Smart learning adoption in employees and HRD managers

Junghwan Lee, Hangjung Zo and Hwansoo Lee

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Abstract
The innovation of online technologies and the rapid diffusion of smart devices are changing workplace learning environment. Smart learning, as emerging learning paradigm, enables employees’ learning to take place anywhere and anytime. Workplace learning studies, however, have focused on traditional e-learning environment, and they have failed to capture the features of new learning environment and prove its impact on the adoption. As a result, they have failed to align educational needs of employee and technology-oriented approach of organisation. Thus, this study addresses the differentiated characteristics of smart learning and analyse how this characteristics influence its adoption. In order to suggest the way of successful adoption, this study compares adoption behaviour of employees and HRD managers, as a learner and a coordinator of learning. The results demonstrate that mobility and personalisation of smart learning is crucial for the adoption. According to comparative analysis, the adoption behaviour of smart learning also differs in employees and HRD manager. HRD manager emphasise perceived ease of use as a reason for adoption, while employees emphasise perceived usefulness. Mobility, interactivity, personalisation and collaborativeness, which are important features of smart learning, have different effects on perceived ease of use and perceived usefulness for the two groups. This analysis provides useful guidance for practice to adopt smart learning successfully.

Introduction
In order to improve their success in globally competitive markets, in recent years, companies have been steadily increasing their focus on and investment in human resource development (HRD). One effective method of approaching HRD is that of workplace learning, which occurs when a company supports its employees by offering opportunities for continued learning and professional development (Capece & Campisi, 2013).

Companies have used workplace learning in various ways. In particular, they have increasingly relied on e-learning and mobile learning (m-learning) (Lee, Hsieh & Ma, 2011). Recently, with the advent of smart devices and the development of novel online technologies (eg, cloud computing, social networking services), m-learning has evolved into “smart learning” and has garnered increasing attention from different organisations in a variety of industries (Kim, Song & Yoon, 2011). These technological evolutions have prompted researchers to investigate workplace learning in more detail, considering different and evolving learning techniques.
New approaches to learning are thus necessary in order to effectively investigate the adoption of workplace learning approaches within new learning paradigms.

Firstly, technology adoption research must consider recent trends in learning services. The existing literature on this topic encompasses the adoption and acceptance of e-learning, m-learning, and various other types of workplace learning (eg, virtual learning, online systems). However, it has not yet extensively investigated the issues within different smart learning approaches (eg, methods, interactions, learning behaviour, content).

Firms have recently begun utilising smartphones and tablet PCs in the workplace. These smart devices allow workplace learning to take place anywhere and anytime. Furthermore, it allows student-centric education by enabling collaboration and communication. While it is true that m-learning enabled the mobility aspect of smart devices, it was limited to displaying the contents of PC-learning on the phone screen. Therefore, it is necessary to understand the evolving context of workplace learning (eg, rise of smart devices and changes in the modes of communication).

Secondly, new approaches to technology adoption research should consider different interest groups like HRD Managers, because much of the literature that is currently available on workplace learning and e-learning has concentrated on employees in large enterprises (Beamish, Armistead, Watkinson & Armfiled, 2002).

It is necessary to incorporate the opinions of HRD Managers as they are the key people who decide on the use of technology, the choice of educational institution, educational program planning, etc. (Nystroma, Ramamurthy & Wilson, 2002). Therefore, research into smart learning adoption by HRD Managers will reveal meaningful managerial and academic implications.

Practitioner Notes

What is already known about this topic

- ICT (information and communications) can be applied to innovate learning and teaching.
- The firms are increasing investment on workplace learning to enhance personnel competency.
- Researches on workplace learning mainly focus on e-learning.

What this paper adds

- Smart learning is a new paradigm that can resolve the constraints of conventional online learning.
- Smart learning is important to provide ubiquitous access.
- HRD managers are not the learners; they are the ones with significant power/influence in the decision-making process.

Implication for practice

- Employees and HRD managers perceive smart learning differently, therefore, firms need to resolve the differences between the preferences, learning purpose, content type, etc.
- In order to enhance the collaboration of smart learning, current information service such as social network service (SNS) will be useful.
- Firms need to provide customised learning programs to satisfy needs of different individuals.
Thirdly, it is necessary to identify the differences between the perceptions of employees on smart learning and those of HRD Managers as this is essential for the successful implementation of a smart learning environment.

Existing literature has either focused on the satisfaction of the learner (Sun, Tsai, Finger, Chen & Yeh, 2008) or the differences between the learner and instructor on e-learning adoption (Bhuasiri, Xaymoungkhoun, Zo, Rho & Ciganek, 2012; Liaw, Huang & Chen, 2007). For smart learning, which is based on various information technologies, the implementation of a smart learning system is a more significant determinant of learning performance than it is for e-learning/m-learning (Chaudhary, Agrawal & Jharia, 2014). In addition, employees are the ones that benefit from smart learning while HRD Managers are the ones who adopt the service. Therefore, it is mandatory for firms seeking to implement an effective smart learning environment to take into account and compare both entities’ perspectives and adoption behaviour.

This paper is organised as follows: the next section presents a literature review, and the subsequent sections offer descriptions of the research model and the hypotheses of this study. These are followed by sections describing the data collection and measurement methods for this study, as well as the results of the data analysis. The final sections discuss the significance of the research, deduce important implications and limitations, and present topics for future study.

**Literature review**

**Smart learning**

Smart learning, as a new educational paradigm, was recently introduced by the Korean government, who defines it as involving an educational environment that provides self-learning, self-motivated and personalised services through smart devices (Kim, Cho & Lee, 2013). While the concept of smart learning has been discussed in practice, it has not yet been defined in extant literature.

Smart learning should be defined considering multiple aspects because m-learning and ubiquitous-learning overlap with some aspects of smart learning. Scholars who have addressed this topic emphasise that the concept of smart learning should not be limited to the utilisation of new devices such as smartphones or tablets (Kim et al., 2013). Noh, Ju and Jung (2011) have explained that smart learning is a concept that combines the advantages of u-learning and social learning, and that it occurs in learner-initiated and collaborative learning environments, based on interactive digital content and services. Therefore, smart learning can be regarded as a learner- and service-oriented education technique, rather than one that is focused on devices. It can be defined as learning in an interactive, intelligent, and tailored learning environment that is based on advanced technologies and services (e.g., context-awareness, augmented reality, cloud computing, and social network service). In addition, the changes in telecom infrastructure are facilitating smart-learning as 4G and Wi-Fi infrastructure is being deployed and unlimited data plans are being introduced. Learners can now access smart learning anywhere, anytime without having to worry about paying for the communication. Figure 1 summarises the key features of e-learning, m-learning, and smart learning.

**Learning adoption research in the workplace**

Much of the existing educational literature on technology has analysed learning adoption. Past researchers have utilised various research models such as the theory of planned behaviour (TPB), the technology acceptance model (TAM), the extended technology acceptance model (E-TAM), and the unified theory of acceptance and use of technology (UTAUT). In particular, research into workplace learning has employed key concepts such as e-learning, m-learning, and web-based
learning systems, and has analysed different groups of respondents such as employees, construction professionals, blue collar workers, and nurses. Existing studies usually emphasise perceived usefulness (PU) and consider additional factors that affect the adoption or acceptance of learning technologies such as social norms, flows, and social influences. However, most previous studies have been conducted within the context of conventional e-learning systems and have limited their focus to learning adoption by general users rather than technology acceptance by HRD Managers. Table 1 provides a summary of current studies on learning adoption and acceptance in the workplace.

### Research model

This study develops a research framework based on the TAM, which is a common model used in technology acceptance and adoption research into innovative products (Venkatesh & Davis, 2000).

The research model employed PU and perceived ease of use as the antecedents of smart learning adoption. The variables that affect the primary factors were deduced from existing e-learning and m-learning literature: mobility, interactivity, personalisation, and collaborativeness. By selecting these variables, this paper analyses the effects of the factors and relationships among the factors on smart learning adoption.

In addition, this study distinguishes between innovation adoption by employees and HRD Managers. For employees using smart learning, the research identifies how its different features enhance usefulness and ease of use.

For HRD Managers, the research identifies how smart learning attributes enhance the firm’s overall performance by fostering employees’ capabilities and implementing an effective smart learning environment. The research model for this study is illustrated in Figure 2.

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<table>
<thead>
<tr>
<th>Wireless Broadband (4G, WiFi)</th>
<th>Smart learning (2010s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Formal and informal learning</td>
</tr>
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<td></td>
<td>• Social and collaborative learning</td>
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<td></td>
<td>• Personalised and situated learning</td>
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<td>• Application and content focus</td>
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<thead>
<tr>
<th>Wireless Internet (2/3G, Wireless Lan)</th>
<th>Mobile learning (2000s)</th>
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<tbody>
<tr>
<td></td>
<td>• Supplement for e-learning within formal education</td>
</tr>
<tr>
<td></td>
<td>• Portability &amp; connectivity</td>
</tr>
<tr>
<td></td>
<td>• Device focus</td>
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<table>
<thead>
<tr>
<th>Wired Internet</th>
<th>e-Learning (1990s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Supplement for offline formal education</td>
</tr>
<tr>
<td></td>
<td>• Cost reduction</td>
</tr>
<tr>
<td></td>
<td>• Browser focus</td>
</tr>
</tbody>
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![Figure 1: Online learning paradigm](image-url)
<table>
<thead>
<tr>
<th>Authors</th>
<th>IS applications</th>
<th>Samples</th>
<th>Theoretical framework</th>
<th>Research purpose and result</th>
</tr>
</thead>
</table>
| Cheng, Wang, Moormann, Olaniran and Chen (2012) | e-learning      | 222 employees      | Expectancy-theoretical model, TAM | • Investigates the impact of the organisational learning environment on employee motivation toward a workplace e-learning system.  
  • The perceived job support has a moderating effect on the relationship between employees’ perceived usefulness and intention to use. |
| Cheng, Yu, Huang, Yu and Yu (2011)          | m-learning      | 264 employees      | UTAUT                 | • Investigated whether the differences of gender, age, and occupation for m-learning showed significance on the utilisation of the mobile devices.  
  • Social influence has significant effects on m-learning intention.  
  • Male and elder employees should be put more emphasis on the communication to enhance m-learning intention. |
| Karaali, Gumussoy and Calisir (2011)        | e-learning      | 546 blue-collar workers | E-TAM                 | • Identifies the influencing factors on a web-based learning system adoption.  
  • Social influence is a stronger predictor of user intention to use. |
| Lee et al (2011)                            | e-learning      | 357 employees      | TAM                   | • Examines influencing factors on employees’ adoption and use of e-learning system  
  • Organisational and management support significantly affected perceived usefulness and intention to use. |
| Lin (2011)                                  | e-learning      | 256 employees      | TAM                   | • Explores the determinants of the e-learning continuance intention and the moderating effects of among the determinants.  
  • Negative critical incidents and attitude are important for the users’ intention.  
  • Perceived ease of use has a more critical effect on less experienced users, whereas perceived usefulness has a stronger impact on experienced users. |
| Wang, Wu and Wang (2009)                    | m-learning      | 330 employees      | UTAUT                 | • Investigates the determinants of mobile learning acceptance in five organisations in Taiwan.                                           
  • Performance expectancy, effort expectancy, social influence, perceived playfulness, and self-management significantly impact on behavioral intention. |
Hypotheses
Based on the theoretical components of the TAM, this paper proposes the following hypotheses with regard to the adoption of smart learning in workplace learning:

**Perceived usefulness**
PU is generally defined as the degree to which an individual believes that a particular system will enhance job performance. Previous studies have revealed that PU positively affects users’ behavioural intentions to use systems (Venkatesh & Davis, 2000). In the context of this research, employees and HRD Managers believe that using smart learning will enhance individual and company performance. If they perceive smart learning to be useful, it will have a positive effect on their acceptance of smart learning.

H1: Perceived usefulness has a positive effect on the intention to use smart learning.

**Perceived ease of use**
Perceived ease of use (PEU) refers to the degree to which an individual believes that using a particular system will be free of effort. Generally, research has indicated that PEU has a positive effect on users’ behavioural intentions (Venkatesh & Davis, 2000). With regard to a personal or organisational context, employees and HRD Managers believe that using smart learning will contribute to reducing effort and facilitating workplace learning.

H2: Perceived ease of use has a positive effect on the intention to use smart learning.

As to the influence of PEU on PU, the lower the complexity required for the use of smart learning, the lower the cost will be, which makes the value of using smart learning higher. Thus, there is a positive correlation between PEU and PU (Barua & Whinston, 1996).

H3: Perceived ease of use has a positive effect on the perceived usefulness of smart learning.

**Mobility**
Mobility is perceived to be the most significant feature of mobile services (Mallat, Rossi, Tuunainen & Oorni, 2008). In the past, m-learning infrastructure was not capable of allocating the necessary resources for learning. However, more developed smart learning environments have recently allowed users to be constantly connected to Wi-Fi and 3G/4G mobile networks (Cho, Park, Nam, Ahn & Lee, 2012), and provided convenience, expediency, and immediacy.
where users can learn whatever they want to learn anywhere, anytime (Seppälä & Alamäki, 2003). Accordingly, smart learning, based on mobility, can support employees who are seeking content that they need or are curious about, as well as encouraging collaboration, mutual inquiry, and time-efficient learning.

H4: Mobility has a positive effect on the perceived usefulness of smart learning.
H5: Mobility has a positive effect on the perceived ease of use of smart learning.

Interactivity
Interactivity is defined as the ability to communicate between two or more objects (including other users) and to mutually influence these objects (Higgins, Mercier, Burd & Joyce-Gibbons, 2012). It is one of the most important factors in online learning (Moore, 2001). Therefore, interactivity is essential to reflect learners’ circumstances and enhance their abilities. In smart learning environments, advanced technologies like social network service (SNS), video conference systems, and online discussion forums enhance the possibility of meaningful interaction and improve the exchange of content (Arturo & Javier, 2010). This enables employees to contact others more personally, exchange ideas, provide real-time feedback, and thereby more actively strengthen their own knowledge base by means of data and information sharing.

H6: Interactivity has a positive effect on the perceived usefulness of smart learning.
H7: Interactivity has a positive effect on the perceived ease of use of smart learning.

Personalisation
Personalisation in an online learning context is to consider the learner’s characteristics such as ability, preferences, interests, and behaviour (Chen, Lee & Chen, 2005). In order to improve the learner’s performance, providing a personalised learning service for these characteristics is critical (Klašnja-Milićević, Vesin, Ivanović & Budimac, 2011). In a smart learning environment, it is easier than before to develop a personalised learning system by using user-specific devices (eg, smart phone, tablet, PC), various sensors, fast network, and mobile applications. This personalised service is effective for engagement and provides a satisfactory and responsive learning experience for learners (Ashman et al, 2014). As the personalisation also requires minimal interaction with the system, the learners can easily control the system and quickly access learning content.

H8: Personalisation has a positive effect on the perceived usefulness of smart learning.
H9: Personalisation has a positive effect on the perceived ease of use of smart learning.

Collaborativeness
The concept of collaborativeness in smart learning is similar to human-to-human interaction, but is a more extended concept than the human interactions of previous learning paradigms. In general, human interactions in traditional e-learning mean educational or formal interactions between learners or the learner and instructor. However, collaborativeness in smart learning refers to a learning environment based on social interactions, and includes both formal and informal interactions beyond the learner’s organisational boundary.

In workplace learning, social interaction between employees is important for sharing explicit and tacit knowledge of practices between individuals, groups, and organisations (Wang, 2011). Previous learning environments have sufficiently provided explicit or codified knowledge through a formal learning process, but sharing tacit knowledge was limited. On the other hand, tacit knowledge can easily be acquired in a smart learning environment, which provides a collaborative learning setting (Frankl & Bitter, 2013). Through smart devices and technologies, learners can effectively communicate and collaborate with others, and even create learner-oriented and
innovative content. In addition, exercises and adequate technical support for the learning environment are easy through the collaborative interaction.

H10: Collaborativeness has a positive effect on the perceived usefulness of smart learning.

H11: Collaborativeness has a positive effect on the perceived easy of use of smart learning.

**Data collection and measurement**

This study focuses on comparing the adoption behaviour of a general user and an HRD Manager. Although an employee-oriented learning environment is important for successful adoption, it is not employees but HRD Managers that typically make the decisions on aspects such as learning methods, courses, and institutions. There may be different perspectives regarding the adoption of a new learning environment. Thus, comparing and analysing these perspectives makes it possible to accurately understand the gap between smart learning adoption on both the practical and academic levels.

The survey respondents in this study were selected from the firm list of a professional marketing research agency that has prior experience in conducting national e-learning industry status surveys. The subject firms were selected through stratified random sampling, taking into account the number of employees in the firm (Greener, 2008). The respondents at the selected firms were then interviewed face-to-face by well-trained interviewers. Monetary rewards were provided to encourage active participation by the respondents. Through this process, responses were collected from 342 employees and 158 HRD Managers. The sample presented a broad range of geographical and workplace diversity, so it was confirmed that sample bias is not an issue to conduct the analyses. The demographics of the respondents are presented in Table 2.

For this study, a specific questionnaire was designed to model smart learning adoption. Most constructs in the research model were measured by using existing validated measures. Some items were modified specifically for this research (see Table 3). Each statement was measured on a 7-point Likert scale, with 1 indicating “strongly disagree” and 7 indicating “strongly agree.”

**Analysis and results**

This study applied the partial least squares (PLS) method to investigate the proposed model. The PLS method is a component-based structure equation model (SEM) technique that analyses the

<table>
<thead>
<tr>
<th>Variables</th>
<th>Employee</th>
<th>HRD manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>170 (50%)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>172 (50%)</td>
</tr>
<tr>
<td>Age</td>
<td>20s</td>
<td>59 (17%)</td>
</tr>
<tr>
<td></td>
<td>30s</td>
<td>168 (49%)</td>
</tr>
<tr>
<td></td>
<td>40s</td>
<td>103 (30%)</td>
</tr>
<tr>
<td></td>
<td>More than 50s</td>
<td>12 (4%)</td>
</tr>
<tr>
<td>Company size</td>
<td>Small (≤49 employees)</td>
<td>89 (26%)</td>
</tr>
<tr>
<td></td>
<td>Medium (50–299 employees)</td>
<td>186 (54%)</td>
</tr>
<tr>
<td></td>
<td>Large (300 employees –)</td>
<td>67 (20%)</td>
</tr>
<tr>
<td>Industry</td>
<td>Finance/Insurance</td>
<td>39 (12%)</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>62 (18%)</td>
</tr>
<tr>
<td></td>
<td>IT/System</td>
<td>66 (19%)</td>
</tr>
<tr>
<td></td>
<td>Learning/contents</td>
<td>85 (25%)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>90 (26%)</td>
</tr>
<tr>
<td>Total</td>
<td>342 (100%)</td>
<td>158 (100%)</td>
</tr>
</tbody>
</table>
causal relationships among multiple variables. Based on inner and outer relationships, the estimates of latent variable scores are determined, and the coefficient values of the relationships are calculated after approximation procedures are carried out (Hsu, Chen & Hsieh, 2006). PLS is an effective method that can explicate the complex relationships of latent constructs for small to medium sample sizes. It can also be used to avoid statistical issues such as inadmissible solutions, factor indeterminacy, and non-convergence (Wetzels, Odekerken-Schroder & Van Oppen, 2009). Since this study investigates the complex relationships between latent variables and involves a relatively small sample, the PLS method was selected.

Measurement model
In order to assess the adequacy of the measurement model, checking reliability and validity is required. The reliability of measures can be tested by composite reliability (C. R.). When C. R. is greater than 0.7, the measures are considered reliable. The C. R. value of each construct varied from 0.705 to 0.944 and, thus, were all above the recommended level (0.7). For the validity of measures, convergent validity and discriminant validity were tested. Convergent validity means whether each indicator of a construct sufficiently justifies the construct, which can be evaluated by factor loading (loading > 0.5) and average variance extracted (AVE > 0.5). All factor-loading values from the confirmatory factor analysis exceeded 0.5. The AVE, which ranged from 0.603 to 0.848, was also greater than the cutoff value (See Table 4).

Discriminant validity means that the indicators of the construct being used are significantly different from indicators of unrelated constructs. Discriminant validity is assessed by comparing the square root of the AVE for a given construct with other correlations. The square root of AVE

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Item</th>
<th>Measure</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility (Mo)</td>
<td>Mo1</td>
<td>Smart learning has an outstanding advantage in mobility.</td>
<td>(Huang, Lin &amp; Chuang, 2007)</td>
</tr>
<tr>
<td></td>
<td>Mo2</td>
<td>It is convenient to access (connect) smart learning anywhere at anytime.</td>
<td></td>
</tr>
<tr>
<td>Interactivity (In)</td>
<td>In1</td>
<td>Smart learning support various interactive tool in workplace learning.</td>
<td>(Paechter, Maier &amp; Macher, 2010)</td>
</tr>
<tr>
<td></td>
<td>In2</td>
<td>Smart learning system gives very quick response to the learner’s request.</td>
<td></td>
</tr>
<tr>
<td>Personalisation (Pe)</td>
<td>Pe1</td>
<td>Smart learning system provides personalised learning functions to employees.</td>
<td>(Tam &amp; Ho, 2006)</td>
</tr>
<tr>
<td></td>
<td>Pe2</td>
<td>Employees can select and combine appropriate learning contents to them.</td>
<td></td>
</tr>
<tr>
<td>Collaborativeness (Co)</td>
<td>Co1</td>
<td>Employees can create content together and share them.</td>
<td>(John, Frances &amp; Hin-wah, 2003)</td>
</tr>
<tr>
<td></td>
<td>Co2</td>
<td>Through social network services, learners can have class together, and recommend good contents to each other.</td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness (PU)</td>
<td>PU1</td>
<td>Smart learning system enhances the effectiveness of workplace learning in our company.</td>
<td>(Venkatesh &amp; Davis, 2000)</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>Using smart learning system improves the learning performance of our company.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>Using smart learning system in workplace learning improves our company’s productivity.</td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use (PEU)</td>
<td>PEU1</td>
<td>Smart learning system is easy to use in workplace learning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEU2</td>
<td>Using smart learning system does not demand much care or attention in workplace learning.</td>
<td></td>
</tr>
<tr>
<td>Adoption intention (AI)</td>
<td>AI1</td>
<td>Given the opportunity, our company hopes to use smart learning system in workplace learning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AI2</td>
<td>Our company intends to use smart learning system as soon as possible.</td>
<td></td>
</tr>
</tbody>
</table>
should be greater than the correlations between that construct and all other constructs. Table 5 presents the correlation matrix from this study, including the square root of the AVE. As shown in Table 5, the square roots of all AVEs are larger than the correlations. This confirms that the discriminant validity of the constructs was satisfied (Fornell & Larcker, 1981).

**Table 5: Correlation matrix**

<table>
<thead>
<tr>
<th>Employee</th>
<th>HRD manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mo</td>
<td>0.84</td>
</tr>
<tr>
<td>In</td>
<td>0.24</td>
</tr>
<tr>
<td>Pe</td>
<td>0.41</td>
</tr>
<tr>
<td>Co</td>
<td>0.43</td>
</tr>
<tr>
<td>PU</td>
<td>0.60</td>
</tr>
<tr>
<td>PEU</td>
<td>0.56</td>
</tr>
<tr>
<td>AI</td>
<td>0.37</td>
</tr>
</tbody>
</table>

| 1   | 2 | 3 | 4 | 5 | 6 | 7 |
| Mo  | 0.89 |       |   |   |   |   |
| In  | 0.05 | 0.91 |   |   |   |   |
| Pe  | 0.50 | 0.40 | 0.78 |   |   |   |
| Co  | 0.47 | 0.40 | 0.62 | 0.86 |   |   |
| PU  | 0.60 | 0.29 | 0.60 | 0.50 | 0.92 |   |
| PEU | 0.78 | 0.19 | 0.49 | 0.46 | 0.56 | 0.88 |
| AI  | 0.52 | 0.32 | 0.57 | 0.53 | 0.56 | 0.57 | 0.86 |

**Structural model**

The statistical significance of the proposed hypotheses was assessed by the bootstrap re-sampling method. This method, which extracts additional samples from an original data set, is effective for enhancing statistical power when the sample data is relatively small. The bootstrap re-sampling method has been applied to various research fields and statistical methods (Brás, Lopes, Ferreira & Menezes, 2008). In this study, we conducted the method with 1000 bootstrap samples, satisfying the generally recommended subsample size requirements.

The global goodness of fit (GoF) of the proposed model was also tested with the geometric mean of the AVE and the average $R^2$ (Tenenhaus, Esposito Vinzi, Chatelin & Lauro, 2005). The minimum cut-off value of the GoF for the structural model is 0.31 ($\text{GoF}_{\text{small}} = 0.31$, $\text{GoF}_{\text{medium}} = 0.41$, $\text{GoF}_{\text{large}} = 0.58$) (Chin, 1998; Fornell & Larcker, 1981). In this study, the GoF for the model for employees was 0.586 and that of the HRD Managers was 0.626. This result showed that the proposed model satisfied the GoF criteria and had better than medium explanatory power.

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According to the hypothesis-testing results, the PU and PEU for smart learning adoption were found to be statistically significant for both the employee and the HRD Manager. This is consistent with existing literature on TAM-based e-learning acceptance research. Mobility (Mo), which strongly influences both PU and PEU, was also determined to be important to firms’ acceptance of smart learning. Personalisation was a significant antecedent for PU in both cases. On the other hand, interactivity, personalisation, and collaborativeness had a different impact on PU and PEU in both the cases. Moreover, other path coefficients and their significances varied considerably in both cases. This shows that there is a difference in adoption behaviour between employees and HRD Managers (see Figure 3).

In order to examine the difference thoroughly, this study applied a comparative analysis method. According to Chin (1998) and Esposito Vinzi, Chin, Henseler and Wang (2010), the differences in the path coefficients of the two groups can be tested with the following equation:

\[ \text{GoF} = \sqrt{\text{AVE} \times R^2} \]

**Figure 3: Hypotheses testing results**
Interestingly, employees exhibited more dependence on PU (0.546) than on PEU (0.162) with regard to their adoption intention (AI), while HRD Managers exhibited the opposite tendency, with more depending on PEU (0.375) than PU (0.356). In addition, PU had statistically stronger effects on AI in employees rather than in HRD Managers, while PEU showed the opposite trend.

If the significant relationship is found in only one case, it is possible to conclude that there is a difference (Esposito Vinzi et al., 2010). In our analysis, PEU had a significant impact on PU in employees only. Mobility, which was considered to be important in this research, had a stronger influence on PEU for HRD Managers than for employees. The relationship between In and PEU was found to be significant only for the HRD Manager sample. The significant relationships between Pe and PEU (H9), and PEU and Co (H10) were observed only in the employee sample (see Table 6).

### Conclusion and implications

The results of this study suggest that smart learning is an appropriate means of workplace learning because it presents advantages such as mobility, interactivity, personalisation, and collaborativeness, as compared with conventional e-learning and m-learning approaches. However, the results of a comparative analysis show that employees, as learners, have a different perspective of smart learning adoption from HRD Managers. Thus, HRD Managers should consider the following differences when they plan to adopt or implement a smart learning environment:

Firstly, employees are more focused on the usefulness of the smart learning system rather than ease of use, whereas HRD Managers are more concerned with ease of use. Considering the
relatively weak effect of PEU on PU in the employee group, it seems that PEU is considered as a basic condition and not a critical factor for the adoption. However, HRD Managers, as people responsible for the learning environment, expect many employees to use the smart learning system actively, so they tend to decrease the complexity or increase the usability of the system. As current employees have used a PC, the internet, and various applications at their workplace for a long time, and smart devices are common, they are used to encountering new systems and services. Therefore, it is effective to focus on the improvement of its usefulness (eg, quality, practicality, and diversity of learning content) for successful smart learning adoption.

Secondly, this study identified the important role of personalisation and collaborativeness in a smart learning environment. Although mobility was also an important antecedent of PU for employees, personalisation had the strongest impact on PU. Collaborativeness also significantly influenced PU in the employee group. This means that personalisation and collaborativeness, which are differentiated features of smart learning, are relatively more important than others, as the concepts of mobility and interactivity have already been introduced in m-learning. It suggests that companies should focus on how to provide personalised and collaborative learning content through a smart learning environment in order to increase the usefulness of the environment.

Thirdly, mobility had a strong impact on PEU rather than PU in both groups. Mobility is a major advantage of mobile systems, and it is considered an important antecedent of PU for mobile service adoption. This relationship has been empirically proved in various mobile service contexts (eg, mobile payment and game context) (Park, Baek, Ohm & Chang, 2014; Schierz, Schilke & Wirtz, 2010). However, our results show that mobility is more closely associated with PEU than PU. This may be due to the contextual or situational difference. In general, learners tend to study in specific places where they can focus (eg, home, office, and library), so the diversity of the learning place is relatively low. In this perspective, the mobility in learning environment may not be of great advantage for learners. Thus, employees, as learners, may perceive mobility as a secondary factor for convenience or usability of the system, rather than as a major factor for the quality of learning.

To summarise, this study has shown that it is important for HRD Managers to consider the differences between their and employees’ perspectives of the successful adoption of smart learning. The HRD Manager cared more about technological factors such as ease of use or mobility. On the other hand, employees considered the practicality (usefulness) and differentiated features (personalisation and collaborativeness) of smart learning. Therefore, it is important to consider the different aspects of smart learning and what employees really want to do when HRD Managers design a smart learning environment.

Limitations and further study
This study provides various implications for academia and practice, but further study is required to overcome a few limitations.

According to the results, the relationships between interactivity and mediators (PU and PEU) were not significant among employees. This can be interpreted in two ways: as learners have already experienced interactivity from an e-learning environment, they perceived interactivity as a less important factor than others (mobility, personalisation, and collaborativeness). Accordingly, its statistical significance could not be observed. The other reason could be that interactivity can be a different mediator of a different variable, which is not considered in the research model, such as perceived enjoyment. Therefore, for a detailed analysis, further study and discussions are required with an extended research model.

This study did not consider industrial characteristics and a propensity of respondents, and the sample of this study was relatively diverse (construction, finance and insurance). However, the
acceptance may vary in different industries due to the existence of industrial (manufacturing, services, etc.) and functional (technical, sales, office, etc.) differences. Individual characteristics can also influence the acceptance of smart learning. In order to generalise our findings, future studies considering these limitations are required.

References

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