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Sains Humanika

Technology, Pedagogy and Knowledge Element (TPACK) in The Malaysian Automotive Industry In-House Training Framework

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Abstract

In order to ensure that the Malaysian automotive industry is able to compete with the world market, continuous workplace learning must be in place. This is to ensure existing employees in the automotive industry maintain productivity and competitiveness. This study is conducted to identify the element of TPACK to further explore the component of in-house training framework for the automotive industry. This study uses a sequential exploratory mixed method model as a research design. The components of TPACK for the in-house training framework have been identified through the use of expert interviews. The interview phase featured seven panels, including technical trainers and academics with expertise in automotive industry. Data on the suitability of the TPACK elements was gathered quantitatively using questionnaires. The survey included 114 automotive technical trainers in total as a sample. Pedagogical knowledge (PK) comprises 22 out of the 36 training elements that were found to be the majority. The findings of this study also suggest the importance for technical trainers to integrate the TPACK model in the development of in-house training in the automotive industry. By integrating the TPACK model, a comprehensive in-house training can be developed and implemented.

Keywords: TPACK, in-house training, automotive industry, technical trainer

Abstrak

Bagi memastikan industri automotif Malaysia mampu bersaing dengan pasaran dunia, pembelajaran di tempat kerja yang berterusan perlu berlaku. Ini bagi memastikan tenaga kerja sedia ada dalam industri automotif mengekalkan produktiviti dan daya saing. Kajian ini dijalankan untuk mengenal pasti elemen TPACK bagi meneroka lebih lanjut komponen kerangka latihan dalaman bagi industri automotif. Kajian ini menggunakan model kaedah campuran eksplorasi yang berturutan sebagai reka bentuk kajian. Kaedah temubual pakar dilaksanakan bagi mengenalpasti elemen-elemen latihan dalaman industri automotif Malaysia. Seramai tujuh orang pakar yang terdiri dari jurulatih teknikal dan pensyarah teknikal automotif telah terlibat dalam fasa temubual. Pendekatan kuantitatif digunakan melalui soal selidik bagi mengumpul data berkaitan kesesuaian elemen dan elemen pelaksanaan latihan dalaman. Seramai 114 jurulatih teknikal automotif telah terlibat sebagai responden kajian ini. Majoriti elemen-elemen latihan (22 daripada 36) yang dikenalpasti adalah dalam kategori pengetahuan pedagogi (PK). Dapatan kajian ini juga mencadangkan kepentingan bagi jurulatih teknikal untuk mengintegrasikan model TPACK dalam pembangunan latihan dalaman industri automotif. Dengan mengintegrasikan model TPACK, pembangunan latihan dalaman yang komprehensif dapat dibangunkan dan dilaksanakan.

Kata kunci: TPACK, latihan dalaman, industri automotif, jurulatih teknikal

1.0 INTRODUCTION

In-house training refers to training managed by managers, mentors or trainers in helping employees adapt to their work and to equip employees with appropriate job-related skills including theoretical and practical knowledge. In-house training involve teaching or coaching by more experienced people or trainers in lecture rooms or directly in the workplace (Kumar, Singh & Kumar 2017). Within any automotive industry, in-house training is the most frequently utilized forms of training commonly referred to as technical training or on-the-job training. When conducting in-house training, the coach or trainer must take an active role in incorporating real-world scenarios into the curriculum. According to Twitchell, Holton, and Trott Jr. (2000), technical or in-house training is intended to alter employees' knowledge and abilities. For employees in the automotive business, in-house training is crucial to ensuring that they can carry out their responsibilities accurately, efficiently, and correctly.

By 2030, cars will have undergone a total revolution thanks to digital applications, autonomous navigation, and the use of alternative energy sources for propulsion, predict Pisal et al. (2015). Therefore, to guarantee that Malaysia's automotive sector can contend with global markets, current industry personnel ought to engage in ongoing education to sustain their efficiency and competitiveness. Globally, the Society of Motor Manufacturers and Traders UK anticipates that new technology skills will need to be acquired and retrained for the automotive sector, and that traditional procedures and basic skills like welding and machining will gradually disappear (Ian Henry, 2015). As per the International Labour Organization's (2021) report titled "The Future of Work in the Automotive Industry," it is highly recommended that nations allocate resources towards educators and trainers who provide education and training. This includes bringing about significant modifications to the curriculum and pedagogy of most training systems and vocational training. Thus, there is a need to pay attention to on-the-job training in the automotive industry.

The absence of investigation into the training delivery techniques or the pedagogical component of the training is one of the gaps found in the current frameworks or models for in-house training. The framework or training process guide for technical trainers could be improved, according to Marope, Chakroun, and Holmes (2015). One of the issues raised by earlier studies is that the majority of training provided in the automobile industry is theoretical in nature, particularly that provided by dealers, and is therefore viewed as outdated (Howard, 2000). Gauld and Miller (2004) assert that an in-house training guide or frameworks is crucial for the automotive sector since technical trainers may come from a variety of backgrounds. The element of trainer's teaching competence or pedagogy is still very little explored in the field of research and training literature (Andoh, Mensah, & Owusu, 2022). Apart from the pedagogical element, Dankbaar (1996) also stated that automotive companies such as Fiat, Rover, Ford and other automotive companies face issues in the use of the latest technology in the implementation and delivery of training. According to Levy (2019), automotive companies face several challenges to create and deliver training. They face the challenge of providing training for a workforce that has different roles. The use of Learning Management System (LMS) will be able to meet this requirement. Technological elements in the development and implementation of in-house training are now seen as necessary, especially when there is a crisis such as the COVID 19 pandemic. For the global automobile sector as a whole, it is imperative that technology be used in the execution of training.

This study investigates the Technological, Pedagogical and Content Knowledge (TPACK) element to serve as a reference for the in-house training framework of Malaysia's automotive industry, taking into consideration the limitations mentioned by previous studies. This study provides beneficial information and will contribute to Malaysian automotive industry training aspects. The information can be used by automotive technical trainer as a guide in the proses of planning and developing an in-house training program.

■2.0 LITERATURE REVIEW

2.1 The State of Automotive Industry

According to Yannick and Gerpisa (2004), one of the significant changes in the world's automotive industry stems from the development of technology (especially in microelectronics and ICT) where innovation is very important to ensure the automotive industry is always competitive. In the 21st century, the automotive industry is no longer only focused on models such as Ford and Toyota (Boyer & Freyssenet, 2002), but on the latest innovations from various automotive manufacturers, especially from China. According to Griffiths et.al, (2015), China's automotive industry has grown rapidly, and the country plays an increasingly important role in the global automotive market. The biggest transformation in the automotive world in the 21st century is the production and sale of electric vehicles. This transformation of the automotive industry occurs in parallel with digital development and awareness of the environment.

As a car manufacturer, Malaysia similarly prioritises raising the standard and output of its vehicles. The Malaysia National Automotive Policy 2020-2030 supports the participation of companies in the domestic and global supply chain, encourages R&D and engineering activities, national support of car projects and increases exports, investment and total local production and capacity building of the local workforce (Malaysia Automotive Robotics & IoT Institute, 2019). To further enhance the calibre of the workforce, the Malaysian government has allotted RM 4792.6 million (Ninth Malaysia Plan 2006–2010) for corporate training, which comprises industrial, commercial, and management training (JPM, 2010). In the case of Malaysia, companies typically allocate three to five percent of their budget on employee training.

Globally, a huge number of financial resources had been allocated to workforce capacity building in the automotive industry. According to TRAINING (2017), major American organisations spend USD 17 million, medium-sized companies spend approximately USD 1.5 million, and small companies spend approximately USD 376,251 on staff training. As per the Lamda Solution study (Solution, 2018), Toyota has been allocating hundreds of thousands of dollars annually towards employee training and e-Learning.

2.2 In-house Training

Training is described as "a systematic approach to improve attitudes, knowledge, abilities, or behaviour through educational experiences in order to attain optimal performance in one or more activities." In professional settings, the goal is to address the organization's present and future demands while also fostering individual ability (Milhem, Abu Shamsieh, & Pérez Aróstegui, 2014). In-house training is defined as "Programmes designed to encourage skilled workers or supervisors to train and equip new workers with relevant skills" by the Malaysian Ministry of Human Resources (2023). This will make it easier for workers to transfer the competencies, abilities, and information needed to carry out particular tasks in the workplace. There are various approaches or tactics for putting in-house or workplace training into practice in order to guarantee that the goal of the training is attained. In house training could be delivered in different method and strategies. For example, job rotation strategy serves which aims to adjust workers to the activities inside the organisation and exposing them to and enhancing their grasp of the organization's overall operation (Triggs & King, 2000). Other method of in-house training also involves team training (Forbush & Morgan, 2004), mentoring, simulation, e-learning, train of trainers and others. In -house training is a process of systematically developing work-related knowledge and expertise for the purpose of improving performance. Therefore, in-house training should be planned in detail by technical trainers to achieved the desirable objectives. There are various theories and models that could provide guidance to technical trainers in the implementation of training in the workplace.

For the purpose of this research Technological, Pedagogical and Content Knowledge Model (TPACK) was referred to guide the exploration of in-house training elements. The TPACK Model consists of three main knowledge categories: Content Knowledge (CK), Pedagogical Content (PK) and Technology Knowledge (TK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006). The TPACK framework was primarily created to assist educators in incorporating technology into their lessons, but it has now been used to a wider range of disciplines in technology education studies. This model was selected because its three key components—technology application, pedagogy, and knowledge content—are crucial components that trainer conduction in-house training programmes or curricula must grasp.

■3.0 METHODOLOGY

This study applied a sequential exploratory mixed method approach to determine the components of TPACK for the automotive industry's in-house training framework. With this approach, data for the first part of the investigation are first collected qualitatively, and then data for the second phase of the study are collected quantitatively (table 1). The purpose of the qualitative phase is to explore the elements and sub-elements of TPACK. In order to complete the Qualitative Phase, a thorough literature analysis and seven expert interviews in the field of automotive training were conducted. The seven interviewed respondents were selected based on three main characteristics which include (a) Technical trainer in the field of automation, (b) Expert/academic in the field of automation, and (c) Expert trainer. Qualitative data was analysed using the thematic analysis method.

Through the use of a questionnaire and the Cohen Kappa coefficient value, the quantitative phase sought to validate if each element and sub-element identified in the qualitative phase was appropriate from the perspectives of two experts and 114 automotive technical trainers. Validation from two expert involved expert in automative training with more than 10 years' experience in the field. Prior to the distribution of survey to 114 automotive trainers, a pilot study with 20 participants was conducted.

Table 1 Summary of the Respondent

Data Collection Method	Number of Responden	Data Analysis Requirements
Interview	7	Thematic Analysis- Suggested -6 (Guest, Bunce, & Johnson, 2006)
Survey	114	Descriptive analysis
Pilot Study	20	10% of the expected sample (Connelly, 2008) or ,10 to 30 (Hill, 1998)

■4.0 RESULTS

Thematic analysis using Atlas.ti 22 software was used to analyze the interview data. On the other hand, questionnaire was analyzed using descriptive analysis. Based on the thematic analysis and descriptive analysis obtained from surveying 114 technical trainers, elements of TPACK in the in-house training of the automotive industry have been identified and validate (Figure 1). The majority (22 of the 36 sub-elements) of the in-house training framework were classified as components of pedagogical knowledge. This finding symbolizes the importance for technical trainers to emphasize the pedagogical aspects such as designing effective teaching and learning strategies in conducting a training. The majority of interviewees in the interview also highlighted the importance of technology, particularly its involvement during the Covid-19 Pandemic. Technical trainers are expected to be able to use technological platforms in conducting training. Technical trainers must possess content expertise such as conducting training need analysis and understanding workplace safety, among other things, as outlined in Figure 1. Based on the descriptive analysis, the majority of respondents gave high agreement on each item which is on a scale of 4 (suitable) and a scale of 5 (very suitable) for the elements of TPACK. The results confirm that 22 out of the 36 sub-elements, or the majority of them, are recognized as pedagogical knowledge, seven are technological knowledge and nine are content knowledge.

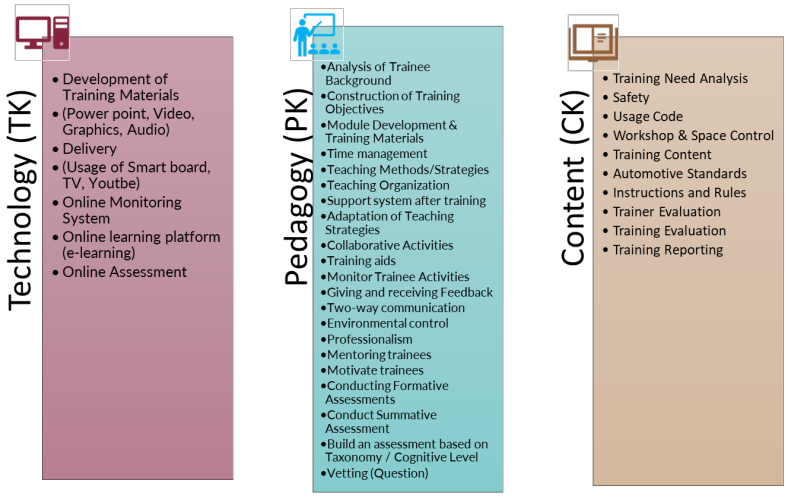

Figure 1 Technology, Pedagogy and Content Element**s**

■5.0 DISCUSSION AND RECOMMENDATION

Overall, this study found that pedagogical aspects was given a great emphasized in the design and development of an in-house training program for the automotive industry. Ability to create or modify training materials and modules, as well as recognize and apply efficient teaching techniques and training delivery strategies, are among the pedagogic knowledge that interviewees have noted relatively frequently. It is essential to have a thorough understanding of pedagogy, which is the process and practice of teaching and learning and how it incorporates, among other things, the general educational purpose, values, and goals (Ay, Karadağ and Acat, 2015). Beside the technical knowledge, automotive technical trainers must also be capable of leading training sessions effectively in addition to being experts in the technical subjects they will be teaching. Andoh et al. (2022) pointed that training will not be effective if the trainer is not pedagogically competent.

The pedagogical knowledge identified in this study also includes methods, strategies, and techniques employed to facilitate learning. These aspects encompass the instructional design, delivery methods, engagement strategies, and assessment techniques utilized in training programs. These results have resemblance to elements of instructional design, such as those found in the ADDIE Model (McGriff, 2000). ADDIE Model emphasized noted that an effective instructional design is a fundamental pedagogical aspect in training. It involves the systematic process of analyzing, designing, developing, implementing, and evaluating training programs. The instructional design phase of training ensures that the content is organized in a logical and coherent manner, taking into consideration the specific needs and learning styles of the workers.

Another significant in-house training factor highlighted in the study is delivery techniques. They are alluding to the several methods that learners are given training materials. Traditional classroom instruction, online training courses, on-the-job training, role-playing games, simulations, and group discussions are some examples of the pedagogical techniques mention in the interview. In addition, engagement strategies are also crucial pedagogical aspects in training, as they aim to actively involve employees in the learning process. These strategies may include interactive activities, hands-on exercises, case studies, group projects, and real-life scenarios that enable workers to apply their knowledge in practical situations. Assessment techniques are also integral pedagogical aspects in training. They provide feedback and measure the effectiveness of the training program. These techniques can include quizzes, tests, practical demonstrations, performance evaluations, and self-assessment tools. Pedagogical Knowledge aspects in training foster a positive learning environment that encourages active participation and engagement. Additionally, these aspects promote continuous learning and professional development, allowing workers to adapt to changing work environments and acquire new skills as needed.

Technological Knowledge (TK) are technology related aspects that were found in this study to be important for an in-house training program. The study found seven elements of technological knowledge which include the ability to apply technology in developing training material and modules, using technology for delivering the training and managing an online learning system. According to most of the respondent in the interview session, the application of technology as a medium of training (online training), is gaining more and more attention and changing the landscape of training in places that are traditionally conducted face-to-face. Literature also agree with this since the integration of technology in workplace training can increase the effectiveness of training where learning will be more integrated with work, saving time with modular training as well as saving training costs (Attwell, Baumgartl, et al., 2008; David, Salleh, & Lahad, 2012; M. A. Jones, 2016). The ability to comprehend the significance and development of computer-based electronic communication and distant education, which entails recognizing the rising trends in delivery methods enabled by technology, is one of the technological expertise that technical trainers need to address. This is to cope with the increase in training costs, where automotive companies are now turning to an online training approach or E-learning (Bogdan & Ancusa, 2016).

The third element of training identified from this study is Content Knowledge (CK). Content Knowledge (CK), as defined by Rienties & Townsend (2012), is the understanding of what has to be taught or learnt. This study found that the automotive industry is a complex and ever-evolving field that requires a deep understanding of various components, technologies, and processes. To succeed in the automotive industry, professionals must be well-versed and possess extensive content knowledge about vehicles, including their design, engineering principles, manufacturing processes, and technological advancements. This knowledge is essential for individuals working in various roles within the industry, such as technical trainer, automotive engineers, designers, technicians, salespeople, and marketing professionals. For a technical trainer, without a strong foundation of content knowledge, it would be challenging for them to make informed decisions, develop innovative solutions, and effectively communicate with trainees. Furthermore, the study reveals that content knowledge encompasses knowledge pertaining to training management, including safety and logistics needs, among other things.

Future research might build on this work by developing a training module specifically for the Malaysian automobile industry, which would be one of the resources used in Train for Trainers. The results of this study are expected to contribute to the development of Malaysian automotive industry training in general and training in particular. Researching automotive technical trainer competency in terms of pedagogy, technology, and expertise would also be a recommendation for future research.

■6.0 CONCLUSION

The elements of TPACK identified in the in-house training program for the automotive industry would involve providing trainers with a deep understanding of the intersection between technology, pedagogy, and content knowledge. Moving forward, the TPACK element could act and served as a guide for continuous professional growth and cooperation amongst trainers. Trainers should be encouraged to participate in communities of practice, attend conferences and workshops, and engage in collaborative discussions with colleagues to further enhance their TPACK knowledge and skills. A TPACK-based training program would give automotive educators the know-how and abilities they need to confidently and successfully plan and develop their training curriculum. This would ultimately enhance their instructional practices and improve trainees' engagement and learning outcomes. Moreover, without a deep understanding of the interplay between technology, pedagogy, and content knowledge, trainers may not be able to select and utilize technology tools that are most appropriate for their instructional goals and content areas. As a result, the potential benefits of pedagogical aspects and technology integration in the training may not be fully realized.

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