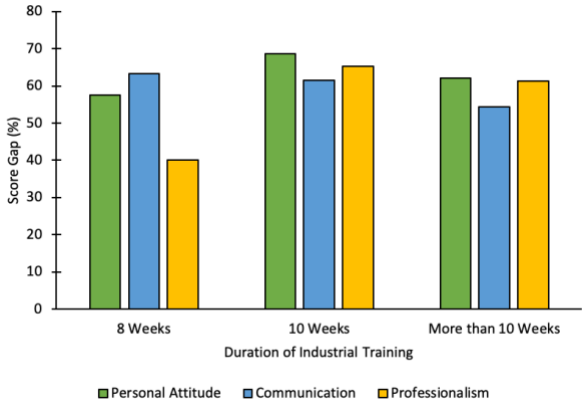


**Fig. 9** Score gaps of student-respondents' satisfaction on their performance by duration of training

### 3.5 Relationship between respondents' satisfaction with type of industrial training organisation

The relationship between respondents' satisfaction with their performance after attending industrial training and the type of organisation of placement was also investigated. Fig. 10 presents the score gap of student-respondents' satisfaction on their performance at government/ GLC, local private company and multinational private company. It is found that the effectiveness of industrial training in improving generic skills varies across the different types of industrial training organisation. On average,

the government/GLC relatively recorded the highest increment of score followed by multinational private companies.

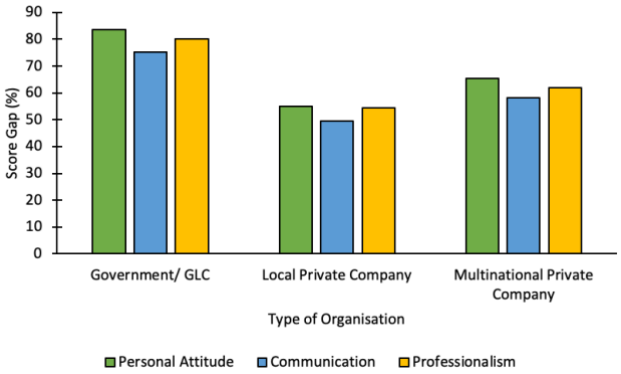


**Fig. 10** Score gaps of student-respondents' satisfaction on their performance by type of organisation

The mean Likert scale on industrial training experiences from the outcome in Section 3.2 was also investigated by type of organisation. This is because the questions for industrial training experiences are closely related to the preparation and suitability of the industrial training organisation. The outcomes (see Fig. 11) show comparatively similar results to the ones obtained in Fig. 10. The local private company has the lowest mean Likert scale at 4.2, approximately 7% lower than the government/ GLC. However, the fact that the mean Likert scale for all types of organisations is above 4 indicates that student-respondents have above satisfaction for their training experiences.

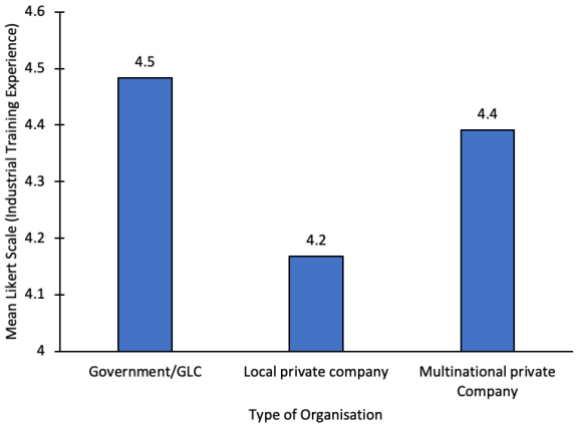


**Fig. 11** The mean Likert scale of student-respondents' satisfaction on their industrial training experiences

## 4. Conclusion

Based on the findings, the following conclusions have been made:

i. In general, students who have undergone industrial training during the Covid-19 pandemic are satisfied with the technical experiences that they have obtained.
ii. Measurement of perception of performance is also an indication of confidence level. It is therefore evidence of a confidence level rise for most of the students who undertook industrial training during the Covid-19 pandemic.
iii. The effectiveness of industrial training during the pandemic is still significant to achieve the course outcome (CO) of the course.
iv. The Covid-19 pandemic does not significantly affect the industrial training opportunities for

undergraduate students of the Mechanical Engineering programme in Malaysia.

v. It is evident that the perception of students on their performance after industrial training has not been affected by the pandemic in Malaysia.

## 5. Acknowledgements

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