Poor mastery of technical communication skills has affected the employability of technical and vocational education and training (TVET) graduates. This has arisen from the lack of communication between TVET institutions and the industry when designing a curriculum for technical communication skills development. In Malaysia, little emphasis is given to developing this skill. Therefore, the current study seeks to develop a technical communication pedagogical model (TCPM) by identifying the pertinent objective, content of learning, method of delivery and assessment method of TCPM, and the effect of the perceived importance of English language proficiency on the relationships of the pertinent curriculum components of TCPM. A survey questionnaire was developed and validated for content validation by seven experts from local industry and TVET institutions. A total of 205 English language instructors in Malaysian vocational colleges (MVC) were selected using a stratified random sampling method and responded to the questionnaire. Their responses were analyzed using the partial least square-structural equation modeling (PLS-SEM). Analysis of reliability, discriminant and convergent validity, significance of relationship, predictive accuracy ($R^2$), predictive relevance ($Q^2$), effect size ($f^2$), and mediation analysis was conducted to test the model. The overall findings indicated that all constructs have a positive and significant effect on perceived importance of TCPM (Objective: $p = 0.012$, $t = 2.249$, content of learning: $p = 0.032$, $t = 1.852$, assessment method: $p = 0.000$, $t = 4.196$), except for method of delivery ($p = 0.301$, $t = 0.522$). The coefficient of determination level is moderate ($R^2 = 0.526$). Analysis of effect size ($f^2$) indicates a small effect size for all constructs (objective: $f^2 = 0.032$, content of learning: $f^2 = 0.027$, assessment method: $f^2 = 0.116$), except for method of delivery with an effect size of 0.002. In addition, this model achieved acceptable predictive relevance ($Q^2 = 0.316$). On the other hand, the mediation analysis indicates that the perceived importance of English language proficiency only functions as a complementary partial mediator for content of learning and assessment method construct. In short, the TCPM model includes having the relevant objectives, content of learning, method of delivery and assessment method for implementing technical communication in MVC, components which are less emphasized in the current curriculum. It is hoped that, with its implementation in the MVC, graduate employability can be enhanced.
Introduction

Unemployment is a global issue. Countries, even the developed ones, are facing increasing unemployment rate due to the global shift of the current market from manufacturing to the service sector (Dobbs and Madgavkar, 2014). In their study, they predicted a potential shortage of 38–40 million high-skilled workers and a surplus of 38–40 million low-skilled workers, in the near future. In Malaysia, the unemployment issue is a unique case. Over the past few years, the unemployment rate has increased from 3.1% in 2015 to 3.4% in 2016 (Department of Statistics Malaysia, 2017) and has remained stagnant until 2018 (Department of Statistics Malaysia, 2018). However, until October 2019, the unemployment rate has dropped to 3.2% (Department of Statistics Malaysia, 2019). A detailed analysis based on the available statistics until 2013 (in Table 1), revealed that the unemployment rate among graduates with tertiary education qualification has increased from 17.43% in 2010 to 25.81% in 2013.

Studies in the area of unemployment in Malaysia have appointed that poor mastery of employability skills, especially communication skills have affected employability of Malaysian graduates including graduates from tertiary education institutions (Hanapi and Nordin, 2014; Osman et al., 2015; Shuib, 2005).

In response to this growing demand for high-skilled workers, technical vocational education and training (TVET) has become an important education platform to equip graduates with: (a) general education knowledge, (b) technical and scientific knowledge, (c) practical skills, positive attitudes and understanding of various working fields (The United Nations Educational, Scientific and Cultural Organization (UNESCO), 2011). In the recent Malaysia Education Blueprint 2013–2025, Ministry of Education Malaysia (2012) has highlighted the importance of TVET institutions in producing high-skilled workers for the country. Vocational colleges, for example, focus on providing vocational training and academic education in order to achieve this aspiration. These institutions have been introduced to students as early as lower secondary levels (Yunos et al., 2006) with hopes to produce more knowledgeable and competent workers for the country (Hasmosri et al., 2014; Ministry of Education Malaysia, 2012). Students may apply for junior vocational college for Malaysian Skills Certificate Level 1 and 2, and continue for their Diploma in either vocational colleges, public skills training institutions or private vocational colleges. Also, they are encouraged to further their studies in higher learning institutions for their degrees.

However, numerous studies have reported that TVET institutions are still struggling to equip graduates with strong communication-for-work skills (Mourshed et al., 2014; Nagendra et al., 2013; Oxtoby, 1997; Tabbron and Yang, 1997). A mismatch of expectation between industry and TVET institutions have also been reported in the literature (Mourshed et al., 2014; Oxtoby, 1997). Similarly, in Malaysia, Ibrahim et al. (2012) reported that the students in local TVET institutions were not well accepted by the industry. They believed that the curriculum in their institution was inadequate to prepare them for the industry. In fact, Nagendra et al. (2013) affirmed that there is no clear direction to guide the process of curriculum design and development, and assessment for communication-for-work skills.

Clearly, our TVET curriculum is still facing a challenge in producing high-skilled workers, and thus, intensive improvements should be proposed and taken into consideration. In line with Minghat and Yasin’s (2010) sustainable framework of Malaysian TVET, robust educational emphases should be given not only on content knowledge and technical skills but also on communication skills development. Even though communication skills have been proven to be lacking among students or graduates (Mourshed et al., 2014; Nagendra et al., 2013; Oxtoby, 1997; Tabbron and Yang, 1997), the current body of literature seems inadequate to mark the next step to improve communication skills in TVET institutions. Therefore, there is a need to develop a model for technical communication skills development in the Malaysian TVET institutions, especially the vocational colleges.

### Table 1 Unemployment rate according to educational attainment.

| Educational attainment | 2010 (%) | 2011 (%) | 2012 (%) | 2013 (%) |
|------------------------|---------|---------|---------|---------|
| Primary                | 10.98   | 10.37   | 10.17   | 10.00   |
| Secondary              | 59.05   | 55.29   | 59.22   | 57.20   |
| Tertiary               | 17.43   | 25.64   | 22.71   | 25.81   |
| No certificate         | 5.59    | 4.42    | 4.39    | 3.72    |

Adapted from Department of Statistics Malaysia (2016).

### Technical communication and the current TVET curriculum

Numerous studies have suggested technical communication skills integration in TVET curriculum (Brinkman and van der Geest, 2003; Reaves, 2004; Rus, 2014). General communication courses offered in most institutions are viewed as inadequate to equip students with relevant communication-for-work skills (Brinkman and van der Geest, 2003; Kunioishi et al., 2012; Reaves, 2004; Rus, 2014). They believed that technical communication skills, such as interpersonal, verbal presentation, writing and researching skills, that are derived from communicative experiences in the real industry, are needed to be integrated into the TVET curriculum. However, the types of technical communication in the local industry should first be determined in ensuring the curriculum addresses the needs of the local industry.

In Malaysian Vocational Colleges, the current subjects such as General English (introduced in Semester 1 and 2 of Certificate level), English for specific purposes (ESP) (introduced in Semester 3 and 4 of Certificate level) and English for Communication (introduced to Diploma level) are majorly focusing on developing basic communication skills, and competency in English (Ministry of Education Malaysia, 2014a, 2014b, 2014c) and are not specifically designed to prepare them for communication in real industry. Therefore, there is a need to develop a technical communication pedagogical model (TCPM) for Malaysian vocational colleges. This will serve as a clear guideline for instructors to effectively implement the curriculum at micro-level (Batista et al., 2010).

### Classification of technical communication skills

Mitchell (1962) firmly believes that technical communication is a strategic communication scheme across science and engineering fields, as well as industry. According to Mitchell (1962), technical communication consists of eight important elements: (1) content, (2) form, (3) audience level, (4) subject matter, (5) accepted usage and predictive arrangements, (6) conventions, (7) internal forms, and (8) scientific values and techniques. The content and form of technical communication must be suitable to the audience level to ensure information is effectively delivered to the audience. Also, a speaker must understand the subject matter and knows appropriate forms of communication and convention, either in oral or written form to effectively deliver the information and convince the target audience. In addition, in delivering information in working fields, an individual needs to master how to retrieve, structure, organize, and report work-related information in building a factual and convincing content of the communication.
Technical communication can be categorized into two categories: oral presentation and social literacy skills. Oral presentation skills include the ability to: (1) retrieve relevant information from multiple sources related to a topic, (2) gather and organize information to ease understanding, (3) distinguish main ideas with supporting details, (4) plan introduction and conclusion for a presentation, (5) plan and develop the content of an oral presentation, (6) operate technological tools that can further help information gathering and communication, (7) acquire an awareness of technological tools to help promote social interactions and collaboration for work, and (8) plan and prepare visual aids to support the delivery of content (Brinkman and van der Geest, 2003; Cook, 2002; Lappalainen, 2010; McMurrey, 2002; Reaves, 2004; Rus, 2014).

On the other hand, social literacy skills include the ability to: (1) communicate effectively with co-workers and administrators, (2) effectively give instructions, (3) provide constructive feedbacks, (4) establish professional relationships with customers and co-workers, (5) share information in small group settings, (6) acquire multicultural awareness, (7) positively handle conflicts, (8) acquire leadership skills, and (9) produce business documents (Brinkman and van der Geest, 2003; Cook, 2002; Lappalainen, 2010; McMurrey, 2002; Reaves, 2004; Rus, 2014).

On the other hand, technical communication considers the development of English language proficiency skills. In general, technical communication shares characteristics of ESP which include prioritizing students’ specific needs of communication and designing content that help to realize these needs. Also, English language proficiency is not the main focus but is embedded throughout the learning process (Strevens, 1988). Among important language skills relevant to technical communication are the ability to: (1) construct accurate sentence structures, (2) apply verbal communication strategy, and (3) comprehend information in a text. These skills are among important language skills for work, as highlighted in the Test of English for International Communication (Yoo and Manna, 2015) and Occupational English Test (Occupational English Test, 2016).

**Curriculum development**

Curriculum for TVET is viewed as an objective-driven curriculum. According to Ross (2000), vocational curriculum focuses on addressing social needs through education. This curriculum considers industry needs in designing its objective, content, method of delivery and assessment method. Wellington (1993) termed this as industry-based curriculum. The curriculum should have: (1) established targets and programmes relevant to National Curriculum and field of work, (2) clear framework for knowledge and skills development of work and career development, (3) focus on personal and social skills development, and (4) include work-related activities.

As one of the widely practised curriculum models, Tyler’s (1949) curriculum planning model is the basis for this pedagogical development as it is objective-driven. Tyler (1949) emphasizes on four important processes, which starts with establishing objectives and are followed by selecting learning experiences, organizing them and lastly, evaluation.

For this study, the proposed objectives are aligned with the characteristics of an industry-based curriculum and skills needed for technical communication skills development such as to: (1) develop oral, researching, interpersonal, and written technical communication skills, (2) provide and expose students to work-related communicative experiences, and (3) serve as a reference for effective implementation in Malaysian Vocational colleges.

Based on the review of literature, relevant methods of delivery include practical tutorials, collaborative learning activities, field training, a communication module, integration of technical communication across technical subjects, and contextualized learning activities (Lappalainen, 2010; Reaves, 2004).

On the other hand, the review of the literature suggests oral presentations, writing technical documents tasks, observations on students’ communicative experiences during fieldworks and group activities, and evaluation of students’ responses on the online forum as relevant assessment methods for technical communication development (Brinkman and van der Geest, 2003; McMurrey, 2002; Rus, 2014).

**The current study**

In introducing technical communication in Malaysian vocational colleges, this study is aimed at developing TCPM for the Malaysian vocational colleges as a reference for implementation. Therefore, this study seeks to achieve these objectives:

1. propose TCPM for the Malaysian vocational colleges,
2. evaluate the effect of the perceived importance of English language proficiency on the relationships of the pertinent curriculum components of TCPM.

In achieving this, the study aims to answer the following research questions:

1. What is the pertinent objective, content of learning, method of delivery and assessment method of TCPM?
2. What is the effect of the perceived importance of English language proficiency on the relationships of the pertinent curriculum components of TCPM?

**Study model and hypotheses**

The proposed initial model, as presented in Fig. 1, is developed based on an extensive review of the literature. The following hypotheses are to evaluate the overall model.

- Hypothesis 10 (H10): The pertinent objective has no positive and significant effect on the TCPM for the Malaysian vocational colleges
- Hypothesis 20 (H20): The pertinent content of learning has no positive and significant effect on the TCPM for the Malaysian vocational colleges
- Hypothesis 30 (H30): The pertinent method of delivery has no positive and significant effect on the TCPM for the Malaysian vocational colleges
- Hypothesis 40 (H40): The pertinent assessment method has no positive and significant effect on the TCPM for the Malaysian vocational colleges.

In addition, to test the mediation effect for the proposed model, the null hypotheses are:

- Hypothesis 50 (H50): The relationship between pertinent objective and the TCPM for the Malaysian vocational colleges is not positively mediated by English language proficiency.
- Hypothesis 60 (H60): The relationship between pertinent content of learning and the TCPM for the Malaysian vocational colleges is not positively mediated by English language proficiency.
- Hypothesis 70 (H70): The relationship between pertinent method of delivery and the TCPM for the Malaysian vocational colleges is not positively mediated by English language proficiency.
- Hypothesis 80 (H80): The relationship between pertinent assessment method and the TCPM for the Malaysian vocational colleges is not positively mediated by English language proficiency.
vocational colleges is not positively mediated by English language proficiency.

**Methodology**

The TCPM survey was administered to the English language instructors in the Malaysian Vocational Colleges. This is to help gather gaining insights directly from the target population and to generalize to the population (Chua, 2010). For the analysis and model development, the partial least square-structural equation modeling (PLS-SEM) analysis, using Smart-PLS was employed. This analysis was selected as the current study is exploratory in nature and has limited sample size (Ramayah et al., 2018).

**Participants.** For this study, 205 from 435 English language instructors across 81 Malaysian vocational colleges were selected as the research participants. The number of research participants conformed the Krejcie and Morgan’s (1970) guideline for sample size determination \(N = 435; S = 205\), and the minimum number of 150 respondents for SEM study (Hair et al., 2010).

The participants were selected using a stratified random sampling method. The calculation for stratified sampling is based on Er’s (2012) suggestion:

\[
\text{(total of required sample/population) \times (total of instructors in one sub population)}
\]

\[= \text{number of respondents to be randomly selected}\]

Table 2 presents a summary of the required sample size according to six zones.

| Zone/subpopulation | Number of instructors | Number of respondents |
|--------------------|-----------------------|-----------------------|
| Northern           | 117                   | 55                    |
| Central            | 57                    | 27                    |
| Southern           | 95                    | 45                    |
| East coast         | 91                    | 43                    |
| Sabah              | 39                    | 18                    |
| Sarawak            | 36                    | 17                    |
| Total              | 435                   | 205                   |

**Instrument.** The survey instrument was initially developed based on an extensive review of the literature and validated for content validity by seven experts from TVET, local industry and English language in TVET institutions. These experts have more than 10 years of working experiences in their respective fields. This process is to ensure that the concept and information from the literature are accurately interpreted in the instrument (Drost, 2011).

The experts suggested adding a number of items such as the ability to produce marketing literature, and the use of online and contextualized learning activities. However, they also suggested removing an item: the ability to deliver a speech to the audience. After modification based on the experts’ suggestions, the instrument has been piloted face-to-face, on 100 English language instructors, to ensure a high return rate and understanding of the instrument (Chua, 2010). Overall, the instrument has four sections: (1) Section A: Demographic Information (four items); (2) Social context; (3) Objective (two items); (4) Content of learning (two items); (5) Method (two items); and (6) Assessment (four items).
Results

Initial model. The findings in Table 4 indicated that all constructs have achieved internal consistency reliability. The Cronbach’s alpha values for all constructs have exceeded the recommended threshold value of 0.60 (Hair et al., 2006). The outer loading values for all item in each construct were above the recommended threshold value of 0.40 (Chin, 1998). In addition, the CR values for all constructs were above 0.70, indicating a good reliability (Chin, 1998). However, teaching competency construct should be treated with caution as the value of CR was higher than 0.95, indicating a possibility of redundant items in this construct (Hair et al., 2017). Figure 2 provides a summary of the initial measurement model.

The results also indicated that all constructs have achieved a good convergent validity, with average variance extracted (AVE) values above 0.50 (Garson, 2016). However, there were a number of items that have outer loading lower than 0.70, and thus should be treated with caution.

Also, the discriminant validity for all constructs was identified based on the Fornell and Larcker’s (1981) criterion, and heterotrait–monotrait ratio (HTMT). Table 5 provides a summary of the results of Fornell and Larcker’s (1981) criterion analysis. The correlation values between all constructs were lower compared to every construct squared AVE, indicating all constructs have achieved discriminant validity. In addition, the findings of HTMT analysis in Table 6 indicated that all constructs have achieved HTMT values lower than the recommended threshold value of 0.85 (Kline, 2011), except for Method construct (0.871). It was found that one item in this construct (MET6) loaded higher than an item in Assessment construct. Therefore, this item was considered for deletion.

Measurement model. Modification of the initial measurement model includes the deletion of: (a) lower factor loading (<0.70) such as item COL7, COL17, MET1, MET4, and ASM5, (b) almost semantically identical items (TC1: The pedagogical model will help to improve teachers’ understanding of relevant communication skills to the current industry), or TC2: The pedagogical model will help to improve teachers’ understanding of relevant communication skills to the current industry), and (c) item with higher cross-loading value (MET6). The modification has improved the reliability of all construct (refer Table 7). For instance, all items have a higher outer loading value, between 0.602 and 0.910, acceptable Cronbach’s alpha values, between 0.727 and 0.928, and ideal CR values, between 0.847 and 0.941.

In addition, the AVE values were between 0.569 and 0.760, providing evidence of convergent validity (AVE > 0.50) (Garson, 2016). On the other hand, the correlation values between all constructs were lower compared to every construct squared AVE, as presented in Table 8. Evidently, the results indicated that all constructs have achieved discriminant validity based on the Fornell and Larcker’s (1981) criterion. Also, the findings of the HTMT analysis (refer Table 9) indicated that all constructs have achieved lower than 0.85 and the cross-loading value for all items were lower than in its construct, providing an evidence of a good discriminant validity (Kline, 2011).

The results for the higher-order constructs (HOCs) are presented in Table 10. Evidently, the HOCs have achieved: (1) acceptable outer loading value (between 0.662 and 0.841), (2) acceptable Cronbach’s alpha value, above 0.6, and (3) ideal CR with 0.949 for technical communication and 0.950 for content of learning. These provided evidence of a good reliability.

The results have provided evidence of convergent validity for the HOCs. For instance, the AVE for Content of learning was 0.560, and Technical communication was 0.652, which exceeded the recommended threshold value of 0.50 (Garson, 2016). In addition, the outer loadings were above the acceptable value of 0.40 (Hulland, 1999).

The HOCs have also achieved discriminant validity. Based on the Fornell and Larcker’s (1981) criterion, the values of the correlation between all constructs were lower compared to every construct squared AVE (refer Table 11). In addition, as presented in Table 12, all constructs have achieved acceptable HTMT value, between 0.394 and 0.812 (HTMT < 0.85), indicating evidence of good discriminant validity (Kline, 2011).
Table 5 The Fornell and Larcker’s (1981) criterion analysis for the initial measurement model.

|                         | Assessment | English lang. proficiency | Teaching competency | Method | Objective | Oral presentation | Social literacy | Learning environment |
|-------------------------|------------|---------------------------|---------------------|--------|-----------|-------------------|-----------------|---------------------|
| Assessment              | 0.754      | 0.482                     | 0.598               | 0.717  | 0.500     | 0.576             | 0.675           | 0.675               |
| English language proficiency | 0.482      | 0.831                     | 0.561               | 0.481  | 0.506     | 0.451             | 0.506           | 0.506               |
| Teaching competency     | 0.598      | 0.561                     | 0.852               | 0.725  | 0.733     | 0.748             | 0.776           | 0.872               |
| Method                  | 0.717      | 0.481                     | 0.623               | 0.725  | 0.733     | 0.748             | 0.776           | 0.872               |
| Objective               | 0.554      | 0.506                     | 0.610               | 0.633  | 0.563     | 0.742             | 0.790           |                     |
| Oral presentation       | 0.675      | 0.540                     | 0.548               | 0.633  | 0.563     | 0.812             | 0.790           |                     |
| Social literacy         | 0.675      | 0.540                     | 0.548               | 0.633  | 0.563     | 0.812             | 0.790           |                     |
| Learning environment    | 0.675      | 0.540                     | 0.548               | 0.633  | 0.563     | 0.812             | 0.790           |                     |

The bold values are the construct squared AVE value, which should be higher than the correlation values between constructs.

Table 6 The HTMT analysis for the initial measurement model.

|                         | Assessment | English lang. proficiency | Teaching competency | Method         | Objective | Oral presentation | Social literacy | Learning environment |
|-------------------------|------------|---------------------------|---------------------|----------------|-----------|-------------------|-----------------|---------------------|
| Assessment              | 0.611      | 0.679                     | 0.871               | 0.394          | 0.645     | 0.581             | 0.675           | 0.675               |
| English language proficiency | 0.679      | 0.651                     | 0.700               | 0.326          | 0.598     | 0.558             | 0.540           | 0.540               |
| Teaching competency     | 0.871      | 0.590                     | 0.700               | 0.326          | 0.598     | 0.558             | 0.540           | 0.540               |
| Method                  | 0.394      | 0.326                     | 0.503               | 0.307          | 0.503     | 0.503             | 0.503           | 0.503               |
| Objective               | 0.645      | 0.598                     | 0.66                | 0.757          | 0.503     | 0.503             | 0.503           | 0.503               |
| Oral presentation       | 0.581      | 0.558                     | 0.726               | 0.507          | 0.503     | 0.503             | 0.503           | 0.503               |
| Social literacy         | 0.675      | 0.540                     | 0.622               | 0.412          | 0.561     | 0.561             | 0.561           | 0.561               |
| Learning environment    | 0.675      | 0.540                     | 0.811               | 0.412          | 0.561     | 0.561             | 0.561           | 0.561               |

The bold value indicated the only value that is above 0.85, and exceeded the recommended threshold value (Kline, 2011).
In addition, all four LOCs have a significant relationship with their respective HOCs, with r-value above 1.96 and were significant at 0.01 value (Hair et al., 2017), as presented in Table 13. These results provide evidence of significant relationships between HOCs with their respective LOCs.

In addition, all four LOCs have a significant relationship with their respective HOCs, with r-value above 1.96 and were significant at 0.01 value (Hair et al., 2017). These results provide evidence of significant relationships between HOCs with their respective LOCs.

### The structural model

The analysis of multicollinearity through the identification of variance inflation factor (VIF) indicated that all inner VIF values for exogenous variables were <5.0, indicating multicollinearity was not an issue for this model (Hair et al., 2017). Also, the significance of relationships analysis (presented in Table 14) indicated that all exogenous constructs have a significant relationship in predicting Technical communication, except for Method of delivery (p > 0.005, t < 1.645). The analysis of relative importance showed that Assessment was the most important predictor (0.316) to predict Technical communication.

Based on the above results, three null hypotheses (H10, H20 and H40) should be rejected as these variables (Objective, Content of learning, and Assessment) have positive and significant effect on Technical communication. However, one null hypothesis (H20) was accepted as the Method of delivery construct have no positive and significant effect on Technical communication.

On the other hand, Table 15 presents the results of predictive accuracy (R²) and relevance (Q²). The model has achieved the R² value of 0.526, indicating a substantial level of predictive accuracy (Cohen, 1988). Also, the predictive relevance Q² value was 0.316, which exceeded the 0.00 cut-off value (Cohen, 1988). This indicated that the model is predictive by exogenous variables in this study.

Other than that, Table 16 presents the results of the effect size assessment. All exogenous constructs, except Method have achieved small effect size between 0.027 and 0.116 (Cohen, 1988) in producing R² for Technical communication. Figure 3 shows a summary of the structural model results.

#### Mediation analysis

In this study, the relevant skills to English language proficiency are believed to be important in developing

### Table 7 Assessment of the measurement model.

| Construct                  | Outer loading | Cronbach's alpha | CR | AVE |
|----------------------------|---------------|------------------|----|-----|
| Objective                  | 0.709-0.845   | 0.895            | 0.917 | 0.613 |
| Oral presentation          | 0.695-0.857   | 0.900            | 0.922 | 0.628 |
| Social literacy            | 0.751-0.873   | 0.928            | 0.941 | 0.668 |
| Method                     | 0.737-0.871   | 0.727            | 0.847 | 0.649 |
| Assessment                 | 0.602-0.840   | 0.806            | 0.867 | 0.569 |
| Teaching competency        | 0.747-0.903   | 0.927            | 0.943 | 0.736 |
| Learning environment        | 0.819-0.910   | 0.894            | 0.927 | 0.760 |
| English language proficiency| 0.806-0.873   | 0.776            | 0.870 | 0.690 |

### Table 8 The Fornell and Larcker’s (1981) criterion analysis for the measurement model.

| Assessment | English language proficiency | Learning environment | Method | Objective | Oral presentation | Social literacy | Teaching competency |
|------------|------------------------------|----------------------|--------|-----------|------------------|----------------|---------------------|
| Assessment | 0.754                        | 0.483                | 0.576  | 0.681     | 0.348            | 0.599          | 0.496               |
| English language proficiency | 0.483                        | 0.831                | 0.451  | 0.455     | 0.280            | 0.501          | 0.478               |
| Teaching competency | 0.576                        | 0.872                | 0.523  | 0.523     | 0.377            | 0.497          | 0.477               |
| Method     | 0.782                        | 0.783                | 0.431  | 0.641     | 0.585            | 0.793          | 0.817               |
| Objective  | 0.782                        | 0.783                | 0.431  | 0.641     | 0.585            | 0.793          | 0.817               |
| Oral presentation | 0.782                        | 0.783                | 0.431  | 0.641     | 0.585            | 0.793          | 0.817               |
| Social literacy | 0.782                        | 0.783                | 0.431  | 0.641     | 0.585            | 0.793          | 0.817               |
| Learning environment | 0.782                        | 0.783                | 0.431  | 0.641     | 0.585            | 0.793          | 0.817               |

*The bold values are the construct squared AVE value, which should be higher than the correlation values between constructs.*

### Table 9 The HTMT analysis for the measurement model.

| Assessment | English language proficiency | Learning environment | Method | Objective | Oral presentation | Social literacy | Teaching competency |
|------------|------------------------------|----------------------|--------|-----------|------------------|----------------|---------------------|
| Assessment | 0.611                        | 0.546                | 0.554  | 0.539     | 0.641            | 0.791          | 0.569               |
| English language proficiency | 0.675                        | 0.540                | 0.554  | 0.539     | 0.641            | 0.791          | 0.569               |
| Learning environment | 0.675                        | 0.540                | 0.554  | 0.539     | 0.641            | 0.791          | 0.569               |
| Method     | 0.786                        | 0.546                | 0.554  | 0.539     | 0.641            | 0.791          | 0.569               |
| Objective  | 0.394                        | 0.326                | 0.412  | 0.539     | 0.641            | 0.791          | 0.569               |
| Oral presentation | 0.652                        | 0.594                | 0.552  | 0.746     | 0.584            | 0.791          | 0.569               |
| Social literacy | 0.574                        | 0.560                | 0.521  | 0.746     | 0.584            | 0.791          | 0.569               |
| Teaching competency | 0.657                        | 0.642                | 0.813  | 0.633     | 0.501            | 0.644          | 0.569               |
Technical communication. The mediation analysis was conducted, and the results suggested that both Content of learning and assessment were mediated by English language proficiency (refer Table 17). Both constructs have achieved a significant value of indirect (Content of learning with \(t=2.376, p<0.01\); Assessment with \(t=1.875, p<0.05\)) and direct effect (Content of learning with \(t=1.852, p<0.05\); Assessment with \(t=4.196, p<0.01\)).

### Table 11 Discriminant validity result based on the Fornell and Larcker’s (1981) criterion for the HOCs.

| Assessment       | Content of Learning | English language proficiency | Method | Objective | Technical Communication |
|------------------|---------------------|-----------------------------|--------|-----------|-------------------------|
| Assessment       | 0.754               | 0.749                       | 0.831  | 0.806     | 0.783                   |
| Content of Learning | 0.565              | 0.749                       | 0.418  | 0.442     | 0.460                   |
| English language proficiency | 0.483          | 0.526                       | 0.280  | 0.524     | 0.460                   |
| Method           | 0.606               | 0.669                       | 0.543  | 0.539     | 0.807                   |
| Objective        | 0.348               | 0.603                       | 0.608  | 0.634     | 0.491                   |
| Technical Communication | 0.613       | 0.608                       | 0.543  | 0.539     | 0.807                   |

The bold values are the construct squared AVE value, which should be higher than the correlation values between constructs.

### Table 13 Relationship testing for the HOCs.

|                          | \(\beta\) | Std. error | \(t\)-value | \(p\)-value | Remark | \(R^2\) |
|--------------------------|-----------|------------|--------------|-------------|--------|---------|
| Content of learning -> Oral presentation | 0.915     | 0.019      | 49.145       | 0.000*      | Sig.   | 0.838   |
| Content of learning -> Social literacy | 0.941     | 0.011      | 85.478       | 0.000*      | Sig.   | 0.886   |
| Technical communication -> Learning environment | 0.905     | 0.014      | 64.075       | 0.000*      | Sig.   | 0.819   |
| Technical communication -> Teaching competency | 0.958     | 0.007      | 131.665      | 0.000*      | Sig.   | 0.526   |

*\(p<0.01\), **\(p<0.005\).

### Table 14 Significance of relationships for the structural model.

|                          | \(\beta\) | Std. error | \(t\)-value | \(p\)-value |
|--------------------------|-----------|------------|--------------|-------------|
| Assessment → English language proficiency | 0.270     | 0.089      | 3.033        | 0.001*      |
| Assessment → Technical communication | 0.316     | 0.075      | 4.196        | 0.000*      |
| Content of learning → English language proficiency | 0.403     | 0.103      | 3.911        | 0.000*      |
| Content of learning → Oral presentation | 0.941     | 0.011      | 86.011       | 0.000*      |
| Content of learning → Social literacy | 0.186     | 0.101      | 1.852        | 0.032**     |
| English language proficiency → Technical communication | 0.231     | 0.085      | 2.720        | 0.003*      |
| Method → English language proficiency | 0.012     | 0.089      | 0.132        | 0.448*      |
| Method → Technical communication | 0.043     | 0.082      | 0.522        | 0.301       |
| Objective → English language proficiency | -0.062    | 0.096      | 0.646        | 0.259       |
| Objective → Technical communication | 0.154     | 0.068      | 2.249        | 0.012**     |

*\(p<0.01\), **\(p<0.005\).
Also, the sign of $a \times b \times c'$ for both constructs were all positive, indicating a complementary partial mediation exists (Zhao et al., 2010). Therefore, two null hypotheses ($H_6_0$ and $H_8_0$) were rejected, and the other two were accepted ($H_5_0$ and $H_7_0$).

**Discussion**

**Pertinent elements of TCPM.** The overall result of the structural analysis indicated that all constructs have a positive and significant effect on the perceived importance of TCPM (Objective: $p = 0.012$, $t = 2.249$, Content of learning: $p = 0.032$, $t = 1.852$, Assessment method: $p = 0.000$, $t = 4.196$), except for Method of delivery ($p = 0.301$, $t = 0.522$). The effect size of each construct was small, except Method of delivery, and the model has achieved acceptable predictive relevance. The overall components of the TCPM is presented in Table 18.

The objectives of this TCPM focus on the development of both oral presentation and social literacy skills, providing work-related and authentic communicative experiences, as well as providing guidance for English language instructors for effective implementation. These objectives reflect Wellington's (1993) suggestions for effective school–workplace competencies development. The curriculum should provide work-based activities that help to develop their work-related competencies, including communication, as suggested in the previous literature (Moursheed et al., 2014; Nagendra et al., 2013; Oxtoby, 1997; Tabbron and Yang, 1997).

For Content of learning, the ability to retrieve, gather and organize information, distinguish main ideas in a text and awareness of how technological tools help to promote interactions, as well as to plan and develop introduction, content and conclusion of the presentation, should be the focus for oral presentation skills development. Also, the content should include an introduction to social literacy skills such as the ability to communicate and establish a relationship with customer and co-workers, give instruction and constructive feedback, and multicultural awareness. These findings are in line with the suggestions by Lappalainen (2010), Brinkman and van der Geest (2003), and Cook (2002), as they mentioned that these skills are pivotal to enhance students’ employability skills. In the localized context of Malaysia, the proposed content reflects the current needs in the local industry as the employers expected graduates to have interpersonal, social skills, and multicultural awareness (Muda et al., 2012; Rasul et al., 2013; Singh et al., 2014; Zaharim et al., 2012).

Interestingly, the ability to produce business letters was not significant to this model. However, this is not a surprising fact as recent studies in the context of Malaysian TVET noted that the

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**Table 15 Predictive accuracy ($R^2$) and predictive relevance ($Q^2$) assessment for the structural model.**

|                         | $R^2$ | SSO | SSE | $Q^2$ ($1$–SSE/SSO) |
|-------------------------|-------|-----|-----|---------------------|
| Technical communication  | 0.526 | 2050.00 | 1402.44 | 0.316               |

**Table 16 Effect size ($f^2$) assessment for the structural model.**

|                         | Technical communication |
|-------------------------|-------------------------|
| Assessment              | 0.116                   |
| Content of learning     | 0.027                   |
| English language proficiency | 0.075                 |
| Method                  | 0.002                   |
| Objective               | 0.032                   |

**Fig. 3 The structural model.** The summary of the structural model analysis with the loading values between the indicators and each construct and the coefficient values between constructs.
Table 17 Mediation analysis result.

| Path  | Objective → Technical communication | Content of learning → Technical communication | Method → Technical communication | Assessment → Technical communication | Path a | Path b | Path c' |
|-------|-------------------------------------|-----------------------------------------------|----------------------------------|--------------------------------------|--------|--------|--------|
| β     | Std. error | t-value | p-value | β     | Std. error | t-value | p-value | β     | Std. error | t-value | p-value |
| Objective → English language proficiency | −0.062 | 0.096 | 0.646 | 0.259 |
| Content of learning → English language proficiency | 0.403 | 0.103 | 3.911 | 0.000* |
| Method → English language proficiency | 0.012 | 0.089 | 0.132 | 0.448 |
| Assessment → English language proficiency | 0.270 | 0.089 | 3.033 | 0.001* |
| Path b | | | | | English language proficiency → Technical communication | 0.231 | 0.085 | 2.720 | 0.003* |
| Objective → Technical communication | 0.154 | 0.068 | 2.249 | 0.012** |
| Content of learning → Technical communication | 0.186 | 0.101 | 1.852 | 0.032** |
| Method → Technical communication | 0.043 | 0.082 | 0.522 | 0.301 |
| Assessment → Technical communication | 0.316 | 0.075 | 4.196 | 0.000* |
| Total effect | Objective → Technical communication | 0.140 | 0.077 | 1.809 | 0.035** |
| Content of learning → Technical communication | 0.280 | 0.096 | 2.908 | 0.002* |
| Method → Technical communication | 0.045 | 0.089 | 0.508 | 0.306 |
| Assessment → Technical communication | 0.379 | 0.077 | 4.900 | 0.000* |
| Indirect effect | Objective → English language proficiency → Technical communication | −0.0140 | 0.0260 | 0.560 | 0.288 |
| Content of learning → English language proficiency → Technical communication | 0.0930 | 0.0390 | 2.376 | 0.009* |
| Method → English language proficiency → Technical communication | 0.0030 | 0.0210 | 0.129 | 0.449 |
| Assessment → English language proficiency → Technical communication | 0.0620 | 0.0330 | 1.875 | 0.030** |

*p < 0.01, **p < 0.005.

In the Malaysian vocational colleges, the assessment of technical communication can be conducted through oral presentation, writing technical documents, as well as an observation on students’ communication during group work, field training, and online forum. Since traditional assessment such as examination is less relevant in the Malaysian TVET context (Department of Skills Development Malaysia, 2016; Singh et al., 2015; Shuib, 2005). Interestingly, the current study also found that English language proficiency skills should be embedded through the process of teaching and learning. This is because these skills will help to enhance communication for work (Brinkman and van der Geest, 2003; Laverty, 1979; McMurrey, 2003; Nutman, 1987). To support, in the communication process model, Dean and Bryson (1961) highlighted the importance of acquiring a good “language system” to enhance the communication process.

Conclusion

Technical communication reflects the actual communicative experiences that happened in the industry (Brinkman and van der Geest, 2003; Reaves, 2004; Rus, 2014). Therefore, TVET graduates should be able to master the skills. However, in the current curriculum in Malaysian vocational colleges, little emphasis is given in developing this skill. In this study, the proposed model has achieved a moderate level of coefficient of determination ($R^2 = 0.526$), small effect size for almost all curriculum constructs, and an acceptable value of predictive relevance ($Q^2 = 0.316$). These indicate that the model can serve as a relevant reference for the implementation of technical communication skills development in these institutions. Even though, the Method of delivery was insignificant ($p = 0.301$, $t = 0.522$), the proposed methods such as practical tutorials, collaborative teaching.

Effect of English language proficiency on TCPM. The findings in the current study indicated that English language proficiency only functioned as complementary partial mediator for both Content of learning ($t = 2.376$, $p = 0.009$; $t = 1852$, $p = 0.032$) and Assessment ($t = 1.875$, $p = 0.030$; $t = 4.196$, $p = 0.000$). Language skills such as the ability to use accurate sentence structure, apply appropriate verbal communication strategy and comprehend information were found important for Content of learning and Assessment method. This is in line with suggestions to include English proficiency skills in technical communication skills development (Brinkman and van der Geest, 2003; Cook, 2002; Lappalainen, 2010).

Clearly, Technical communication falls under the ESP concept. Technical communication has both absolute and variable characteristics of ESP (Strevens, 1988). In this study, TCPM is aimed to serve as a reference in developing students’ communication-for-work skills, which were found to be lacking among graduates (Hanapi and Nordin, 2014; Osman et al., 2015; Shuib, 2005). Interestingly, the current study also found that English language proficiency skills should be embedded through the process of teaching and learning. This is because these skills will help to enhance communication for work (Brinkman and van der Geest, 2003; Laverty, 1979; McMurrey, 2003; Nutman, 1987). To support, in the communication process model, Dean and Bryson (1961) highlighted the importance of acquiring a good “language system” to enhance the communication process.
learning activities, and field training can be considered to replace the traditional teaching method practised in the institutions. On the other hand, English language proficiency skills such as the ability to use accurate sentence structure, apply appropriate verbal communication strategy, and comprehend information was found to be a complementary partial mediator for both Content of learning (t = 2.376, p = 0.009; t = 1852, p = 0.032) and Assessment (t = 1.875, p = 0.030; t = 4.196, p = 0.000). This indicates that these skills should be considered as part of technical communication skills development.

Data availability
The datasets generated during and/or during the current study are not publicly available due to confidentiality of the respondents’ information but are available from the corresponding author on reasonable request.

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### Table 18 The proposed components for technical communication pedagogical model.

| Objective | Method of delivery (insignificant) |
|-----------|-----------------------------------|
| 1. Develop oral communication skills that are relevant to the industry. | 1. Delivering the content through a practical tutorial. |
| 2. Develop written communication skills that are relevant to the industry. | 2. Delivering the content through a collaborative learning activity. |
| 3. Develop interpersonal skills that are relevant to the industry. | 3. Delivering the content through field training. |
| 4. Develop researching skills that are relevant to the industry. | 4. Delivering the content through the communication module which introduces technical communication across technical subjects. |
| 5. Provide work-related communicative experiences for students. | 5. Delivering the content through communication across the curriculum (integrates technical communication skills across technical subjects). |
| 6. Guide teaching and learning for communication skills in the technical field. | 6. Delivering the content through contextualized learning activity (which is conducted in an authentic working environment). |
| 7. Expose students with authentic communicative experiences in the real settings of the industry. | 7. Develop the ability to plan and prepare visual aids (for a larger audience). |
| 8. Develop the ability to plan an introduction and conclusion of oral presentations. | 8. Develop leadership skills. |
| 9. Develop the ability to produce business letters. | 9. Develop the ability to handle conflicts within groups positively. |

| Content of learning: Oral presentation | Assessment method |
|--------------------------------------|------------------|
| 1. Develop the ability to retrieve relevant information. | 1. Assessment on students’ oral presentations. |
| 2. Develop the ability to gather and organize relevant information. | 2. Assessment on students’ written technical documents. |
| 3. Develop the ability to distinguish main ideas from supporting details. | 3. Observation on students’ communicative experiences during field work training. |
| 4. Develop knowledge on how to operate technological tools. | 4. Observation on students’ communicative experiences in group activities / team work projects. |
| 5. Develop awareness of how technological tools help to promote social interactions and collaboration at work. | 5. Assessment on students’ responses in online forum discussion. |
| 6. Develop the ability to plan and develop the content of oral presentations. | 6. Develop multicultural awareness. |
| 7. Develop the ability to give constructive feedback. | 7. Develop the ability to handle conflicts within groups positively. |
| 8. Develop the ability to establish professional relationships with customers and co-workers. | 8. Develop leadership skills. |
| 9. Develop the ability to give instructions effectively. | 9. Develop the ability to produce business letters. |

| Content of learning: Social literacy | English language proficiency |
|-------------------------------------|-------------------------------|
| 1. Develop the ability to communicate effectively with co-workers and administrators. | 1. Developing the ability to construct accurate sentence structure in writing. |
| 2. Develop the ability to give instructions effectively. | 2. Developing the ability to apply appropriate verbal communication strategy in a conversation. |
| 3. Develop the ability to give constructive feedback. | 3. Developing the ability to comprehend information in a text in English language. |

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Competing interests

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Additional information

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