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ORIGINAL RESEARCH

Predicting Academic Staffs Behaviour Intention and Actual Use of Blended Learning in Higher Education: Model Development and Validation

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Abstract
Blended Learning (BL) has been implemented by lecturers in higher educations for promoting effective pedagogical practices. However, intention to use and actual usage of BL by lecturers in higher education seems to be a major setback for successful BL implementation. Therefore, this study developed a model to examine the factors that influences lecturers' behavioral intention and actual use of BL based on the Unified Theory of Acceptance and Use of Technology and Technological, Pedagogical and Content Knowledge model. Accordingly, survey questionnaire was employed to collect data from 544 academic staffs across universities, colleges, and polytechnics. Results indicate that performance expectancy, effort expectancy, and social influence significantly impact lecturers' behavioral intention to use BL for teaching. Additionally, results confirm that facilitating condition positively influence actual BL usage. Likewise, technological, pedagogical, and content knowledge initiatives employed by lecturers in teaching positively influences actual BL usage. Results from multi-group analysis indicate that gender, age, experience, and voluntariness of use do not predict the behaviour of lecturers to use BL. Also, this study provides insights as to how higher education can enhance lecturers' usage of BL to improve teaching effectiveness. This study provides a better understanding of lecturers' views of knowledge in relation to course content, pedagogy, and technology use in improving teaching. The developed model can significantly be used by academic staffs to monitor and improve their current BL activities in measuring their knowledge about teaching regarding teaching improvement. Practically, lecturers can adopt the developed model to improve teaching pedagogies and course content.

Keywords Blended learning · Academic staffs · Behaviour intention and actual use · TPACK · UTAUT · Higher education

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1 Introduction

Over the decades, there has been an increase of academic institutions adopting Blended Learning (BL) strategies around the world (Wong et al., 2014). In fact, researchers have anticipated that BL will become the new educational model for course delivery in higher education (Graham et al., 2013). Although, the development of BL as a pedagogical means is quite recent it has been amplified by the rapid usage of web technologies for educational purposes (Kumar & Pande, 2017). BL is simply the combination of conventional Face-to-Face (F2F) and online learning by employing didactic designed to accommodate students with diverse learning styles (Ghazal et al., 2018). BL adopts a pedagogical approach that supports lecturers to teach and students to learn in a collaborative and interactive environment at their own time and pace (Anthony et al., 2020a; Poon, 2014). BL involves an essential redesign of the pedagogical model with a shift from lecture-centered learning to student-centered learning where students become interactive and active learners (Wai & Seng, 2015). Moreover, BL refers to the total mix of diverse instructional strategies to improve student learning outcome both with and without the use of technology (Bokolo Jr et al., 2020). BL is a progressively useful approach as it changes the focus of learning prominence by not merely considering the F2F and online environments but also addressing syllabus design issues in improving educational process and synergy of both offline and online learning environments (Bitter & Frankl, 2012; Ifenthaler, 2017). Respectively, findings from Poon (2014) revealed that BL contributes in enhancing the learning outcomes of Australian and UK students by improving students' examination marks and decrease number of students' dropout and withdrawal. Thus, many educators choose BL as a teaching approach as it improves pedagogy, increases flexibility and access to learning materials and increased cost value of course resources (Bitter & Frankl, 2012).

In BL approach lecturer can upload teaching materials, disseminate knowledge and information regarding course works and other related topics (Howard & Ifenthaler, 2018). The lecturer can also announce course schedule, present course summary, and manage class activities (Padilla-Meléndez et al., 2013). Likewise, learners can virtually join online class discussion, and interact with lecturer and other course mates (Ifenthaler, 2012; Lin & Wang, 2012). Similarly, findings from Kumar and Pande (2017) disclosed that BL offers ease of course access, flexible, interactive and cost-effective pedagogy. Conversely, BL usage can pose a few challenges which include increasing students' prospect that fewer F2F classes means less academic work, can lead to inadequate time management skills for learners taking responsibility for personal learning (Prasad et al., 2018). Moreover, findings from Poon (2014) also indicated that BL could make students feel isolated as the prospects to relate socially was limited since they physically did not communicate with their peers as in the traditional classroom environments. Likewise, Kumar and Pande (2017) argued that while BL possess several advantages, lecturers were faced with issues related to lack of time to organize online content and learning activities, problem of managing online student interactions, as well as other technical, instructional, and organizational factors that influence their intention and use of BL. Irrespective of these issues it is evident that BL offers opportunities for lecturers to develop their teaching skills in the design of interactive courses content (Garrison & Kanuka, 2004; Porter et al., 2016; Van Laer & Elen, 2020).

Due to these developments, Malaysia institutions are implementing BL strategies. However, findings from prior studies (Haron et al., 2012; Sivapalan, 2017) suggested that lecturers in Malaysia are apprehensive about adopting BL due to factors that influence their acceptance of BL (Aguti et al., 2014; Ghazal et al., 2018; Haron et al., 2012).

Moreover, prior BL studies are mostly focused on students as their element of research. Evidently, the effect of BL on students' learning is important. Nonetheless, research for lecturer's perspective is limited (Smith and Hill, 2018). Likewise, very limited research has focused on examining lecturers' acceptance of BL for teaching, specifically in Malaysian context (Haron et al., 2012). Thus, given the essential role of lecturers in BL and the limited research in this context. Investigating BL in teaching context is a meaningful issue of enquiry (Dakduk et al., 2018; Edward et al., 2018; Makri et al., 2014; Wong et al., 2018). According to Owston et al. (2008a); Fesol and Salam (2016) there is need for a model that provides an extensive guideline on the factors required for lecturers to design BL pedagogy course content to improve teaching and learning activities. Despite the significant role of lecturers towards the success of BL adoption in institutions only fewer studies (Owston et al., 2008b; Wong et al., 2014; Alhabeeba and Rowley, 2018; Bervell & Umar, 2018; Ghazal et al., 2018) have investigated factors that influence lecturer's adoption of BL to improve teaching quality. Besides, while a few researchers (Al-Busaidi & Al-Shihi, 2012; Bath & Bourke, 2011; Bervell & Umar, 2018; Machado, 2007) have examined lecturers' implementation of BL. There are limited studies that explored BL acceptance by lecturers.

Consequently, researchers such as Deng et al. (2018); Bokolo Jr et al. (2020) disputed that continuing to examine factors that influence lecturers' acceptance of BL in isolation without considering how they relate with each other does not progress Information Technology (IT) in education field. Accordingly, this study aims to address the following research questions:

- Which factors influence lecturers' behavioral intention and actual use of BL?
- Which socio-demographic factors may influence lecturers' behavioral intention and actual use of BL?
- Which are the importance and effects of the identified factors that influence lecturers' behavioral intention and actual use of BL?

Therefore, to address the research questions the objectives of this study is to examine the factors that influence lecturers' behavioral intention and actual BL usage. In order to understand the benefits and issues related to BL adoption for teaching, it is beneficial to employ prior theories of technological innovation. Hence, this study developed a model based on the Technological, Pedagogical and Content Knowledge (TPACK) model to assess if lecturers' pedagogical syllabus content knowledge is sufficiently implemented in their blended course effectively. Moreover, TPACK is employed in this study as a theoretical base for measuring lecturers' knowledge for technology mediated teaching. Furthermore, Unified Theory of Acceptance and Use of Technology (UTAUT) model is also employed to measure lecturers' use of BL approach to articulate and support pedagogical integrating of technology for teaching initiatives. The rest of this study was structured in the following manner: Sect. 2 is the literature review. Section 3 presents the model and hypotheses development. Section 4 is the methodology. Section 5 depicts the results. Section 6 is discussion and implications of the study. Lastly, Sect. 7 is the conclusion.

2 Literature Review

This section presents the review of prior studies similar to this research, overview of BL in Malaysia higher education, and a theoretical background of UTAUT and TPACK model.

2.1 Related Works

This sub-section reviews prior studies that have employed UTUAT and TPACK models to examine factors that influence students and lecturer use of BL and e-learning as shown in Tables 6 and 7 in the appendix respectively. Tables 6 and 7 further presents the aim, methodology applied, and study context. Evidence from the reviewed 28 studies suggest that UTAUT and TPACK have been successfully employed. However, none of the reviewed studies have integrated both UTAUT and TPACK to investigate BL. Thus, this study adopts both UTAUT and TPACK, where UTAUT is utilized to examine the factors that influence lecturers' behavioral intention and actual BL usage. Furthermore, the socio-demographic factors that may determine lecturers' behavioral intention and actual use of BL are examined.

2.2 BL Context in Malaysia Higher Education

The Malaysian government like other countries is advocating the use of technology to facilitate educational activities in higher educations (Anthony et al., 2019). Thus, the Malaysian government has initiated a national council for lifelong learning committee to delivers the platform for coordination e-learning facilities and formulating policies to support e-learning (Chea et al., 2012). Similarly, the Malaysian Educational Blueprint (2015–2025) founded by the Ministry of Higher Education (MOHE) Malaysia termed Globalized Online Learning (GOL) to promote innovative and creative use of Information Communications Technology (ICT) in teaching and learning strategies in public or private institutions (Anthony et al., 2019). MOHE encourages universities, colleges, and polytechnics to implement digital methods of teaching and learning course materials to enhance the skills and knowledge of students based on ICT mediated instructional design for teaching and learning (Chea et al., 2012).

As such, many lecturers in Malaysia higher education are encountered with challenges to design novel interactive syllabus and also deploy BL approaches to facilitate their teaching pedagogy to resolve the needs of learners thus allowing students to have better learning with the course content (Bokolo Jr et al., 2020). Likewise, lecturers are also using virtual learning tools to access online learning resources thus allowing learners to become self-learners and more proactive (Sivapalan, 2017). Moreover, BL helps to facilitate their teaching styles while keeping learners engaged and motivated with the content which helps create active and distributed learning environments (Al-shami et al., 2019). Currently, based on MOHE Malaysia institutions are to implement BL based on the formula, "Blended course = (T1 > = 1) + (TR > = 7) + (TA > = 3) = (TAS > = 2)" to assess their BL effectiveness. Where TI is course information, TR is course resources, TA is course activities and TAS is course assessment. Thus, MOHE Malaysia set a target, where 40 per cent of total course offered should be blended (Anthony et al., 2019).

2.3 Overview of UTAUT Model

A number of theories have been adopted to investigate lecturers' intention and acceptance to use new technologies in educational context such as Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT),

Diffusion of Innovation (DoI) Theory, etc. (Scherer et al., 2019). UTAUT model was developed by Venkatesh et al. (2003) to explore and empirically compare components from different technology acceptance models in predicting and explaining use behavior of variables that influence technology adoption behavior over time (Saleem et al., 2016).

UTAUT was proposed based on eight technology acceptance theories which comprises of social cognitive theory, motivational model, model of personal computer utilization, TAM, DoI, theory of reasoned action (TRA), Theory of Planned Behavior (TPB), and combined TAM and TPB (Venkatesh et al., 2003). The UTAUT model consists of six constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention and use behavior) (Venkatesh et al., 2003). Moreover, UTAUT model comprise of four moderating (gender, age, experience, and voluntariness of use) as seen in Fig. 1.

Figure 1 depicts the UTAUT model. The main constructs are described below;

- Performance expectancy pertains to the extent to which users believe that the use of technologies will impact to improve performance. This construct is also a reflection of the relative advantages, extrinsic motivation to be attained, the perceived usefulness, job fit, and the expected outcomes of the technology.
- Effort expectancy refers to the complexity or ease expected from use of the technology.
- Social influence measures the extent to which a user is motivated to use the technology. This construct also involves social driver as a subjective image and norms.
- Facilitating conditions refers to the technical and organizational infrastructural support required for using the technology. Thus, compatibility and the perceived behavioral control are the explicit factors addressed by this construct.
- Behavioral intention is the extent to which a user has expressed conscious determination to perform or not to perform a definite imminent behavior.
- Use behavior refers to the measured users' actual technology use frequency.

UTAUT model has been employed in e-learning domain by prior studies (Abu-Al-Aish & Love, 2013; Al-shami et al., 2019; Dečman, 2015; Kocaleva et al., 2014; Lakhal et al., 2013; Lwoga & Komba, 2015; Saleem et al., 2016; Sattari et al., 2017; Tarhini et al., 2017) to examined factors that influence students' acceptance of e-learning. Likewise, UTAUT model has been employed by previous BL studies (Brand et al., 2011; Gawande, 2015,

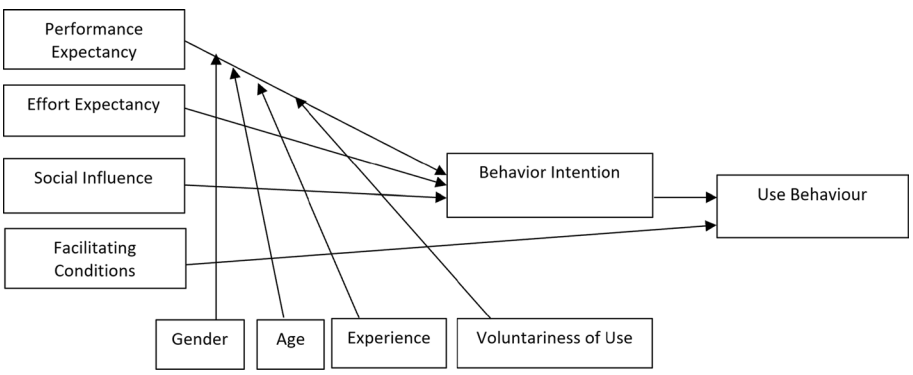

Fig. 1 UTAUT model adapted from (Venkatesh et al., 2003)

2016; Khechine et al., 2014; Radovan & Kristl, 2017) that investigated students and/or lecturers' intention to accept BL. In this study UTAUT was selected as one of the models to examine factors that influence lecturers' behavioral intention to use BL because UTAUT includes a social construct which is important in BL environment as mentioned by Dečman (2015).

2.4 Background of TPACK Model

Based on the study termed "Those Who Understand: Knowledge Growth in Teaching" Lee Shulman (1986) proposed the model of Pedagogical Content Knowledge (PCK). Shulman (1986) highlighted that there is need for a more comprehensible theoretical model regarding what lecturers should know and be competent to do, asking essential questions which relates to the categories and domains of content knowledge in the minds of lecturers and how general pedagogical knowledge and content knowledge inter-relates (Archambault & Crippen, 2009; Shulman, 1987). Thus, based on PCK, the technological pedagogical content knowledge (TPACK) model was developed by Mishra and Koehler (2006), to support lecturers towards effectively integrating technology in teaching based on technological pedagogical and content knowledge referred to as TPACK (Alsofyani et al., 2011).

TPACK aims to provide understand and describe the kinds of knowledge required by lecturers for effective ICT deployment for teaching (Alsofyani et al., 2012). In BL context TPACK highlights the significance of preparing academic staffs to make practical choices in their utilization of technology when teaching specific course content to a specific group of students (Scherer et al., 2019). As it can result to a better understanding regarding how lecturers make decisions that influence BL integration and acceptance into teaching and learning activities (Qasem & Viswanathappa, 2016). TPACK model comprises of content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK) (Alsofyani et al., 2012) as seen in Fig. 2.

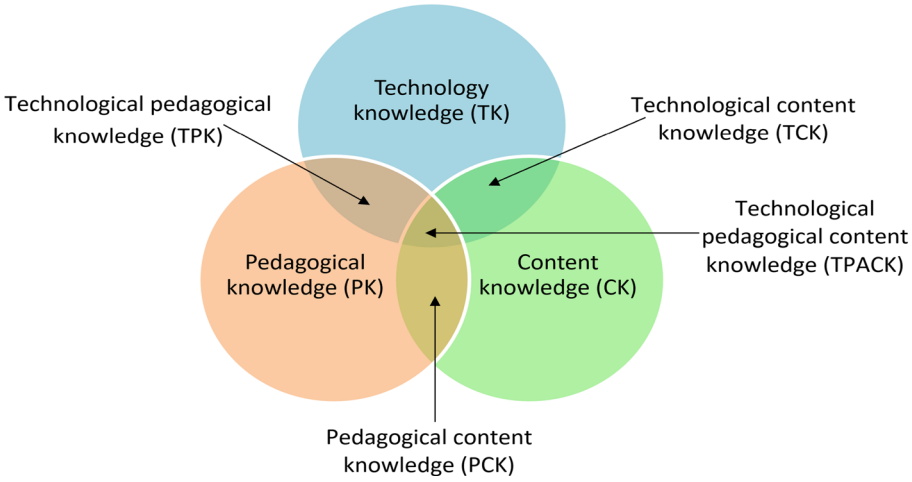

Fig. 2 TPACK model adapted from (Koehler & Mishra, 2009)

Figure 2 depicts the TPACK model, thus each of the seven components are described below;

- Content knowledge refers to the lecturers' knowledge about the actual course that is to be taught to the students (Alsofyani et al., 2011; Mishra & Koehler, 2006).
- Pedagogical knowledge entails the lecturers' extensive knowledge about the methods, practices and/or processes of teaching and how it relates to the aims, values, and overall didactic purposes (Mishra & Koehler, 2006; Papanikolaou et al., 2017).
- Technological knowledge involves the lecturers' technical skills on how to operate regular technologies used for teaching such as presentation application, spreadsheet, word processing, and internet (Alsofyani et al., 2011; Mishra & Koehler, 2006).
- Pedagogical content knowledge comprises of lecturers' knowing which teaching approaches is suitable to fit course content, and equally knowing how elements of the course content can be organized to improve teaching (Koehler & Mishra, 2009).
- Technological content knowledge refers to the knowledge of technological tools and illustrations that are employed by lecturers within a particular domain (Jimoyiannis, 2015; Mishra & Koehler, 2006). TCK also involves lecturers understanding of the method in which content and technology are related and influences each another (Tømte et al., 2015).
- Technological pedagogical knowledge entails the assimilation of general pedagogical strategies with technology based on an understanding of how teaching and learning can change when specific technologies are utilized in certain ways (Lye, 2013; Mishra & Koehler, 2006).
- Technological pedagogical content knowledge is the middle of the model as such it forms the basis for efficient teaching with technology, depicting the utilization of technology to facilitate content-based pedagogical initiatives (Mishra & Koehler, 2006). TPACK supports lectures to decide on selecting the effective method of technology and pedagogy to support and improve teaching effectiveness (Alsofyani et al., 2011).

Furthermore, findings from prior BL studies (Alsofyani et al., 2012; Papanikolaou et al., 2017; Yang & Chen, 2010) suggested a positive outcome in adopting TPACK to improve lecturers' capability to use ICT for teaching practice. Likewise, finding from the literature (Anderson et al., 2013; Maor, 2017; Maor & Roberts, 2011; Ward & Benson, 2010) suggested that TPACK guide teachers' effort in addressing issues related to teaching and learning that results from the rapid changing technologies. Hence, TPACK model is adopted in this study to investigate the factors to be employed by lecturers' that influence actual BL usage in higher education.

3 Model and Hypotheses Development

This section aims to provide answers the first three research question and further develop the proposed model to examine the factors that influences lecturers' behavioral and actual BL usage for teaching.

3.1 Factors that Influence Lecturers' Behaviour Intention

3.1.1 Performance Expectancy

This variable relates to the extent to which a lecturer believes that using BL approach will support him or her to improve teaching effectiveness. Thus, lecturers will use BL for teaching if they perceive that BL would improve their pedagogical performance (Abu-Al-Aish & Love, 2013). Results from Venkatesh et al. (2003); Lakhal et al. (2013) established that performance expectancy had the strongest impact on users' behavioral intention. The literature (Lwoga & Komba, 2015; Venkatesh et al., 2003) indicated that the more users believe that the adoption of e-learning system would result to a better educational performance in their course, the more likely they will continue to use such e-learning system. Likewise, research carried out in Oman by Gawande (2016) confirmed that performance expectancy is an important factor that influences BL adoption. Accordingly, this study examines if the performance expectancy from BL will influence lecturers' behavioral intention to use BL. Therefore, we propose that;

H1 Performance expectancy will have a significant positive influence on lecturers' behavior intention towards BL.

3.1.2 Effort Expectancy

Effort expectancy mostly defined as an intrinsic factor (Abu-Al-Aish & Love, 2013), refers to the extent of ease-of-use related with adoption of technology (Venkatesh et al., 2003). In the context of this study this variable is the measure of ease associated when lecturer use BL approaches for teaching. The effort expectancy relates to lecturers' belief level regarding how easy it is to use BL thus assessing if the deployed BL approaches are user-friendly (Gawande, 2015). Previous studies have revealed that effort expectancy is significant factor that influences teachers' attitude towards adopting technology for educational purposes (Brand et al., 2011; Lakhal et al., 2013). Likewise, effort expectancy was found to be an effective predictor that impacts lecturers' actual use of e-learning system (Khechine et al., 2014; Lwoga & Komba, 2015). Evidently, this confirms that the more lecturers believe that BL approaches would be easy to use, the more they are interested to use in future (Dečman, 2015; Radovan & Kristl, 2017). Likewise, Abu-Al-Aish and Love (2013) argued that lecturers' acceptance of BL approach mainly depends on whether BL is easy to use in supporting teaching. Thus, we hypothesize that;

H2 Effort expectancy will have a positive significant influence on lecturers' behavior intention towards BL.

3.1.3 Social Influence

Social influence is the degree to which academic staff considered that there is requisite to use BL approach based on other people perceived belief (Jnr, 2021; Venkatesh et al., 2003). It is the degree to which an individual lecturer perceives that his/her colleagues and other people (such as family members, friends, associates, faculty, university administration, and government) comprehend that the use of BL as a teaching and learning approach

is significant (Kocaleva et al., 2014; Tarhini et al., 2017). In line with previous research (Abu-Al-Aish & Love, 2013; Lakhal et al., 2013) social influence includes of general social influence and peer influence. Moreover, other technology acceptance theories such as TAM, DoI etc. did not employ a social construct which is important and as such the UTAUT model incorporated a social influence construct to assess the effect of other people on the user acceptance of new technological invention such as BL (Lwoga & Komba, 2015). Prior studies (Al-shami et al., 2019; Radovan & Kristl, 2017; Tarhini et al., 2017) have established that there is significant relationship between social influence and behavior intention to use BL. Accordingly, we hypothesize that;

H3 Social influence will have a significant positive influence on lecturers' behavior intention towards BL.

3.1.4 Facilitating Conditions

This variable refers to the extent to which academic staffs believes that institutional and technical infrastructure exists to support the use of BL approaches (Gawande, 2016). In other words, this is the lecturers' view of whether he/she has the available tangible and intangible resources (such as tools, expertise, equipment, etc.) required to use BL approaches in teaching (Lakhal et al., 2013; Venkatesh et al., 2003). Thus, it is required for institution administration to provide onsite help desk support, online tutorial, availability of training, and a frequently up-to-date technological infrastructure to support BL adoption (Dečman, 2015; Jr et al., 2021). Accordingly, it is important to assess whether facilitating conditions has a significant impact on the lecturers' use of BL, as lack of these facilitating resources may prevent BL usage (Lwoga & Komba, 2015; Tarhini et al., 2017). Moreover, this present research theorized facilitating conditions as positively predicting actual usage of BL by lecturers (Brand et al., 2011; Jnr et al., 2021). Based on the literature, the following hypothesis is proposed that;

H4 Facilitating conditions will have a positive significant influence on lecturers' behavior to use BL.

3.1.5 Behavioral Intention and Use Behavior

Behavioral intention refers to the extent to which an individual has expressed conscious plans to execute or not execute a definite future behavior (Saleem et al., 2016). Intentions are presumed to capture the motivational attributes that influence lecturers' behavior towards BL use (Gawande, 2016). In this study behavioral intention measures if lecturers are enthusiastic to adopt BL initiatives for educational purposes (Lakhal et al., 2013). Furthermore, there has been increasing attention to evaluate the impact of continued usage intention of e-learning system as investigated by prior study (Lwoga & Komba, 2015). Likewise, use behavior relates to the frequency of use of BL carried out by lecturers. It is the actual number of times lecturers use BL to support educational activities (Saleem et al., 2016). Thus, use behavior refers to the continuous use or long-term usage of technology (Abu-Al-Aish & Love, 2013). In BL environment lecturer's intentions to continue using BL approaches for course design is determined by the tendency that BL can offer benefits in enhancing teaching and learning quality (Sattari, et al., 2017). Studies have established that there is a positive relationship between behavioral intention and use behavior in e-learning domain (Kocaleva et al., 2014; Lakhal et al.,

2013; Tarhini et al., 2017). Thus, based on the original UTAUT model, the behavior intention of using BL was posited as a mediating variable to examine whether lecturers are willing to continue to use BL for future teaching as proposed by (Lwoga & Komba, 2015). Thus, we hypothesize that;

H5 Behavior intention has a significant positive relationship on the lecturers' intention to continuously use BL.

3.2 Factors that Improve Actual BL Usage

3.2.1 Technological Knowledge (TK)

Technology Knowledge (TK) refers to lecturers' knowledge about different technologies, which includes tools such as pen and paper to modernized technologies such as the Internet, interactive whiteboards, digital video, and software application (Schmidt et al., 2009). Moreover, TK involved lecturers' knowledge on how to install computer learning software and configuring related hardware components (Lye, 2013). In the context of this study, TK refers to lecturers' knowledge about the applicability of basic technologies such as virtual teaching and learning platforms. Findings from prior studies (Papanikolaou et al., 2017; Yang & Chen, 2010) revealed that academic staffs' ability to use certain technologies in teaching influences their use behavior intention to accept BL approaches for education process. Thus, to change the perception of academic staffs towards use of BL for teaching Archambault and Crippen (2009); Schmidt et al. (2009); suggested that it is necessary for lecturers to be equipped with the technological skills required to effectively utilize these technologies in educational processes. Therefore, we propose that;

H6 Technology knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.2 Content Knowledge (CK)

Content Knowledge (CK) is the lecturers' knowledge regarding an actual subject domain that is to be taught to the students (Mishra & Koehler, 2006). Academic staffs must be familiar with the blended course content they intend to teach, and they should be aware of how the nature of knowledge is different for other content areas (Koehler & Mishra, 2009; Schmidt et al., 2009). Accordingly, findings from Lye (2013) suggested that CK is influenced by the lecturer comprehensiveness about the subject characteristics or uniqueness. The lecturer use behavior is extensively based on his/her understanding of the knowledge of explanation, core facts of the course procedures, concepts, theories that link the ideas, proofing of the course details (Lye, 2013). Thus, we hypothesize that;

H7 Content knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.3 Pedagogical Knowledge (PK)

In BL context, Pedagogical Knowledge (PK) relates to the methods of teaching and entails knowledge in both F2F and online classroom management, student learning, lesson plan development, and assessment (Alsofyani et al., 2011; Koehler & Mishra, 2009). Moreover, PK deals with the methods, strategies employed by the lecturer in teaching and learning processes in supporting students to attain their learning outcomes (Lye, 2013; Schmidt et al., 2009). In BL, PK also refers to the design of course scheduling and planning procedures, organization of educational resources, and evaluation of learners (Alsofyani et al., 2012). PK supports lecturers to specify and assess how learners acquire and construct their knowledge in learning environment (Alayyar et al., 2012; Antwi-Boampong & Bokolo, 2021). Therefore, the lecturers' use intention behavior towards BL is determined by the current pedagogical knowledge of methods adopted in both F2F and online classroom settings, and the initiatives for evaluating learners understanding of the course (Qasem & Viswanathappa, 2016). Therefore, this study suggests the following hypothesis;

H8 Pedagogical knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.4 Pedagogical Content Knowledge (PCK)

Pedagogical Content Knowledge (PCK) denotes the content knowledge that relates to the teaching process (Shulman, 1986). PCK is different for other course content areas, as it is a combination of both pedagogy and content aimed at developing an improved teaching practice (Anderson et al., 2013; Schmidt et al., 2009). Thus, PCK includes the clarification of subject matter, recognizing methods to make course content accessible to learners in teaching and learning processes. Besides that, lecturer must know which BL teaching approaches are most suitable and should be arranged in the syllabus content (Lye, 2013). Additionally, PCK involves the knowledge combinations of each course content, where each course has its own characteristics and uniqueness which should be taught in a different method for attaining teaching and learning effectiveness in BL environment (Qasem & Viswanathappa, 2016). Therefore, in BL context the integration of content and pedagogical knowledge into teaching and learning processes will influence lecturers' behavior intention to use BL in understanding how certain characteristics of the taught course content has been adapted and organized for both F2F classroom and online learning environment (Maor & Roberts, 2011). Consequently, the following hypothesis is postulated;

H9 Pedagogical content knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.5 Technological Content Knowledge (TCK)

Technological Content Knowledge (TCK) defines the knowledge of how technology can construct new representations for a particular course content (Tømte et al., 2015). In TCK, knowledge is articulated as knowing the effects of technologies on the course content that is being taught to the students (Jimoyiannis, 2015). Hence, some technologies can be used for certain course content and not in all course content (Lye, 2013). According to Lye

(2013), lecturers need to understand the course content but at the same time they must be mindful of how technology can change the course content to become more interactive, interesting, and effective in teaching and learning environment. For example, asynchronous tools such as power point software as the technology tool used for teaching (Lye, 2013; Ward & Benson, 2010). Thus, it is required for lecturers to attain knowledge not just on the course content only, but there is need to consider how the course content can be adapted when using technological knowledge in teaching and learning processes (Maor, 2017). Hence, academic staffs use behavior of BL is influenced based on the utilized technology that changes the medium which students practice and learn in a specific course content area (Jimoyiannis, 2015; Schmidt et al., 2009). Hence, this study postulates the following hypothesis;

H10 Technological content knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.6 Technological Pedagogical Knowledge (TPK)

Technological Pedagogical Knowledge (TPK) is the knowledge of how different technologies can be utilized by lecturers in teaching, and to understand how deploying such technologies may improve the way lecturers teach (Schmidt et al., 2009). Thus, TPK in BL relates to knowledge of different technologies employed in teaching and learning settings. It also denotes how teaching and learning activities might change when the lecturers applied different types of technologies to promote educational activities (Anderson et al., 2013; Ward & Benson, 2010). Findings from prior studies (Alayyar et al., 2012; Papanikolaou et al., 2017) indicated that TPK improved teaching and learning processes deployed by lecturers who implemented technologies in their current pedagogical strategies. Accordingly, in BL environment TPK involves lecturers' knowledge on deploying suitable tools for both F2F classroom and online learning management tasks such as in maintaining learners' attendant, grading learners' assessment, deploying discussion forum, and online chat room (Anderson et al., 2013). Thus, the mixture of technological pedagogical knowledge employed by the lecturer predicts their behavior intention to use BL for teaching. Therefore, we propose that;

H11 Technological pedagogical knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.2.7 Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK) refers to the knowledge required by lecturers for incorporating technology into their current teaching in any course content area (Lye, 2013). Academic staffs have an intuitive knowledge of the multifaceted interplay between the three elementary components of knowledge (CK, PK, TK) by teaching course content using suitable pedagogical strategies and technologies (Schmidt et al., 2009). TPACK component support lecturers to deliberate on what knowledge must be integrated with technology into teaching pedagogy on how they can develop students' learning (Papanikolaou et al., 2017). Therefore, the integration of CK, PK, TK employed by the lecturers in teaching influences their behavior intention to use BL for educational process. Thus, this study suggests the following hypothesis;

H12 Technological pedagogical content knowledge of lecturers has a significant influence on their behavior to use BL for teaching.

3.3 Socio-Demographic Factors

This study considers the gender, age, ICT experience of the lecturers and voluntariness of use of BL by the lecturers as socio-demographic factors or moderating variables. Note that a moderating variable is a quantitative or a qualitative variable that influences the strength and/or direction of the relationship between two other independent variables (Anthony et al., 2020b; Baron & Kenny, 1986). Venkatesh et al. (2003) stated that gender, age, experience, and voluntariness of use are factors that moderate the relationship between the independent variables (performance expectancy, effort expectancy, social influence, and facilitating conditions) and behavioral intentions to use variable.

Findings from the literature (Kocaleva et al., 2014; Lakhal et al., 2013) also provide strong evidence for the significant effect of the moderating variables effects. Accordingly, Abu-Al-Aish and Love (2013) reported that gender and age moderated students' behavioral intentions to use mobile learning. Also, findings from Lakhal et al. (2013); Khechine et al. (2014) indicated that the gender and age of students mediates behavioral intentions to use BL, stating that females were found to be more profound than males and therefore the impact on behavioral intentions was higher for females, predominantly for older females.

Likewise, findings from Venkatesh and Morris (2000); Padilla-Meléndez et al. (2013); Dečman (2015) indicated that both men and female technology acceptance decisions were influenced by their use behavior. However, regarding age, men use of technology diminished as their age increases. Similarly, results from Abu-Al-Aish and Love (2013); Khechine et al. (2014) suggested that in BL adoption male students are more concerned with the learning performance whereas female students are more interested with the ease of use and social influence factors opinions regarding the use of BL. Also, empirical evidence from Venkatesh et al. (2003) suggested that the impact of performance expectancy on behavioral intentions was higher for younger people, but the impact of social influence and effort expectancy were much lower for older people. Furthermore, regarding age, gender and computer experience influence on BL adoption, findings from Gawande (2015) indicated that older students (adult students) need more assistance and technical support than the young, aged students in relation to using BL approached for learning, known as facilitating conditions.

This is in line with results from Brand et al. (2011) where the authors mentioned that the young age students achieved higher learning performance in using iPad for BL approaches as compared to older students. Findings from previous studies (Abu-Al-Aish & Love, 2013; Brand et al., 2011; Dečman, 2015; Gawande, 2015; Kocaleva et al., 2014; Saleem et al., 2016) revealed that lecturer perception towards BL have a significant impact on their prior experience on technology usage. Lastly, based on the original UTAUT model (Venkatesh et al., 2003) predicted the influence of voluntariness of use on user behavior intention. Besides, the results of the research of Kocaleva et al. (2014); Saleem et al., (2016), conducted in e-learning environment, support the influence of voluntariness of use on student/teacher behavior intention to use e-learning systems. Therefore, similar to prior research (Vankatesh et al., 2003; Abu-Al-Aish & Love, 2013; Kocaleva et al., 2014; Saleem et al., 2016) the effect of gender, age, ICT experience, and voluntariness of use are examined in this study. Accordingly, we suggest the following hypotheses that;

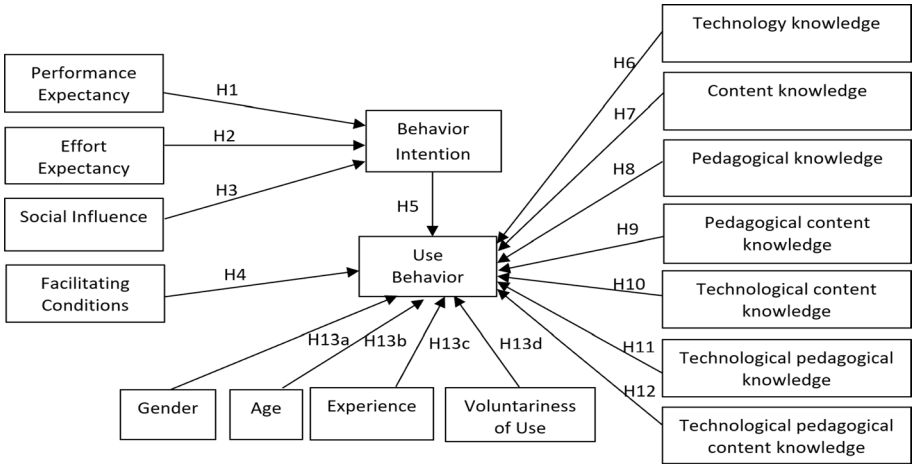

Fig. 3 Proposed research model

Table 1 Institutions involved in the survey

Institution's category	Respondents
Public University	100
Private University	72
Institute of Teachers Education	62
Public and Private College/Institutes	70
Polytechnics	240
Total	**544**

The bold signifies the hypothesis

H13a The behaviour of lecturers to use BL is moderated by the gender of the lecturer.

H13b The behaviour of lecturers to use BL is moderated by the age of the lecturer.

H13c *The behaviour of lecturers to use BL is moderated by the ICT experience of the lecturer.*

H13d *The behaviour of lecturers to use BL is moderated by the lecturers' voluntariness of use.*

Based on the factors that influence lecturers' behavior intention and actual use of BL grounded by UTAUT and TPACK model, and socio-demographic factors, the proposed model is developed as seen in Fig. 3.

Figure 3 depicts the proposed model based on UTAUT and TPACK model to examine the factors that impacts lecturers' behavioral intention and actual BL usage in higher education.

4 Methodology

4.1 Research Approach

This study adopts a quantitative research method and data was collected from academic staffs from Malaysia institutions (see Table 1) that adopts both F2F weekly classes and e-learning system such as Massive Open Online Courses (MOOC), Learning Management Systems (LMS), etc. in teaching and learning process. Moreover, each lecturer involves in the data collection process uses e-learning system as a platform to upload teaching material (e.g., links, power point,.doc,.pdf files, etc.), publish course schedule/timetable, carry-out course description and summary, manage class assignments submitted, conduct online quiz, and conduct class management in their respective institution.

5 Research Design

Based on UTAUT model the perception of the lecturers were rated regarding BL use is measured based on a five-point Likert scale. Lastly, based on TPACK model the questionnaire rates how BL is currently implemented by the lecturers in their institutions also based on a five-point Likert type scale anchored from 1 to 5, where (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) similar to Yeou et al. (2016); Ghazal et al. (2018). The questionnaire was developed based on existing instruments from prior studies. All respondents were guaranteed of their confidentiality.

5.1 Sampling Techniques

Links to the survey was sent to purposive sampled selected academic staffs in Malaysia institutions, where the target sample for this research included academic staffs who teach blended courses. The lecturers were selected due to their experience and familiarity with blended settings in providing answers based on their perceptions toward BL environment. Accordingly, implicit consent was provided to the respondents who completed the survey. The aim and purpose of the study and respondent's rights not to partake in the survey was clearly specified. Hence, participation in the survey was voluntary.

5.2 Data Collection Instrument

The pre-validated questionnaire in English language and was sent to experts (7 IT and 3 education domain) to proofread and amend the questionnaire for face and content validity to verify the correctness of the questionnaires in the pre-test phase, after which pilot study was carried out and data was collected from 10 lecturers to assess if the respondents understand the questions and to test the reliability of questionnaires instruments. Accordingly,

Table 8 in Appendix depicts the variables, items, and sources. The questionnaire comprised of 51 items, and at the end of the data collection a total of 544 samples was collected, but 131 samples were excluded due to incomplete data which resulted to a final 413 usable samples. Table 9 in Appendix depicts the demographic characteristics of the survey respondents. Then, invitations to participate in the main survey, including weblink to the questionnaire, was distributed to lecturers via emailed and the weblinks was also distributed to the faculties and e-learning centers of the selected universities, colleges, and polytechnics from January 2019 to March 2019. The data collection involves a survey of academic staffs in Malaysia institutions as seen in Table 1.

On average, each respondent took not more than 10 min to answer all questions. The questionnaire included demographic question (gender, age, nationality, job title, qualification, institution type, institution category, years of experience in teaching, years of involvement in e-learning, years of experience in ICT, employment type, educational field, and voluntary number of bl training attended 2016–2018) measured using ordinal measurement (see Table 9).

5.3 Ethical Consideration

Although some rewards were given to some participants based on a raffle draw for respondents that provided their emails address after completion of the survey. All research ethics were adhered to when coding, analyzing, and reporting of the collected data. All response from the survey remained anonymous to avoid any form of bias.

5.4 Data Analysis

This study employed Statistical Package for Social Science (SPSS) version 23 and Structural Equation Modeling (SEM) based on Partial Least Squares (PLS) for data analysis. SEM approach was selected because it can be utilized to analyze all hypotheses in a single analysis (Lin & Wang, 2012). Similarly, SEM was employed in this research due to its ability to analyze the relationships between the variables and approximate random errors in the observed constructs directly in providing precise measurements of the questionnaire items and variables (Teo, 2019). Furthermore, PLS is a latent SEM technique that uses a component-based method for estimation (Anthony Jr, 2019). Thus, PLS-SEM provides two analyses which include assessment of measurement model (evaluation of reliability and validity of constructs) and assessment of structural model (checks relationships among model variables) (Hair et al., 2016). SmartPLS version 3.0 was deployed to assess the measurement and the structural model and SPSS version 23 was employed to carry out descriptive analysis.

Table 2 Descriptive statistics

Constructs	Mean	Std. Deviation	Skewness	Kurtosis
Performance expectancy	3.89	0.673	−0.889	2.071
Effort expectancy	4.01	0.676	−0.914	1.786
Social influence	3.83	0.708	−0.683	1.254
Facilitating conditions	3.82	0.636	−0.713	1.389
Behavioral intention	3.76	0.777	−0.724	0.778
Use behavior	3.91	0.704	−0.827	1.587
Content knowledge CK	3.71	0.715	−0.755	1.126
Pedagogical knowledge PK	3.90	0.664	−0.845	1.543
Technological knowledge TK	3.85	0.658	−0.740	1.812
Pedagogical content knowledge PCK	3.78	0.640	−0.799	1.999
Technological content knowledge TCK	3.78	0.665	−0.866	2.351
Technological pedagogical knowledge TPK	3.77	0.685	−0.862	1.809
Technological pedagogical content knowledge TPACK	3.75	0.689	−0.732	1.379

6 Results

6.1 Assessment of Measurement Model

This is the first step involved in assessing the developed model (see Fig. 3). This step helps to assess how well the observed questionnaire items measure the unobserved variables as presented in Table 8 (Teo, 2019). The measurement model was evaluated based on descriptive analysis, item loadings, reliability measures, convergent validity, and discriminant validity.

6.1.1 Descriptive, Convergent Validity and Reliability

SPSS was employed to check the descriptive statistics for all constructs.

Results from Table 2 indicate that the mean values are higher than 2.5 based on a 5-point scale. Besides, the SD indicate a narrow spread between the mean indicating that the responses from the respondents are close, and not widely dispersed (Anthony et al., 2019). The data was also screened to confirm normality by checking the Skewness and Kurtosis values. The values of the Skewness and Kurtosis for the items were between the recommended cutoffs of 3.0 for Skewness and 8.0 for Kurtosis as recommended by Teo (2019).

Furthermore, the reliability and validity were assessed, where the reliability refers to the degree to which the variables give consistent results and are free from errors. Likewise, validity refers to the extent to which a variable differs from other variables in the same model in measuring what it supposed to measure (Yeou, 2016). In assessing the measurement model all results from Table 3 depicts that the items loaded exceed the minimum threshold of 0.4 as is recommended (Lin & Wang, 2012). In addition, results in Table 3 show the reliability measure based on the Composite Reliability (CR) and Cronbach's alpha score which should be greater than 0.70 for CR and Cronbach's alpha (Anthony et al., 2019; Hair et al., 2016). Besides, convergent validity, which specifies that a set of items corresponds to one and the same underlying variable, was assessed as seen in Table 3

Table 3 Loading and reliability

Constructs	Indicators	Loadings	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
Performance expectancy	PE1	0.880	0.935	0.947	0.721
	PE2	0.804			
	PE3	0.860			
	PE4	0.852			
	PE5	0.799			
	PE6	0.881			
	PE7	0.861			
Effort expectancy	EE1	0.824	0.887	0.922	0.748
	EE2	0.876			
	EE3	0.842			
	EE4	0.915			
Social influence	SI1	0.874	0.778	0.870	0.692
	SI2	0.852			
	SI3	0.766			
Facilitating conditions	FC1	0.694	0.800	0.869	0.627
	FC2	0.694			
	FC3	0.879			
	FC4	0.878			
Behavioral intention	BI1	0.879	0.915	0.940	0.797
	BI2	0.905			
	BI3	0.882			
	BI4	0.906			

Table 3 (continued)

Constructs	Indicators	Loadings	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
Use behavior	UB1	0.800	0.909	0.932	0.734
	UB2	0.837			
	UB3	0.873			
	UB4	0.891			
	UB5	0.878			
Content knowledge (CK)	CK1	0.793	0.792	0.878	0.707
	CK2	0.856			
	CK3	0.871			
Pedagogical knowledge (PK)	PK1	0.849	0.850	0.909	0.768
	PK2	0.882			
	PK3	0.897			
Technological knowledge (TK)	TK1	0.797	0.787	0.875	0.700
	TK2	0.894			
	TK3	0.816			
Pedagogical content knowledge (PCK)	PCK1	0.872	0.800	0.882	0.715
	PCK2	0.888			
	PCK3	0.773			
Technological content knowledge (TCK)	TCK1	0.879	0.738	0.850	0.654
	TCK2	0.730			
	TCK3	0.811			
Technological pedagogical knowledge (TPK)	TPK1	0.847	0.786	0.875	0.699
	TPK2	0.833			
	TPK3	0.829			

Table 3 (continued)

Constructs	Indicators	Loadings	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
Technological pedagogical content knowledge (TPACK)	TPACK1	0.797	0.844	0.895	0.681
	TPACK2	0.863			
	TPACK3	0.812			
	TPACK4	0.827			

Table 4 Discriminate validity

#	Constructs	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Behavioral intention	**0.893**												
2	Content knowledge (CK)	0.705	**0.841**											
3	Effort expectancy	0.723	0.623	**0.865**										
4	Facilitating conditions	0.868	0.753	0.766	**0.792**									
5	Pedagogical content knowledge (PCK)	0.698	0.766	0.689	0.759	**0.846**								
6	Pedagogical knowledge (PK)	0.715	0.762	0.684	0.748	0.804	**0.876**							
7	Performance expectancy	0.907	0.686	0.737	0.765	0.703	0.722	**0.849**						
8	Social influence	0.737	0.643	0.816	0.766	0.672	0.655	0.742	**0.832**					
9	Technological content knowledge (TCK)	0.740	0.758	0.681	0.764	0.811	0.829	0.749	0.652	**0.809**				
10	Technological knowledge (TK)	0.698	0.776	0.697	0.752	0.821	0.770	0.726	0.678	0.795	**0.837**			
11	Technological pedagogical content knowledge (TPACK)	0.760	0.792	0.731	0.797	0.796	0.779	0.761	0.722	0.767	0.781	**0.825**		
12	Technological pedagogical knowledge (TPK)	0.727	0.756	0.660	0.768	0.782	0.786	0.762	0.688	0.801	0.756	0.794	**0.836**	
13	Use behavior	0.892	0.688	0.735	0.856	0.716	0.769	0.822	0.726	0.759	0.731	0.756	0.746	**0.857**

Bold specifies the signified values which should be higher than 0.5

Table 5 Results of hypotheses (H1–H12)

Models	Hypotheses	Path Description	Standard error (*SE*)	*Beta (β)*	R^2	*t value*	Significance Level (*p* value)	Results
UTAUT	H1	Performance expectancy→Behavioral intention	0.018	0.905	0.820	43.255	0.000	Supported
	H2	Effort expectancy→Behavioral intention	0.030	0.719	0.517	20.976	0.000	Supported
	H3	Social influence→Behavioral intention	0.031	0.733	0.537	21.831	0.000	Supported
	H4	Facilitating conditions→Use behavior	0.029	0.846	0.715	32.119	0.000	Supported
	H5	Behavioral intention→Use behavior	0.020	0.889	0.791	39.457	0.000	Supported
TPACK	H6	Technological knowledge→Use behavior	0.037	0.717	0.515	20.879	0.000	Supported
	H7	Content knowledge→Use behaviour	0.035	0.685	0.469	19.042	0.015	Supported
	H8	Pedagogical knowledge→Use behavior	0.034	0.760	0.578	23.736	0.000	Supported
	H9	Pedagogical content knowledge→Use behavior	0.038	0.708	0.501	20.309	0.000	Supported
	H10	Technological content knowledge→Use behavior	0.035	0.733	0.538	21.875	0.000	Supported
	H11	Technological pedagogical knowledge→Use behavior	0.034	0.738	0.544	22.140	0.000	Supported
	H12	Technological pedagogical content knowledge→Use behaviour	0.033	0.746	0.557	22.713	0.000	Supported

Decision: Hypothesis is supported if *t-value* = > 1.96 and *p-value* = < 0.05

based on the values of the Average Variance Extracted (AVE) which should be greater than 0.50 denoting that a variable is able to explain more than 50% variance of its items (Fornell & Larcker, 1981; Hair et al., 2016).

6.1.2 Discriminant Validity

Discriminant validity relates to the level of difference between the sets of variables and their own indicators. In this regard, Hair et al. (2016) mentioned that the correlations between items in two variables should not be higher than the square root of the mean variance shared by a single variable's items. To assess for discriminant validity, the Fornell and Larcker (1981) test was employed, where this test checks if the square root of AVE of each variable exceeds the correlation shared between the variables and other variables in the model. Moreover, the AVE value should be greater than 0.50 for all variables measuring 50% variance (Anthony Jr et al., 2018). Results from Table 4 indicate that all variables acceptably higher than 0.50 and the square root of the AVE (on the diagonal) are larger than the cross-correlations with other variables.

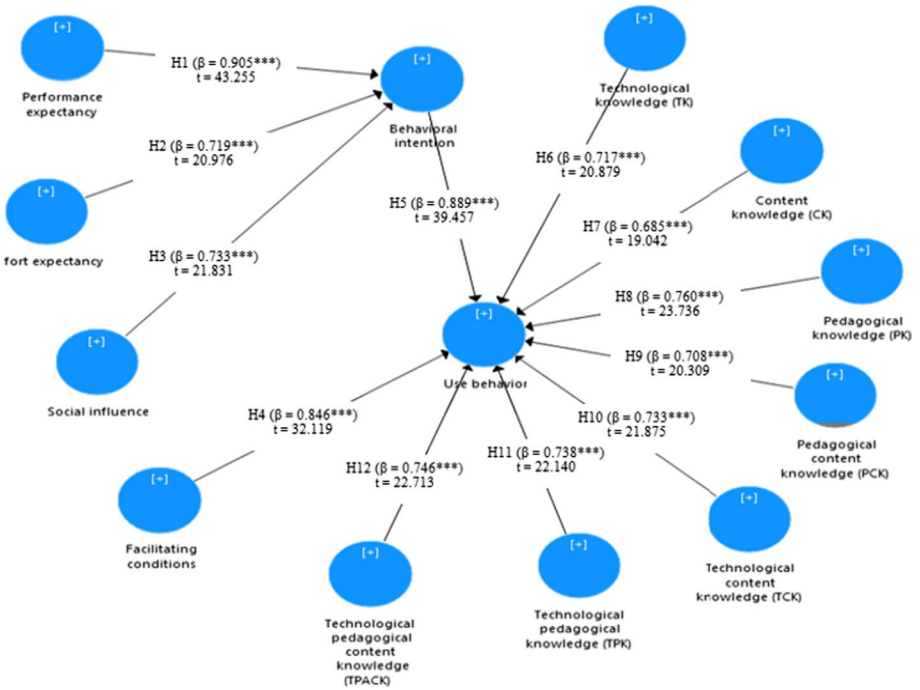

Fig. 4 Results of structural model

6.2 Assessment of Structural Model

This is the second step which involves the test of the structural model which confirms the relationships among the variables (Teo, 2019). Accordingly, the model hypotheses (H1–H12) (see Fig. 3) are tested by deploying PLS algorithm in SmartPLS 3.0 based on bootstrap re-sampling performed to examine the path significance levels of each hypothesis. Results from Table 5 depicts the hypotheses testing, where statistical significance of each hypothesis was assessed based on a two-tail test (***). Additionally, the structural model assessment is measured by examining the path coefficients value (β) which evaluates the association between variables based on their degree of significant levels (*p value*) which is significant when $p = < 0.05$. Moreover, the coefficient of determination termed R^2 value is used to measure the predictive significance of the model hypotheses. Next, the *t-value* is employed to assess the effects of each hypothesis which is based on

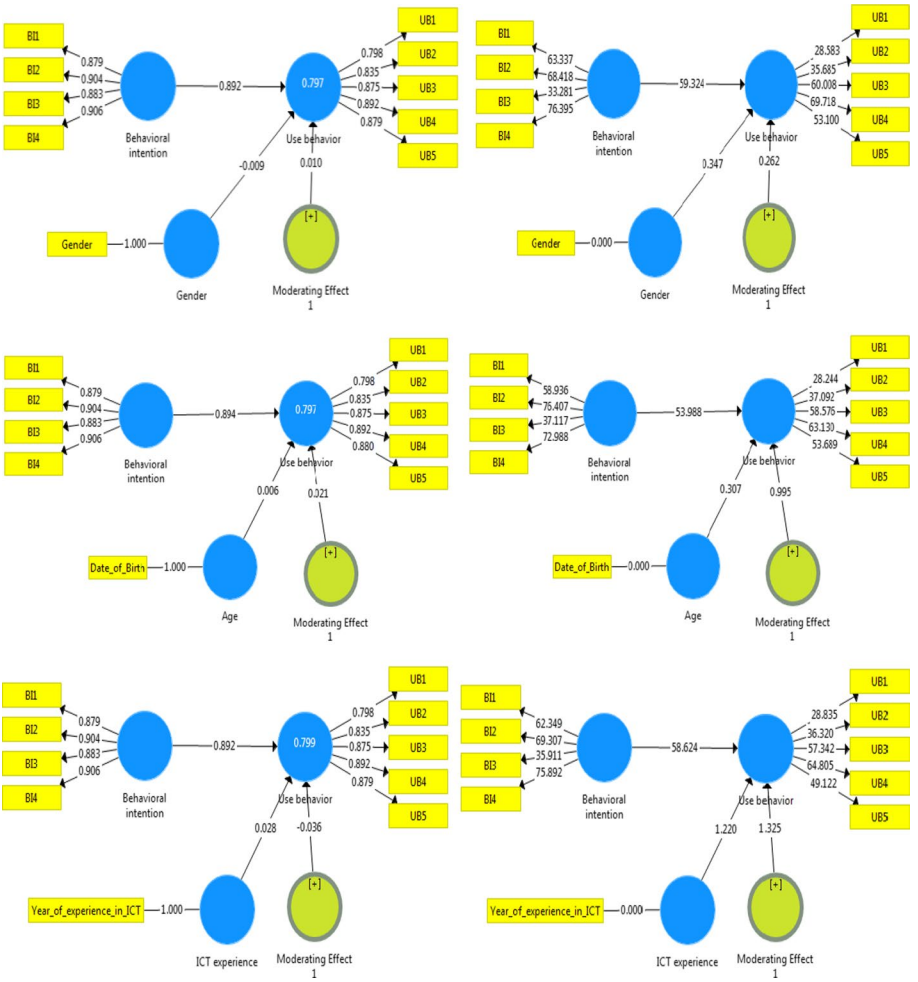

Fig. 5 Results of moderating influences of gender, age, and ICT experience

the regression coefficients and associated significances as listed in Table 5 and Fig. 4, where *t-value* should be greater than 1.96 (Hair et al., 2016).

Results from Table 5 and Fig. 4 show the hypotheses test using a two-tailed *t-test* with a significance level of 5% (0.05). As seen all *t-values* are higher than 1.96. Furthermore, results from Table 5 also depict the β and R^2 values which is the different path coefficients ranking of the hypotheses, where H1 has the strongest effect of 0.905 (0.820), followed by H5 with 0.889 (0.791), then H8 with 0.760 (0.578), next is H4 with 0.846 (0.715), then H12 with 0.746 (0.557), H11 with 0.738 (0.544), H10 with 0.733 (0.538), H3 with 0.733 (0.537), H2 with 0.719 (0.517), H6 with 0.717 (0.515), H9 with 0.708 (0.501) and lastly H7 with 0.685 (0.469). Therefore, the hypothesized path relationship (H1-H12) is statistically significant since the β and R^2 values are greater than 0.1 and *p-values* are lower than 0.05 (Hair et al., 2016).

6.3 Assessment of Socio-Demographic Factors

To validate the effect of gender, age, experience, and voluntariness of use on lecturers' behavioral intention to use BL approach for teaching, we employ multi-group analysis (MGA) in SmartPLS3 as suggested by Hair et al. (2016); Padilla-Meléndez et al. (2013), to confirm the hypotheses H13a, H13b, H13c, and H13d. MGA was previously adopted by Anthony et al. (2020b). Thus, this study opted to validate if they exist a structural relationship between behavioral intention and use behavior in relation to the moderating variables to ascertain if there is a change in the variance values of gender, age, experience, and voluntariness of use. Thus, each moderating variable is tested twice. Results from MGA are shown in Fig. 5, where the first test depicts the path coefficients value (β) and the second test shows the *t-value* which should be higher than 1.96 to be significant.

Results of the moderating effect path coefficient of gender on lecturer's behavioral intention to use BL is given as $\beta = 0.010$ which should be lower than "0" (Anthony et al., 2020b) and *t-value* is given as 0.262 which is lesser than 1.96 (see Fig. 5). The results suggest that, the gender do not mediate lecturers' intention to use BL. Thus, reject H13a, since no significant was observed. In addition, the moderating effect path coefficient of age on the lecturers is given as $\beta = 0.021$ and *t-value* is given as 0.995 also lower than 1.96. Thus, indicating that age does not mediate lecturers' behavioral intention to use BL. Hence, reject H13b. Similarly, the moderating effect path coefficient of ICT experience on the lecturers is given as $\beta = -- 0.036$ (see Fig. 5), whereas the *t-value* is given as 1.325 which is lower than 1.96. Thus, suggesting that prior ICT experience of lecturers does not mediates their

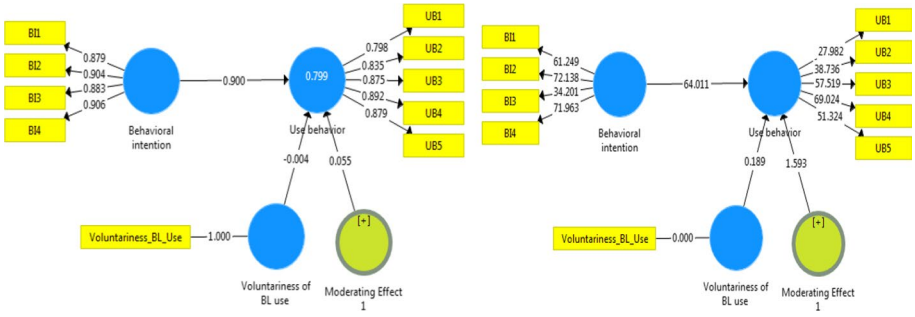

Fig. 6 Results of moderating influences of voluntariness of BL use

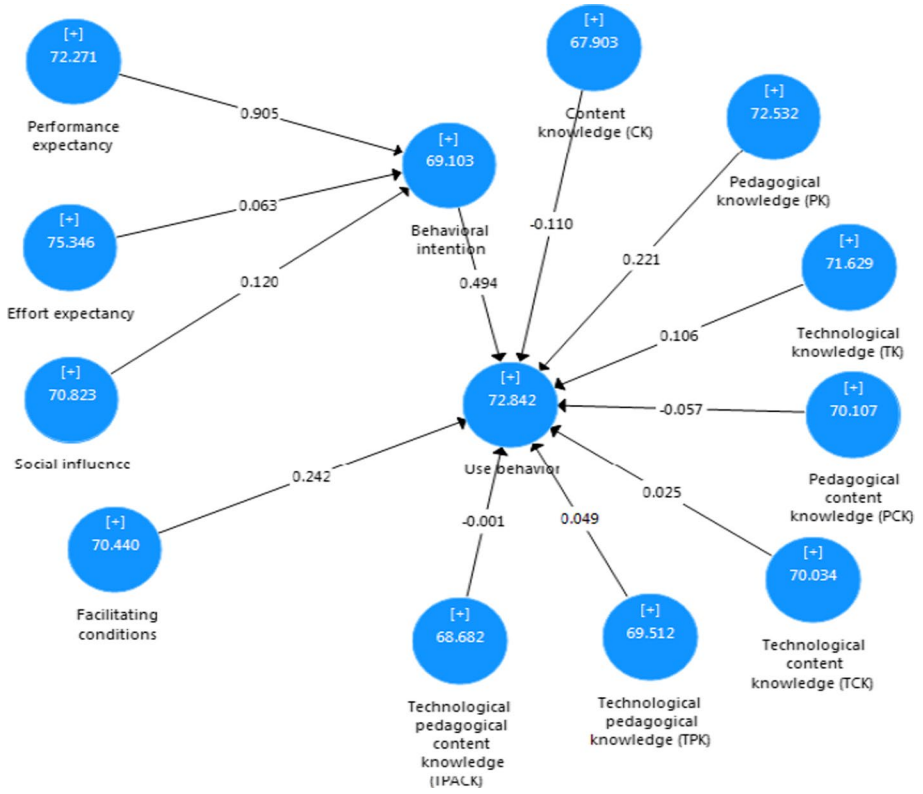

Fig. 7 Results for importance-performance map analysis

intention to use BL, hence reject H13c. Likewise, the moderating effect path coefficient of voluntariness of BL is given as $\beta = 0.055$ (see Fig. 6), whereas the *t-value* is given as 1.593 also lower than 1.96. Hence, indicating that the lecturers' voluntariness of using or not using BL to teach does not have any effect on their behavior and intention to use, thus reject H13d.

6.4 Importance Performance Map Analysis (IPMA)

Accordingly, researchers such as Chin (1998); Anthony et al. (2020b) mentioned that researchers should not only confirm if there is a significant relationship among the variables or not, but also check the size of effect between the constructs. Thus, in addition to confirming hypotheses there is need to check the model's effect size which measures the percentage of the importance and impact levels of the identified factors influence on the use behavior intention of lecturers to use BL approaches for teaching R^2 value for both UTAUT and TPACK model. Where, the effect size assesses the strength of correlation among the UTAUT and TPACK constructs. This helps in providing answer to the last research question, this confirming the complete impact of the study. Hence, importance-performance map test (IPMA) was deployed similar to prior BL study (Bervell & Umar, 2018) as seen in Fig. 7 to test for total

effect for importance (values inside the circles) and impact levels (values on the line) of the identified factors.

Hence results from IPMA test in SmartPLS3 as depict in Fig. 7 reveal the test of total effect for UTAUT suggesting that performance expectancy is the most influencing driver with total effect of 0.905 in relation to behavior intention of lecturers towards BL. This result confirm findings from prior studies (Lakhal et al., 2013; Venkatesh et al., 2003) which stated that performance expectancy is the most influential UTAUT construct. Additionally, results from Fig. 7 show that effort expectancy is the most performing driver with value of 75.346, signifying that the perceived academic performance to be derived from adopting BL approaches will impact lecturers' attitude towards BL. Considering TPACK, pedagogical knowledge has the higher effect of 0.221 and is also the most performing determinant with value of 72.532. Hence, institutions should lay more emphasis on the pedagogy employed for BL in teaching students as lecturers' behavior to use BL is influenced by their pedagogical knowledge in managing blended course contents, teaching, and learning resources.

7 Discussion and Implications of Study

7.1 Discussion

This study develops a model to examine the factors that influence lecturers' behavioral intention and actual BL usage based on the applicability of UTAUT and TPACK model in Malaysia higher education. Moreover, this study investigated how gender, age, experience, and voluntariness of use moderate lecturers' intention and actual use of BL. This research has successfully supported both theoretically and empirically applicability of UTAUT and TPACK as useful theoretical models for better understanding lecturer's behavioral intention to accept and use BL for teaching in Malaysia higher education. Data was collected using survey from lecturers in universities, colleges, and polytechnics and analyzed using PLS-SEM. Grounded on UTAUT model. The results suggest that performance expectancy positively influences lecturers' behavior intention towards using BL for teaching. This result is consistent with findings from prior studies (Abu-Al-Aish & Love, 2013; Lakhal et al., 2013), where the authors stated that performance expectancy relates to extent to which academic staffs assumed that their teaching performance would influences their perception towards using BL for teaching activities. Likewise, findings from Radovana and Kristl (2017) revealed that the performance expectancy impact of BL predicts if lecturers will find BL useful when they teach at their convenience and quickly towards improving teaching productivity.

The results also indicated that effort expectancy positively influences lecturers' behavior intention towards using BL for teaching. This driver is considered as an important construct of teaching behavioral intention to use BL approach (Tarhini et al., 2017). This result confirms prior works (Saleem et al., 2016; Sattari et al., 2017), in which the findings from the authors suggested that effort expectancy which refers to the extent to which lecturer believes that BL adoption will have self-efficacy and will be easy to use in implementing teaching activities. Furthermore, findings from prior study Lwoga and Komba (2015) demonstrated that effort expectancy is a significant factor that affect both involuntary and voluntary environment during the initial stages of BL adoption. Findings from this study

suggest that statistical significance was observed between social influence and lecturers' behavior intention towards using BL for teaching. This suggests that lecturers would agree to continue using BL due to both internal and external influence such as from the university management and government pressure (Dečman, 2015; Sattari et al., 2017). Besides, other studies (Brand et al., 2011; Gawande, 2015; Khechine et al., 2014) also reported similar finding stating that academic staffs are influenced to adopt BL for educational purpose if it is essential that others believe he/she should use BL approaches.

The study also found that facilitating conditions significantly predicts lecturers' behavior intention towards using BL for teaching. This result suggest that lecturers will continue to use BL approach if infrastructure are provided to support BL adoption such as the provision of training, facilities, and support to lecturers (Radovana and Kristl, 2017). The result of this study is consistent with findings from previous studies (Abu-Al-Aish & Love, 2013; Sattari et al., 2017) which indicated that the quality of service of BL provided to lecturers can influence their behavioral intention and level of acceptance towards the acceptance of BL. Thus, it is evident that the better the support perceived by the lecturers, the more they will continue to use BL (Kocaleva et al., 2014). Further, this study found that behavioral intention represents lecturers' intention of using BL approaches for educational purpose, which is consistent with results reported by Saleem et al. (2016); Sattari et al. (2017) which revealed that behavioral intention relates to lecturers' intention of using BL approaches in the future for teaching and learning activities.

Based on TPACK model, statistical results indicate support that technology knowledge of lecturers has a significant influence on their behavior to use BL for teaching. This result suggests that TK entail lecturers understanding on how to utilize various technologies for teaching (Graham et al., 2009). This result is analogous with findings from the literature (Koehler & Mishra, 2009; Schmidt et al., 2009) which specifies that lecturers' knowledge of operating systems, software, and hardware, and the capability to utilize teaching software applications such as Microsoft word, PowerPoint, Excel spreadsheets, creating of documents, use of browsers, and e-mail will impact their use of BL for teaching. Furthermore, the results suggest that content knowledge of lecturers predicts their behavior towards using BL for teaching. According to Koehler and Mishra (2009) CK refers to the knowledge lecturers must be aware of the content they intent to teach and how the content of that knowledge differs for several content areas. This implies that CK relates to fundamental theories, concepts, facts, and procedures of the actual subject matter that is to be taught or learned (Sahin, 2011). Hence, findings from prior studies (Alsofyani et al., 2011; Qasem & Viswanathappa, 2016) revealed that lecturers' knowledge of how to organize and connect course content ideas for BL determines if they will accept BL.

Pedagogy knowledge is also found to have a strong effect on lecturers' behavior towards using BL which confirms the studies carried out by (Alsofyani et al., 2012; Papanikolaou et al., 2017; Yang & Chen, 2010). Respectively, PK involves lecturers' knowledge about the practices or procedures of teaching and learning and how it links to educational aims and objectives. Moreover, lecturers' PK involves issues related to student learning, managing classroom, developing and implementing lesson plan. This result also corroborates findings postulated in the literature (Wang, 2004; Schmidt et al., 2009), that PK entails knowledge steps to be followed by the lecturers in the classroom based on the type of students and strategies for assessing student learning thus influences teacher's acceptance of BL. In addition, the results indicate that pedagogy content and knowledge predict lecturers' behavior towards using BL. This result is similar with findings from other BL studies (Alayyar et al., 2012; Maor & Roberts, 2011), which mentioned that PCK entails the intersection of pedagogy and content. Therefore, PCK represents the integration of pedagogy

and content by the lecturer into an understanding of how the subject matter are prearranged, adapted, and represented for teaching students in a BL environment (Koehler & Mishra, 2009; Schmidt et al., 2009).

On the other hand, technology content knowledge appeared to have a significant influence on lecturers' behavior towards using BL. This result is in line with finding from prior studies conducted by Tømte et al. (2015), where the authors suggested that TCK relates to lecturers' perception and understanding of how adopting a particular technology can change the way students learn and practice in a particular content area. Furthermore, results from other studies (Graham et al., 2013; Koehler & Mishra, 2009) confirmed the result from this study that TCK which is knowledge relating to the method in which content and technology for teaching entails how technology is used by lecturers to present course contents to students. The results also revealed that technology pedagogy knowledge impact lecturers' behavior towards using BL for teaching. This result seems quite reasonable and consistent with findings of previous studies (Wang, 2004). In order words, TPK refers to lecturers' knowledge of how several technologies can be deployed in teaching and understanding that utilizing such technologies may change the way the lecturer teaches (Lye, 2013). TPK is lecturers' knowledge of the current modules, and capabilities of different technologies that can be deployed for BL teaching (Koehler & Mishra, 2009). Thus, it involves lecturers' knowing how teaching with a particular technology might change the learning outcome of students (Ward & Benson, 2010). Additionally, the results indicate that technological pedagogical content knowledge of lecturers positively impact on their behavior to use BL for teaching. This is evident because TPACK encompasses the knowledge lecturers need for incorporating technology into their teaching (Wang, 2004). Thus, results from Schmidt et al. (2009) revealed that lecturers must have a spontaneous understanding of the composite interplay between CK, PK, TK components of knowledge by teaching course content using suitable pedagogical strategies and technologies (Koehler & Mishra, 2009).

Furthermore, regarding the moderating effects of gender, age, experience, and voluntariness of use on lecturers' intention and actual use of BL, the results reject the effect of gender moderating lecturers' intention to use BL for teaching. This result is in line with results from Saleem et al. (2016), where the authors found that gender do not influence the acceptance of Moodle as a teaching and learning tool. But is dissimilar to the findings from Lakhal et al. (2013); Padilla-Meléndez et al. (2013); Dečman (2015); Gawande (2015), who revealed that gender influences e-learning adoption. Conversely, the results also reject that the age of lecturers moderates their intention to use BL for teaching. This contradicts findings from previous studies (Venkatesh & Morris, 2000; Venkatesh et al., 2003; Lakhal et al., 2013; Khechine et al., 2014; Saleem et al., 2016). Regarding influence of experience, the results reveal that prior IT experience of the lecturers does not moderate their intention to use BL for teaching. This result is analogous with results from the literature (Dečman, 2015) who stated that experience does not have a positive influence student intention to use e-learning. Lastly, voluntariness of use is proven not to moderate lecturers' intention to use BL for teaching. On the contrary, this result is not consistent with findings from prior study (Saleem et al., 2016).

7.2 Theoretical Implications

This study provides academic staffs in higher education with guidance for how to implement BL approach based on empirical data regarding factors that influence lecturers' behavioral intention to use BL derived from UTAUT model (Venkatesh et al., 2003) and factors to be employed by lecturers' that influence actual BL usage derived from TPACK

model (Koehler & Mishra, 2009). Therefore, this research is a one of the first studies that integrates UTAUT and TPACK to develop a model to examine technology acceptance literature in BL environment. Overall, the results of the present study suggest that UTAUT and TPACK models were able to provide empirical evidence of lecturers' acceptance and use of BL approach for teaching. Theoretically, based on UTAUT model this research provides valuable insights into technology acceptance and use in academic setting. Overall, this research adds to the body of knowledge about acceptance theory in BL environment. Thus, the utilizing of UTAUT model as a base theory in the context of lecturers' behavioral intention to adopt BL for teaching provide possible prospects for future research on the investigation of various theoretical perspectives to understand lecturers' BL continued usage intentions. The model developed in this study provide better understanding into how institutions can develop initiatives to encourage continuous usage of BL strategies for lifelong learning and future studies among lecturers towards planning and implementing a successful BL approach in their respective institutions.

Moreover, findings from this study are useful to e-learning administration to identify important factors to be considered in developing appropriate strategies and policies to promote long-term usage of BL approaches in higher education. Additionally, the main outcomes of this study are to develop a model that better understand the factors that affect academic staffs' behavioral intention to use BL by academic staffs in institutions. This study concludes that performance expectancy, effort expectancy, social influence, and facilitating conditions play important roles on lecturer's behavioral intention to use BL. Another important contribution of this study is that socio-demographic factors (gender, age, experience, and voluntariness of use) as moderating variables do not influence lecturers' behavioral intention to use BL for teaching. The results of our study confirm that lecturers' behavior intention is an important variable that predicts their attitude to use BL.

Respectively, findings from this study help to better understand the perception of lecturers in Malaysia towards BL adoption which can help educators, policy makers, and practitioners to understand what the lecturers expect from BL approaches. This can help institutions administration in achieving the most effective deployment of BL and also aid them to improve their strategic decision making regarding technology for education in future. Moreover, this study provides the current practice of BL in Malaysia higher education from the lens of lecturers' opinions on the important factors that impact the acceptance and adoption of BL approaches which will help in improve future direction of BL practices. Furthermore, the institutions should formulate policies to guide BL usage and development by focusing on educating lecturers to use BL through training, workshops, printed leaflets or posters, and electronic medium such as social media, institutions' website, etc. For instance, it should be mandatory for lecturers to deliver course modules, assignment, assessment and feedback to learners by using both F2F and online medium. Thus, BL policy should stress the prominence of collaboration between faculties and department in providing BL infrastructure, IT technical help desk and support to students and lecturers.

7.3 Practical Implications

The findings of this study have practical implications for academic staffs and course designers in proving a model that serves as a basis that support lecturers in integration ICT in improving teaching and learning performance. Ultimately, TPACK is incorporated

in the developed model to serves as a valuable tool for assessing lecturers' knowledge in the domain of technology integration to improve teaching efficiency. Besides, as there are fewer empirical research on the applicability of TPACK in improving BL in Malaysia educational context, the current study will be useful for educators, academicians, and lecturers to provide a roadmap to improve BL experiences towards developing alternative and new approaches as compared to the conventional methods of teaching. Furthermore, based on TPACK, the developed model provides an analytical instrument for assessing what lecturers should knowledge regarding BL adoption. Specifically, findings from this study helps to incorporate the use of technology in providing important implications for examining issues related to BL use. The instrument developed as presented in Table 8 can be employed by academic staffs in universities, colleges, and polytechnics as a benchmark tool to improve the acceptance and use of BL approaches to improve teaching and learning effectiveness and also assist lecturers in focusing on important aspects of effective teaching in both F2F and online mode.

Findings from this study offer several possibilities for promoting research in academic staffs' education, lecturer professional development, and lecturers' use of technology by developing a model that examines the factors to be employed by lecturers' that influence actual BL usage. Thus, this study provides a better understanding of lecturers' views of knowledge in relation to course content, pedagogy and technology use in improving teaching. The model can significantly be used by academic staffs to monitor and improve their current BL activities in measuring their knowledge about teaching regarding teaching improvement and career development. As a reflective tool, the model provides an in-depth analysis method for lecturers to improve teaching in BL environments. Moreover, university administration can use the develop model based on TPACK items as seen in Table 8 to assess lecturer practices and perceptions towards BL. Thus, the developed model serves as a useful instrument in analyzing actual on-campus and F2F teaching practices of lecturers for the continuous motivation and development of academic staff teaching in Malaysia higher education. By employing TPACK, the developed model assists the development of BL approaches for discovering and describing how technology-related knowledge is instantiated and implemented in practice.

8 Conclusion

This study develops a model based on UTAUT and TPACK to examine the factors that impacts lecturers' behavioral intention and actual BL usage for teaching. The empirical results indicate that the factors predict lecturers' behavioral intentions to use BL were, in order of importance comprises of performance expectancy, facilitating conditions, social influence effort expectancy, and behavior intention mediates use behavior. Interestingly, the results also confirm that the TPACK factors implemented by the lecturers' positively influences their perception towards using BL for academic purposes. Moreover, the developed model was further tested based on gender, age, experience, and voluntariness of use. The results reveal that moderating variables do not influence lecturer's behavior intention to use BL for teaching. From a theoretical perspective, the results of the present research add support to scientific literature on technology acceptance and use by validating the UTAUT and TPACK model in Malaysia context.

From a practical viewpoint, this research offers several opportunities of reflection for both faculties and institution administration in helping them elucidate their vision and enhance their actions and decisions regarding the use of BL, by informing them about the most influential factors that predicts academic staffs' intentions to use BL. This study also provides questionnaire indicators as BL initiatives to be adopted lecturers as presented in Table 8. In addition, educational designers have to design BL teaching and learning approaches that are easy to use to improve lecturers and students' educational performance as these increases' acceptance toward BL. However, to motivate lecturers there is need to increase their awareness of BL and provide them with adequate training. Furthermore, pedagogies functionalities offered by BL approaches needs to be user-friendliness and up to date as this will influence lecturers in using BL.

8.1 Limitations and Future directions

This research has some limitations. First, the result from this study is from Malaysia higher educations, thus generalizability of the results to other countries should be treated with caution. Secondly, this study employs quantitative survey to collect the data. While, the survey is theoretical valid and reliable, adopting only quantitative approach limits the ability to have an in-depth investigation which is mostly found in qualitative method. Thirdly, this study was conducted among lecturers in management and engineering faculties where the use of BL approaches is widespread. Fourth, the effectiveness of BL in teaching was explored and student learning outcome was not examined in this current study. Therefore, future studies could replicate this study within other countries. Moreover, qualitative case study by interview can be adopted to further explore the model to understand BL acceptance and adoption. Also, academic staffs in more disciplines should be included for comparative analyses. Additionally, individual variables such as teaching and teaching satisfaction, etc. should be included to enhance the predictive significance in explaining the impact of BL for teaching and learning effectiveness. Lastly, students learning outcome will be examined in future studies.

Appendix

Tables 6, 7, 8, 9

Table 6 Prior studies that employed UTAUT for BL acceptance

Authors & Contribution	Purpose/Aim	Employed Factors	Methods	Context
Al-shami et al. (2019) explored the adoption of MOOC use in university	Aimed to assess the influence and progression of MOOC usage among students	Performance expectancy, effort expectancy, Social expectancy, motivations circumstances, and behavioral intention	Data was collected using questionnaire from 200 students in a university. SPSS was employed to run regression analysis	Malaysia
Radovan and Kristl (2017) proposed a model to investigate the acceptance of BL and its impact on lecturer's activities in a virtual classroom	Aimed to examine the use and acceptance of LMS among lecturers and the effect of LMS use in improving teaching	Performance expectancy, effort expectancy, social influence, facilitating condition, behavioral intention, planning and organization of learning, guidance and facilitating discussions, social presence, and cognitive presence	Data was collected from 326 teaching staff in a university. SPSS and Structural Equation Modeling (SEM) AMOS was employed to analyze the survey data	Slovenia
Sattari et al. (2017) examined the drivers that influences health students' acceptance of web-based training	Aimed to improve training via web based platforms by identifying factors that influence learners' perspective	Performance expectancy, effort expectancy, attitude, social influence, facilitating condition, self-efficacy, anxiety, behavioral intention, and usage	Data collection based on survey from 226 students and SPSS was employed for analysis	Iran
Tarhini et al. (2017) examined the drivers that impacts learners' use of e-learning	Dedicated to specifying the drivers that may affect or support students' use of e-learning systems	Performance expectancy, social influence, effort expectancy, habit, facilitating conditions, trust, hedonic motivation, self-efficacy, price value, and behavioral intention	Data was collected from 366 students using questionnaires and SPSS was employed for descriptive, confirmatory factor analysis	UK
Gawande (2016) studied lecturers' perceptions toward BL adoption at higher education institutes	Proposed to define the determinants affecting BL adoption, and examine if the teaching method predict BL	Performance expectancy, effort expectancy, facilitating conditions, social influence, behavioral intention, and teaching style	Questionnaire was used to collect data from 30 faculty staffs. SPSS was employed to run descriptive, reliability, and validity test	Oman
Saleem et al. (2016) studied the acceptance of Moodle as a tool to support teaching and learning in a university faculty	Aimed to assess the influence of UTUAT variables on lecturers' behavioral intention to employ Moodle for education activities	Performance expectancy, effort expectancy, social influence, facilitating condition, behavioral intention, use behavior, gender, experience and voluntariness of use	Interview method was adopted to collect data from 14 academic staffs	Oman

Table 6 (continued)

Authors & Contribution	Purpose/Aim	Employed Factors	Methods	Context
Dečman (2015) examined the acceptance of e-learning in higher education based on the gender and education	Determined to confirm the appropriateness of UTAUT within e-learning domain	Performance expectancy, effort expectancy, social influence, behavioral intention, gender, and education	Data collection based on survey from 228 students. Descriptive, factor analysis, and SEM was employed to analyze the data	Slovenia
Gawande (2015) designed a BL model to investigate the perceptions of students at a university	Aimed to identify the drivers affecting BL adoption and verify if learning process was predictive of BL adoption initiatives	Performance expectancy, effort expectancy, facilitating conditions, social influence, behavioral intention, gender, age, experience, and learning style	Questionnaire was used to collect data from 841 students. SPSS was employed to run descriptive statistics, reliability, and validity analysis	Oman
Lwoga and Komba (2015) examined the antecedents that determine LMS continued usage intentions	Focused to identify the factors of continued actual usage intentions of e-learning and issues linked with the system	Performance expectancy, effort expectancy, facilitating condition, social influence, actual use, and continued usage intention	Data collection based on survey from 300 students and interview from 20 lecturers. Used SPSS for analysis	Tanzania
Khechine et al. (2014) developed a BL model to examine the role of age and gender in influencing students' intention to utilize webinars	Focused on determining the drivers that predict the acceptance of a BL course webinar system	Performance expectancy, effort expectancy, facilitating conditions, social influence, intention to use, gender, and age	Collected data using survey from 114 students enrolled in a blended course. SPSS was employed to run reliability and regression analysis	Canada
Kocaleva et al. (2014) employed UTAUT to study educational activities in universities	Aimed to explore the factors that influence acceptance and use of e-learning	Performance expectancy, effort expectancy, social influence, facilitating condition, anxiety, self-efficacy, attitude, behavioral intention, and use behavior	Data collection based on survey from 92 students and SPSS was employed for data analysis	Macedonia
Abu-Al-Aish and Love (2013) researched on the variables that influences students' acceptance of m-learning	Aimed to explore the factors that impacts university students' intentions to utilize m-learning	Performance expectancy, effort expectancy, social influence, quality of service, personal innovativeness, behavioral intention, and experience	SEM was deployed to analyze survey data collected from 174 students	UK

Table 6 (continued)

Authors & Contribution	Purpose/Aim	Employed Factors	Methods	Context
Lakhal et al. (2013) investigated learners' behavioral intentions to adopt desktop video conferencing for distance course based on autonomy integration	Motivated on evaluating the psychological factors that may influence learners' acceptance and use of video technology for learning	Autonomy, performance expectancy, effort expectancy, general social influence, peer social influence, facilitating condition, and behavioral intention	Data was collected using online questionnaire from a sample of 177 students. Then PLS-SEM was employed for data analysis	Canada
Brand et al. (2011) examined the correlation of mobile learning and BL experience	Aimed to test the efficacy of BL iteration for mobile learning application	Performance expectancy, effort expectancy, attitude, social influence, self-efficacy, facilitating conditions, anxiety, behavioral intentions, self-managed learning, and perceived playfulness	Data was collected from 135 students and SPSS was utilized to carry out descriptive and correlation analysis	Australia

Table 7 Prior studies that employed TPACK for BL acceptance

Authors & Contribution	Purpose/Aim	Factors	Methods	Context
Maor (2017) employed TPACK to design a digital pedagogue	Aimed to improve learners' ability to utilize technology in their learning and also in their profession	TK, CK, PK, PCK, TCK, TPK, and TPACK	Employed mixed model qualitative and survey to collect data from students	Australia
Papanikolaou et al. (2017) designed a framework for constructivist pre-service tutor training for Technology Enhanced Learning (TEL)	Focused to design a TEL approach based on TPACK in a blended lecturer training	TK, PK, TCK, TPK and TPACK and Community of Inquiry (CoI)	Data was collected using questionnaire from 207 samples and SPSS was used to descriptive inferential and correlation analysis	Greece
Qasem and Viswanathappa (2016) employed BL approach to implement educators' TPACK	Aimed to assess the levels of ICT knowledge on e-course via BL approach within science tutors	TK, TCK, TPK, and TPACK	Data was conducted based on a sample from 60 science teacher trainees. SPSS was utilized to for t-test analysis	Yemen
Jimoyiannis (2015) developed a framework to guide Web 2.0 educational practice integration	Aimed to direct lecturers' preparation and teaching design towards promoting web 2.0 deployments into educational syllabus	TK, CK, PK, PCK, TCK, TPK, and TPACK	Conceptual no empirical data was reported	Greece
Tømte et al. (2015) investigated how to train online student teachers towards learning professional digital knowledge	Aimed to explore how online teacher training can improve innovative means of teaching and learning with ICT	TPACK	Adopted mixed method and collected data using survey from 157 students. Then 5 students and 3–4 teaching staff was interviewed from 4 groups	Sweden & Norway
Anderson et al. (2013) researched on how to utilize TPACK to unite lectures from disciplines in supporting online learning and BL	Aimed to evaluate the state to which lecturers' knowledge was confirmed throughout their teaching practices	TK, CK, PK, PCK, TCK, TPK, and TPACK	Adopted a qualitative case study method were data was collected from 15 lecturers	Australia
Lye (2013) explored the issues and opportunities faced by a university adopting TPACK for educational purpose	Motivated to assess how to adopt TPACK to benefit academic staff in for teaching and learning process	TK, CK, PK, PCK, TCK, TPK, and TPACK	Collected data from convenient selected 39 academic staffs. Employed SPSS for descriptive and t-test	Malaysia
Alayyar et al. (2012) employed TPACK for pre-service science instructors to facilitate BL	Aimed to integrate ICT in improving education based on TPACK	TK, CK, PK, PCK, TCK, TPK, and TPACK	Data was collected from 78 pre-service science teachers to measure TPACK using a survey. SPSS was employed to carry out t-test	Kuwait

Table 7 (continued)

Authors & Contribution	Purpose/Aim	Factors	Methods	Context
Alsofyani et al. (2012) developed TPACK based on technology acceptance model (TAM) to assess blended online workshop training	Aimed to confirm that online BL training possess the capability to achieve a conducive environment for teaching	TPACK. and TAM	Employed a convenience selected sample of 26 participants. SPSS was used to test for reliability and descriptive analysis	Saudi Arabia
Alsofyani et al. (2011) developed a model for blended online training based on TPACK	Aimed to apply TPACK to support lecturers in attaining knowledge adequately and effectively utilizing it in their classes	TK and PK	Employed convenience sampling to gather data using distributed questionnaire from 13 faculty members	Saudi Arabia
Maor and Roberts (2011) examined if TPACK supports lecturers to design a more engaging learning experience for students BL	Focuses to explore how lecturers can assimilate pedagogical, knowledge and technology to facilitate BL	TK, CK, PK, PCK, TCK, TPK, and TPACK	Collected data from flexible learning environment questionnaires and the university student surveys of units	Australia
Yang and Chen (2010) researched how to design teachers' TPACK via BL process and WebQuest approach	Aimed to offer a conceptualization of TPACK for project-oriented learning	TK, CK, PK, PCK, TCK, TPK, and TPACK	Convenience sampling was employed to collect data from 29 students	USA
Ward and Benson (2010) developed new schemas for improving online teaching and learning based on TPACK	Focused to offer a complete approach towards to help lecturers develop a medium for transitioning from F2F to online learning	TK, CK, PK, PCK, TCK, TPK, and TPACK	Collected data from instructors using survey and results of validity and reliability	USA
Archambault and Crippen (2009) investigated TPACK use among K-12 online distance lecturers	Determined to assess and measures e-tutors knowledge with respect to their technology, pedagogy, and content	P, C, T, TC, TP, CP, and TPC	Included a sample of 596 K-12 online tutors and used SPSS to present descriptive and correlation analysis	USA

Table 8 Questionnaire items

Constructs	Items	Sources
Performance expectancy	PE1-BL allows me to manage time efficiently PE2-I receive recognition for my BL implementation PE3-Teaching with BL exhibits an interactive teaching style PE4-BL assists me in completing my teaching task PE5-BL helps to provide prompt feedback to students PE6-Teaching with BL encourages students' learning interactions PE7-I give opportunity for my student to review and improve their works	(Dakduk et al., 2018; Lin & Wang, 2012; Prasad et al., 2018)
Effort expectancy	EE1-Learning how to use BL for teaching is easy for me EE2-I feel confident implementing BL EE3-BL is important for teaching and learning delivery EE4-I am comfortable using BL for my teaching and learning	(Dakduk et al., 2018; Poon, 2014; Sun & Qiu, 2017)
Social influence	SI1-I am comfortable using BL to interact with my students SI2-I feel the relationship between teachers and students are more harmonious in BL SI3-BL helps for collaborative teaching and learning	(Barnard et al., 2009; Machado, 2007; Poon, 2014)
Facilitating conditions	FC1-I have the resources and skills necessary to use BL FC2- BL simplifies course content design FC3- BL helps to carryout student assessment FC4- BL to monitor my student performance	(Dakduk et al., 2018; Lin & Wang, 2012; Prasad et al., 2018)
Behavioral intention	BI1-Using BL materials would make it easier to teach course content BI2-Using BL improves my teaching skills BI3-BL helped me to achieve my teaching goals BI4-BL creates effective learning environment	(Arbaugh et al., 2008; Lin & Wang, 2012; Prasad et al., 2018)

Table 8 (continued)

Constructs	Items	Sources
Use behavior	UB1-Using BL to teach improves student engagement UB2-BL use allows teaching to occur anytime, anywhere and anyhow UB3-Using BL provides more opportunities for me to improve my teaching continuously UB4-I prefer to use BL in my next academic trainings UB5-I become more innovative to use different teaching strategies in my BL course	(Arbaugh et al., 2008; Dakduk et al., 2018; Prasad et al., 2018)
Content knowledge (CK)	CK1-BL helps me to prepare my teaching material CK2-I use BL to monitor my student learning progress CK3-I use BL to execute various type of assessment	(Baragash & Al-Samarraie, 2018; Sun & Qiu, 2017)
Pedagogical knowledge (PK)	PK1-I spend time to explore more about BL PK2-I learnt more educational tools to make my BL more effective PK3-I use BL to enhance my teaching technique	(Baragash & Al-Samarraie, 2018; Lin & Wang, 2012; Schmidt et al., 2009)
Technological knowledge (TK)	TK1-I can develop the course content for BL TK2-I use BL to carry out teaching and learning activities TK3-I use BL to carry out assessment	(Lin & Wang, 2012; Schmidt et al., 2009)
Pedagogical content knowledge (PCK)	PCK1-I make preparation for my BL course PCK2-I select proper teaching strategy for my BL delivery PCK3-I give assessment feedback in BL	(Ghazal et al., 2018; Schmidt et al., 2009; Sun & Qiu, 2017)
Technological content knowledge (TCK)	TCK1-Using BL fits into my working style TCK2-I provide extra support beyond the anticipated task in the course outline for BL TCK3-I schedule my time to assist students for my online courses	(Wang, 2004; Arbaugh et al., 2008; Sun & Qiu, 2017)

Table 8 (continued)

Constructs	Items	Sources
Technological pedagogical knowledge (TPK)	TPK1-BL assists me to develop interactive learning content TPK2-BL is an excellent medium for social learning interactions with my students TPK3-BL assists in responding to online inquiries and discussions in timely manner	(Padilla-Meléndez et al., 2013; Sun & Qiu, 2017)
Technological pedagogical content knowledge (TPACK)	TPACK1-BL is valuable in helping me to appreciate my student's different perspectives TPACK2-I am a regular BL practitioner to deliver teaching TPACK3-I share my BL practices with my colleague TPACK4-I assist my colleague in implementing BL	(Wang, 2004; Padilla-Meléndez et al., 2013; Sun & Qiu, 2017)

Table 9 Characteristic of lecturers

Profile	Options	Percentage (%)
Gender	Male	31.5
	Female	68.5
Age	1950–1959	0.9
	1960–1969	15.6
	1970–1979	35.1
	1980–1989	43.3
	1990–1999	2.6
	2000	2.4
Nationality	Malaysian	97.3
	International	2.7
Job Title	Tutor or Equivalent	1.7
	Lecturer or Equivalent	66.6
	Senior Lecturer/Assistant Professor or Equivalent	24.0
	Associate Professor or Equivalent	2.4
	Professor	1.2
	Others	4.1
Qualification	Doctorate	23.5
	Master's Degree	50.1
	Bachelor's Degree	22.3
	Advance Diploma	1.2
	Diploma or Equivalent	2.7
	Others	0.2
Institution Type	Public	85.0
	Private	15.0
Institution Category	University	38.0
	College or Equivalent	12.7
	Polytechnic	49.4
Years of Experience in Teaching	1–5	13.1
	6–10	23.5
	11–15	24.5
	16–20	21.2
	21–25	8.0
	26–30	5.8
	Above 30	1.4
Years of involvement in E-learning	1–5	57.1
	6–10	32.9
	11–15	6.1
	16–20	3.2
	Above 21	0.6

Table 9 (continued)

Profile	Options	Percentage (%)
Years of Experience in ICT	1–5	26.1
	6–10	27.8
	11–15	17.4
	16–20	17.0
	21–25	7.0
	26–30	2.6
	31–35	1.5
	36–40	0.6
Employment Type	Permanent	92.7
	Contract	5.6
	Part time	1.7
Educational Field	Management/Business/Accounting/Finance	28.6
	Sciences	2.7
	Technology	0.7
	Engineering	27.6
	Computer science	10.1
	Social science	7.1
	Health & Medicine	1.2
	Arts & Humanities	9.4
	Agriculture	1.2
	Law	0.7
	Mathematics & Statistics	4.9
	Architecture & Building	1.0
	Others	4.7
Voluntary Number of BL Training Attended 2016–2018	1–3	88.2
	4–6	9.1
	7–10	2.7

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