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Original Citation

Ahmed, Ejaz and Ward, Rupert (2016) Analysis of factors influencing acceptance of personal, academic and professional development e-portfolios. Computers in Human Behavior, 63. pp. 152-161. ISSN 0747-5632

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Abstract This research investigates factors that influence students' intentions to use personal, academic and professional development portfolios using a theoretical model based on the Decomposed Theory of Planned Behaviour (DTPB). Electronic portfolios (e-portfolios) are important pedagogical tools and a substantial amount of literature supports their role in personal, academic and professional development. However, achieving students' acceptance of e-portfolios is still a challenge for higher education institutions. The model suggests that Attitude towards Behaviour (AB), Subjective Norms (SN) and Perceived Behavioural Control (PBC) and their decomposed belief structure can assist in predicting and explaining students' Behavioural Intention (BI) to use e-portfolios. After using e-portfolios, data was collected from 204 participants from a UK university and analysed through the Structural Equation Modelling (SEM) technique. The results demonstrated that the proposed personal, social and control factors in the model were well supported statistically and significantly influenced e-portfolio acceptance. The study provides for the first time a proven theoretical model which can be used to predict e-portfolio acceptance. The findings are valuable for system developers, educational developers and higher education institutions where e-portfolios are being used.

Keywords higher education; educational technology; theory of planned behaviour; technology adoption; e-portfolio

Introduction

Personal, academic and professional development planning have been heavily emphasised within UK higher education for the best part of two decades, with e-portfolios widely seen as an effective method of capturing this information. Beetham (2005) described portfolios as a "collection of documents relating to a learner's progress, development and achievements", in this study it is defined as a technologically-enhanced collection of contents related to an individual's personal, academic and professional development which can be used for reflection, skills development and presentation. One of the early drivers for the use of e-portfolios in the UK were the Dearing Report (Dearing, 1997) and the Leitch Report (Leitch, 2006). The Dearing Report proposed that UK higher education institutions should provide students with wider learning experiences through personal development planning. The Leitch Report built on this by emphasising the need to recognise and record students' achievements of skills at all levels, in a form suitable for employers, with e-portfolios providing a natural mechanism to do this. These changes drew significant attention from both educators and career advisors (Gerbic, Lewis, & Northover, 2009), with increased interest from higher education institutions in supporting graduate employability through helping students with developing and recording their skills (Brooks & Everett, 2009).

E-portfolios' role in providing learning, developing and showcasing personal, academic and professional skills is widely recognised (Abrami & Barrett, 2005; Jafari & Kaufman, 2006). Various projects and case studies have explored how e-portfolios develop effective practice through the application of e-portfolio and Personal Development Planning (PDP) (CRA, 2013; ePIC, 2014; JISC, 2014). Similarly, a considerable amount of literature identifies the teaching and learning opportunities offered by e-portfolios and supports their learning benefits

(Beetham, 2005; Madden, 2007; Garrett, 2011; McNeill & Cram, 2011). This paper is not a further attempt to explore these areas, but instead it focuses on how to achieve students' acceptance of e-portfolios as no substantial attempt has yet been made to investigate acceptance of e-portfolios by students. This study attempts to address this gap in knowledge by investigating the factors that influence students' intentions to use e-portfolios using a theoretical model based on the Decomposed Theory of Planned Behaviour (DTPB). The study uses a quantitative research approach to test the hypothesised relationships in the theoretical framework. The findings help to explain the relationship between students intention to use e-portfolios and the proposed factors in the model. The outcome of this research is valuable for system developers, educational developers and higher education institutions where e-portfolios are being used.

During the last two decades, considerable efforts have been made by researchers and practitioners to understand and explain adoption of ICT based solutions from various theoretical perspectives (Deborah Compeau, Higgins, & Huff, 1999; Armitage & Conner, 2001; Yousafzai, Foxall, & Pallister, 2007). The DTPB is a theoretical viewpoint amongst many others; such as Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (TPB) (Ajzen, 1985) and the Technology Acceptance Model (TAM) (Davis, 1989). All these theoretical perspectives have been used to investigate educational technology acceptance, including e-learning (Roca, Chiu, & Martínez, 2006; Selim, 2007; Liu, Liao, & Pratt, 2009) and classroom technologies (Landry, Griffeth, & Hartman, 2006; Claudia Smarkola, 2007; Ayesha Sadaf, Newby, & Ertmer, 2012). Even though theories on technology acceptance have been applied and their suitability has been tested, no widely accepted model for e-portfolios acceptance has ever been developed.

All the above theories are based on the beliefs-intention-behaviour structure (Venkatesh, Morris, Davis, & Davis, 2003; Shih & Fang, 2004). Within this structure, intention is a major factor, and this indicates that an individual's beliefs influence their behaviour (Ajzen, 1991). In the present study, intention is therefore viewed as an indicator of a student's acceptance of technologically-enhanced portfolios. The determinants of intention are different across the theories and models. Perceived Behavioural Controal (PBC) has an additional predictor of Behavioural Intention (BI) in TPB, whereas, TRA does not have PBC. The inclusion of this additional construct changes the charactersitics of TPB, as the addition of PBC contributes to predicting the behaviour where there is no volitional control (Ajzen, 1991; Taylor & Todd, 1995c). Similarly, the TPB, which provides understanding of technology acceptance behaviour by including attitudinal beliefs, social beliefs and control beliefs, is more of a general theory to predict any human behaviour (Ajzen & Fishbein, 1980). It does not specify the associated beliefs with a particular behaviour (George, 2004). The DTPB however decomposes the belief components into a stable set of multi-dimensional beliefs thus increasing the explanatory power of the model (Agarwal, 2000; Shih & Fang, 2004) and making it more applicable across various settings (Venkatesh, et al., 2003). Taylor and Todd (1995b) argued that decomposing the belief structure provides a deeper understanding of the determinants of intention. By using the Decomposed Theory of Planned Behaviour (DTPB) to identify and analyse factors that influence e-portfolio acceptance, a comprehensive and coherent set of characteristics can be developed and then compared to other models. This enables better insights to be gained into the factors which influence behavioural intention to use e-portfolios.

Theoretical framework

This study used behavioural intention to measure acceptance of e-portfolios. Moore and Benbasat (1991) argue that technology acceptance can be measured by individuals' intention to use technology as well as its actual usage. According to Ajzen (1991), Behavioural Intention (BI) is presumed to capture the influential factors that affect individuals' behaviour. This means, strong intentions to perform a certain behaviour mean an individual is more likely to perform that behaviour. In literature related to understanding human behaviour, the concept of intention holds a central place. It refers to a person's conscious plan to make effort in performing a particular behaviour (Eagly & Chaiken, 1993). Warshaw and Davis (1985) define behavioural intention as the degree to which a person has formulated "conscious plans to perform or not perform some specified future behaviour". According to Ajzen (2005), behavioural intention can successfully predict tendencies to perform a particular behaviour. The positive relationship between BI and Behaviour (B) has been confirmed (Sheppard, Jon, & Warshaw, 1988; Venkatesh & Davis, 2000; Sheeran, 2002; Ajzen, 2011; A Sadaf, Newby, & Ertmer, 2013). Various studies used Behavioural Intention (BI) to measure acceptance of different technologies such as spreadsheets (Mathieson, 1991), computer based assessment (Terzis and Economides 2011), e-learning (Lee 2010) and mobile learning (Cheon et al. 2012). This indicates, conceptualising BI to measure technology acceptance is a common practice among researchers.

The DTPB postulates that BI has three core constructs: Attitude towards Behaviour (AB), Subjective Norm (SN) and Perceived Behavioural Control (PBC) as illustrated in Fig. 1. AB is an individual's evaluation to perform a certain behaviour (Ajzen, 2005), SN is one's perception of how others would think if they perform a certain behaviour (Fishbein & Ajzen, 1975) and PBC is a person's perception of the ease or difficulty in performing a particular behaviour (Ajzen, 1991). The relationship between BI and the three determinants, AB, SN and PBC, is supported empirically (Sheppard, et al., 1988; Armitage & Conner, 2001; Yousafzai, et al., 2007; Ajzen, 2011; McEachan, Conner, Taylor, & Lawton, 2011). The theory decomposes these three constructs into specific beliefs, which means BI is formed by the cumulative influence of all belief components. In the context of the present study, positive feelings towards the use of e-portfolios can make students intend to use them. Introducing e-portfolios to students, facilitating their use and working with peers can influence students' behaviour towards e-portfolio usage. Similarly skills and facilitating conditions may influence intention to use e-portfolios. In conclusion, a student's intention to use e-portfolios is determined by their attitude towards using the e-portfolio, their subjective norms in relation to the e-portfolio and their perceived behaviour control over using the e-portfolio. Positive influences in these components should improve student's acceptance of e-portfolios. Based on the DTPB model and evidence from the empirical literature, it is hypothesised that:

H1 - Attitude towards the Behaviour (AB), Perceived Behavioural Control (PBC) and Subjective Norms (SN) have a positive influence on students' Behavioural Intention to use e-portfolio.

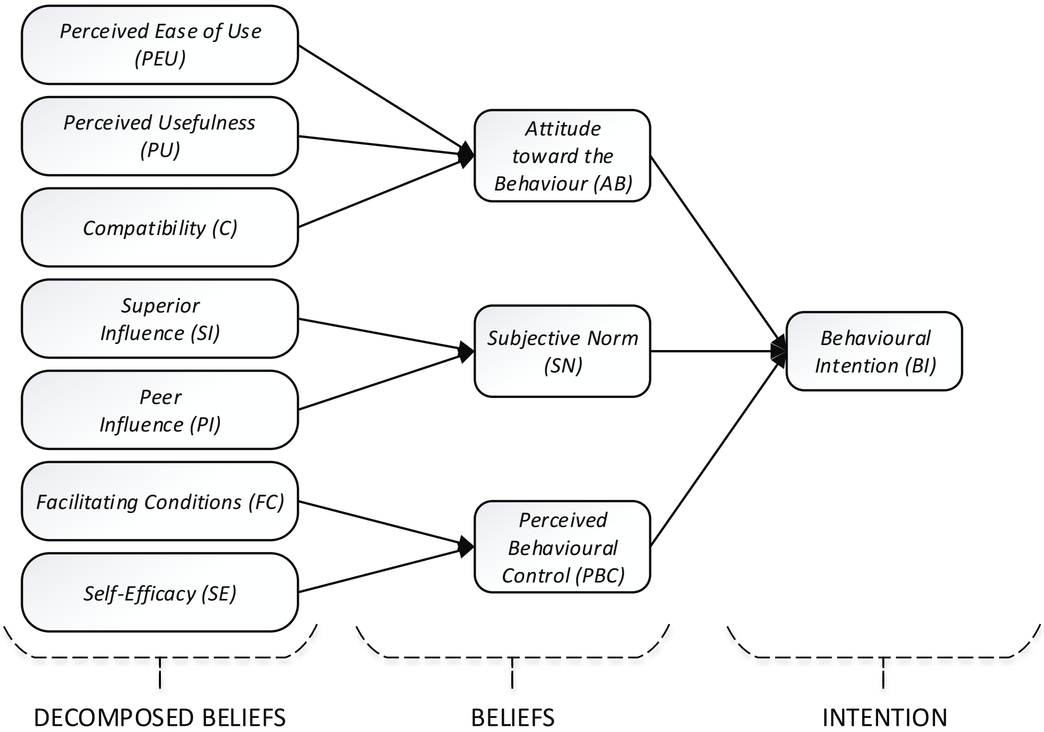


Fig. 1 The Conceptual Model of e-portfolio acceptance based on the DTPB *(Taylor and Todd 1995a)*

Based on the DTPB, Fig. 1 illustrates the causal relationships within the conceptual model. Considering Behavioural Intention to use as a measure of the acceptance of e-portfolios, the conceptual model is divided into three levels of constructs, intention, beliefs and decomposition of beliefs. Taylor and Todd (1995b) argue that decomposing the belief structure provides deeper understanding of the determinants of intention. The decomposition of beliefs help in overcoming operationalisation issues noted with other models such as the TRA, the TPB and the TAM (Mathieson (Mathieson, 1991; Shih & Fang, 2004). Moreover, the traditional models (TRA, TAM and TPB) have monolithic belief structures that represent a variety of dimensions (Taylor & Todd, 1995c), the DTPB instead provides us with specific beliefs that influence AB, SN and PBC to provide a more complete picture of the behaviour (Mathieson, Peacock, & Chin, 2001). It can therefore be claimed that decomposition of the belief structure can aid understanding of the factors that influence students' intention towards e-portfolio acceptance.

Attitudinal beliefs

Attitudinal beliefs, associated with Attitude towards Behaviour (AB) (Taylor & Todd, 1995b), represent evaluations to perform a particular behaviour (Ajzen, 2005). This positive and negative evaluation is a complex process that depends on characteristics that influence the beliefs about a particular behaviour (Ajzen & Fishbein, 1980). Decomposing the attitudinal belief structure can assist in exploring these characteristics, which play a considerable role in determining an individual's attitude towards technology adoption (Pituch & Lee, 2006).

The DTPB postulates that three characteristics influence attitude towards acceptance of new technology – Perceived Usefulness (PU), Perceived Ease Usefulness (PEU) and Compatibility. Davis (1989) used PU and PEU in the Technology Acceptance Model (TAM), which theorises that an individual's perception about system usefulness and ease of use influence his or her attitude towards system usage as well as his or her behavioural intention, which in turn determines system acceptance and its usage (Davis, 1989). He defined PEU as "the degree to which a person believes that using a particular system would be free from effort" and PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). In the present context, it is important that students perceive the e-portfolio as easy to use and useful if they are to be accepted. Despite the potential of e-portfolios to enhance students' academic and professional development, if students find them difficult to use their acceptance will be adversely affected.

The third factor, Compatibility, is defined as the degree to which a new information system is consistent with existing values, needs and past experiences (Moore & Benbasat, 1991). Individuals are more likely to adopt a system which is compatible with their existing needs and values (Tornatzky & Klein, 1982). Similarly, it can be argued that students' perceptions about the compatibility of e-portfolios with their existing beliefs and the role of e-portfolios in their personal, academic and professional development may affect acceptance of e-portfolios and influence the way they evaluate them. Based on this argument, the following hypothesis is proposed:

H2 - Perceived Ease of Use (PEU), Perceived Usefulness (PU) and Compatibility (C) have a positive influence on the students' Attitudes toward e-portfolios acceptance.

Normative Beliefs

Normative beliefs are associated with Subjective Norms (SN) and characterise the social influences that make a person perform certain behaviours (Ajzen, 1991). Taylor and Todd (1995b) identified two groups of individuals that could influence an individual's behaviour towards the usage of an information system – peers and superiors. They argued that monolithic normative structures may show no influence on subjective norms in situations where peers and superiors have opposite opinions. Superiors may encourage users to use a particular system but peers may have negative views about the system. In this study, Superior's Influence (SI) comes from lecturers whilst Peer Influences (PI) come from fellow students and friends. This agrees with other empirical studies conducted in the context of higher education (Taylor & Todd, 1995b; C Smarkola, 2011), and leads to the following hypothesis:

H3 - Superior Influences (SI) and Peer Influences (PI) towards e-portfolio usage have a positive influence on the Subjective Norms.

Control beliefs

Control beliefs, associated with Perceived Behavioural Control (PBC), were proposed by Ajzen (1985) in the TPB to represent non-volitional actions, where personal shortfalls and external barriers can obstruct performing a particular behaviour (Ajzen, 2005). Taylor and Todd (1995b) decomposed control beliefs into facilitating conditions and self-efficacy. They identified adequate time, money and technology as the key facilitating conditions, and their absence a technology acceptance constraint. Self-efficacy was introduced by Bandura (1977), and represents an individual's capabilities to perform a certain behaviour. The influence of self-efficacy on technology acceptance has broad support (DR. Compeau & Higgins, 1995; Taylor & Todd, 1995c; Moore & Benbasat, 1996), with high levels of self-efficacy linked to intention to use e-portfolios, and the following hypothesis is proposed:

H4 - Facilitating Conditions (FC) and Self-Efficacy (SE) to use e-portfolios have a positive influence on Perceived Behavioural Control.

Methodology

Research design

This research is based on a positivist paradigm, and is underpinned by scientific methods, with the hypothesised relationships tested via a quantitative research approach (Creswell, 2003). The hypotheses were based on a theoretical framework (Sekaran & Bougie, 2010) and a survey questionnaire was developed to test them. This is a common practice when using behavioural-based models (Armitage & Conner, 2001; Yousafzai, et al., 2007; Ajzen, 2011; McEachan, et al., 2011).

Data was collected and analysed after e-portfolio use by students from a higher education institution in England. This involved introducing, and facilitating, the use of e-portfolios within the sample group of students during the first few weeks of the first term of their studies. Students were given more than eight weeks to engage with the e-portfolio before conducting the survey at the end of the term. Data was collected anonymously using an online self-administered survey. A convenience sampling technique, a commonly used method for sampling in behavioural science research (Gravetter & Forzano, 2010), was used in this study, with the cohort of 267 undergraduate students. A large sample size is considered better when using SEM for analysis. Even though there is no fixed rule for sample size (Raykov & Maarcoulides, 2006; Sivo, Fan, Witta, & Willse, 2006), more than 200 participants is considered an adequate sample size as a general rule of thumb (Anderson, Sweeney, & Williams, 2011). In this study 204 valid responses were used for analysis, just above threshold.

The data was analysed using a Structural Equation Modelling (SEM) approach. In this approach complex statistical analyses were used to test the hypotheses above concerning the inter-relationships among multiple variables (Hoyle, 1995; Pallant, 2011). The rationale for applying a SEM approach lies in its capacity to analyse multiple observed and unobserved (latent) variables, as required in the current study. The data was analysed in two stages. First, a measurement level analysis was completed, which verified the reliability and validity of the instrument used. Next, a structural model was analysed, in which Goodness of Fit (GoF) indices were observed and the hypotheses were analysed.

Research Instrument

Behavioural Intention (BI) is a complex phenomenon, which is measured using latent constructs. Latent constructs are abstract concepts that cannot be observed directly or measured with a single item (Byrne, 2010). A set of questions was therefore used to measure each construct in the theoretical model, as suggested by Hair, Black, Babin, and Anderson (2010). An existing theoretical model, with previously tested factors, was used with the instrument consisting of validated measures which were modified to suit this study. The instrument was therefore tested to establish the validity and reliability of items and questions after modification.

The constructs in the theoretical model were measured using 32 items, divided into four sections. The first section was attitudinal beliefs and its constructs, the second section normative beliefs and its constructs, the third section controlled beliefs and its constructs, and the fourth section Behavioural Intention. All items for each construct were measured using the format proposed by Likert (1932), a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

The instrument was analysed in stages to verify its reliability and validity and to confirm theoretically meaningful questions. Content validity was established at the pre-pilot stage. An internal consistency reliability test was conducted at the pilot study stage and again at the main study stage. More complex approaches within Structural Equation Modelling (SEM) were used at the main study stage, such as composite reliability and construct validity. Content validity was established via literature review, expert advice and empirical assessment, as suggested by Straub, Boudreau, and Gefen (2004). As the constructs were measured using previously validated items, with some items modified to suit the existing research, the questionnaire was reviewed by academic experts and pre-piloted before conducting the pilot study. An internal consistency test was conducted using the pilot study data, and this test examined the degree to which the items used in the instrument were consistent in their measurements (Eagly & Chaiken, 1993; Hair, et al., 2010). For this test, Cronbach's α values were evaluated as this method is well-accepted within academic research (Tabachnick & Fidell, 2013). In general, reliability scores are considered good at around 0.7 and very good at 0.8 or above (Andrews, Robinson, Shaver, & Wrightsman, 1991; Sekaran, 2003; Hair, Money, Samouel, & Page, 2007). Cronbach α from the main study are shown in Table 1. At both stages, pilot and main, the Cronbach α reliability statistics were greater than 0.7, which means internal consistency reliabilities were acceptable. The remaining tests on instruments were conducted as part of the measurement level analysis of the main study data.

Analysis and Results

To determine whether the DTPB was a good model for predicting students' behaviour, a two-step analysis approach was used, measurement and structural level. The quality of the adopted measures was assessed at measurement level before testing structural relationships among the latent constructs at structural level.

Measurement level analysis

At this stage, inter-relationships between latent constructs and observed variables were assessed. This analysis ensures the quality of the adopted measures before testing structural relationships among the latent constructs. Composite reliability and construct validity of the instrument were both established, which was important in order to obtain reliable results (Sekaran, 2003). The validity of the instrument was established by assessing whether it measured what it was designed to measure (Pallant, 2011). The reliability of measurement (the degree to which the items used in an instrument are consistent in their measurements (Eagly & Chaiken, 1993)) was tested via a composite reliability test. The composite reliability, which is often used in conjunction with SEM, measures the reliability of the latent variables. The recommended value of composite reliability is 0.70 or higher (Nunnally & Bernstein, 1994). As shown in the results presented in Table 1, the composite reliability values exceeded the minimum threshold for all constructs.

Construct validity was assessed through convergent validity, discriminant validity and nomological validity, as suggested by Straub, et al. (2004). Convergent validity is the extent to which a measure correlates with other measures of the same construct (Robins, Fraley, & Krueger, 2009; Pallant, 2011). To examine the convergent validity of an instrument, factor loadings of a construct, its average variance extracted (AVE) and its composite reliability estimation are used (Hair, et al., 2010). The recommended value for factor loadings is 0.50 or higher and ideally 0.70 or higher, for AVE it is 0.50 or higher (Hair, et al., 2010) and for composite reliability it is 0.70 or higher (Nunnally & Bernstein, 1994). The results from this work met the minimum thresholds, indicating good convergent validity, and are shown in the Table 1.

Table 1 Convergent validity analysis in CFA

Construct	*Cronbach Alpha*	*Composite Reliability*	*AVE*	*Items*	*Standardised factor loading*
Self-Efficacy (SE)	*0.858*	*0.86*	*0.672*	*SE01*	*0.783*
				SE02	*0.805*
				SE03	*0.869*
Perceived Ease of Use (PEU)	*0.898*	*0.899*	*0.691*	*PEU1*	*0.865*
				PEU2	*0.809*
				PEU3	*0.795*
				PEU4	*0.853*
Perceived Usefulness (PU)	*0.914*	*0.914*	*0.727*	*PU01*	*0.872*
				PU02	*0.857*
				PU03	*0.842*
				PU04	*0.84*

Compatibility (C)	*0.852*	*0.852*	*0.743*	*C001*	*0.842*
				C002	*0.881*
Attitude towards the behaviour (AB)	*0.872*	*0.873*	*0.697*	*AB01*	*0.813*
				AB02	*0.804*
				AB03	*0.885*
Behavioural Intentions (BI)	*0.863*	*0.864*	*0.682*	*BI01*	*0.876*
				BI02	*0.867*
				BI03	*0.725*
Superior Influence (SI)	*0.801*	*0.799*	*0.571*	*SI01*	*0.798*
				SI02	*0.724*
				SI03	*0.743*
Peer Influence (PI)	*0.784*	*0.802*	*0.674*	*PI01*	*0.933*
				PI02	*0.691*
Subjective Norm (SN)	*0.868*	*0.869*	*0.768*	*SN01*	*0.904*
				SN02	*0.848*
Facilitating Conditions (FC)	*0.849*	*0.85*	*0.654*	*FC01*	*0.807*
				FC02	*0.818*
				FC03	*0.801*
Perceived Behavioural Control (PBC)	*0.863*	*0.864*	*0.68*	*PBC1*	*0.788*
				PBC2	*0.828*
				PBC3	*0.857*

Discriminant validity refers to the extent to which a measure is distinct from other measures from which it is supposed to differ (Mitchell & Jolley, 2012). To test the discriminant validity, the square root of AVE was compared with construct correlations, as suggested by Fornell and Larcker (1981).

Table 2 shows that the square root of the average variance extracted (AVE) for each latent construct was higher than the inter-construct correlation, providing sufficient evidence of discriminant validity for the constructs. Finally nomological validity examines whether the correlation between the latent constructs is supported by theory (Hair, et al., 2010). In other words, nomological validity is established when the relationship between constructs conforms to the theoretical framework (Goertz, 2012). The structural model results in Section 4.2 confirmed nomological validity.

Table 2 Discriminant Validity

	SE	*PEU*	*PU*	*C*	*AB*	*BI*	*SI*	*PI*	*SN*	*FC*	*PBC*
SE	*0.820*										
PEU	*0.576*	*0.831*									
PU	*0.415*	*0.552*	*0.853*								
C	*0.335*	*0.567*	*0.751*	*0.862*							
AB	*0.432*	*0.642*	*0.804*	*0.799*	*0.835*						
BI	*0.481*	*0.527*	*0.775*	*0.729*	*0.759*	*0.826*					
SI	*0.372*	*0.297*	*0.462*	*0.452*	*0.485*	*0.597*	*0.756*				
PI	*0.321*	*0.487*	*0.589*	*0.597*	*0.609*	*0.539*	*0.487*	*0.821*			
SN	*0.386*	*0.414*	*0.517*	*0.527*	*0.569*	*0.665*	*0.675*	*0.593*	*0.876*		
FC	*0.565*	*0.467*	*0.437*	*0.450*	*0.544*	*0.547*	*0.537*	*0.383*	*0.478*	*0.809*	
PBC	*0.784*	*0.660*	*0.437*	*0.446*	*0.579*	*0.605*	*0.509*	*0.390*	*0.483*	*0.668*	*0.825*
Perceived Ease of Use (PEU), Perceived Usefulness (PU), Compatibility (C), Attitude towards the behaviour (AB), Superior Influence (SI) Peer Influence (PI), Subjective Norm (SN), Facilitating Conditions (FC), Self-Efficacy (SE), Perceived Behavioural Control (PBC), Behavioural Intentions (BI)											

Structural model analysis

The next step after having established the constructs' validity was to examine the causal relationship among the latent constructs. This step evaluates the logically meaningful relationships between latent constructs based on the theory under consideration. Structural models in SEM are similar to standard regression models, apart from the fact that only latent variables (LVs) are used. In other words, the emphasis of the analysis moves from the relationships between latent variables and their indicators to the relationships among latent variables. For this, Goodness of Fit (GoF) indices and hypothetical relations among the latent constructs were examined. To assess the model fit, comparative fit index (CFI), Tucker-Lewis index (TLI), along with the chi-square (X^2) value, degree of freedom (*df*), root mean square error of approximation (RMSEA) and standardised root mean residual (SRMR) values were used, as recommended by Hu and Bentler (1998), Kashy, Donnellan, Ackerman, and Russell (2009) and Widaman (2010). Hair, et al. (2010) provide guidelines for using these fit indices in different situations, both in terms of sample size and number of observed variables. For a study with a sample size less than 250 and number of variables more than 30, Hair, et al.

(2010) suggested the value of X^2/df should be less than 3, CFI and TLI above .92, RMSEA below .08 with CFI above 0.92 and SRMR less than .09 with CFI above 0.92.

A Maximum Likelihood (ML) estimation technique was used to calculate the Goodness Of Fit (GOF) indices using AMOS (version 20.0). The model fit indices in Table 3 indicate that the model has proved to be a good fit to the data. The absolute fit measure, RSMEA (0.041), and the incremental fit measures, TLI (0.962) and CFI (0.967), were above the minimum requirement values. However, the likelihood ratio chi-square (Chi-square (X^2) = 577.839; *df* = 433, p=.000) was significant (p<0.001). A non-significant value of chi-square (X^2) represents good model fit. Chi-square (X^2) is highly sensitive to sample size and it nearly always rejects the model when a large sample is used (Kline, 2011). Hence, as recommended (Hair, et al., 2010), the value of chi-square divided by the degree of freedom ($X^2/df = 1.335$) was also reported, which was within the threshold level ($1.0 < X^2/df < 3.0$). These results indicated a good model fit.

Table 3 Chi-square results and GOF indices for the structural model

	Chi-square (X2) = 577.839, p=.000					
	Absolute Fit Measures				**Incremental Fit / Goodness-of-fit**	
	DF	***X2/df***	***RMSEA***	***SRMR***	***TLI***	***CFI***
Obtained	*433*	*1.335*	*.041*	*.052*	*.962*	*.967*
Benchmark		*<3.00*	*<.08*	*<.09*	*≥.92*	*≥.92*
Note: *df = degree of freedom; Normed chi-square or ratio of likelihood (χ2) to degrees of freedom= χ2/df; RMSEA = Root mean square error of approximation; TLI= Tucker–Lewis Index; CFI = Comparative fit index. Benchmark for sample size <250 and Variables > 30 (Hair, et al., 2010)*						

Assessment of hypothetical relations

To assess the hypothetical relations among the latent variables and their significance, the standardised path coefficients or regression coefficients (β), unstandandardised regression coefficients (***B)***, critial ratio (C.R.) and squared multiple correlations (SMC or R^2) were examined. The standardised path coefficients (β) are used to measure the effect size of different variables in the model. Their value is judged with the help of critical ratio (CR or t-value). To obtain the critical ratio for an estimate (regression weight), its regression coefficient is divided by the standard error (S.E.) estimate. A coefficient value is considered significant at the .05 level when the value for the critical ratio (CR or t-value) is 1.96 or higher (Hair, et al., 2010). In this study, ten casual paths were analysed using the path estimation and critical ratio. Table 4 shows that all hypothesised paths were positive and statistically significant.

Table 4 Path coefficients for the structural model

Hypotheses	Hypothesised Path	B	B	S.E.	C.R.	p
H1	***PEU → AB***	*0.171*	*0.167*	*0.062*	*2.78*	*0.005*
	PU → AB	*0.424*	*0.441*	*0.081*	*5.263*	***
	C → AB	*0.369*	*0.403*	*0.081*	*4.552*	***
H2	***SI → SN***	*0.759*	*0.52*	*0.125*	*6.049*	***
	PI → SN	*0.424*	*0.361*	*0.093*	*4.57*	***
H3	***FC → PBC***	*0.338*	*0.342*	*0.072*	*4.683*	***
	SE → PBC	*0.605*	*0.611*	*0.076*	*7.928*	***
H4	***SN → BI***	*0.278*	*0.30*	*0.059*	*4.726*	***
	AB → BI	*0.564*	*0.555*	*0.07*	*8.015*	***
	PBC → BI	*0.192*	*0.18*	*0.065*	*2.971*	*0.003*

Note: *Unstandardised estimates (B), Standardised estimates (β), Standard error (S.E.), Critical ratio (C.R./t-value), *** probability (p) < .001, Perceived Ease of Use (PEU), Perceived Usefulness (PU), Compatibility (C), Attitude towards the behaviour (AB), Superior Influence (SI), Peer Influence (PI), Subjective Norm (SN), Facilitating Conditions (FC), Self-Efficacy (SE), Perceived Behavioural Control (PBC)*

The standardised estimates (β) in Table 4 indicate that the exogenous variables have strong relationships with endogenous variables i.e. the paths were statistically significant and support the model.

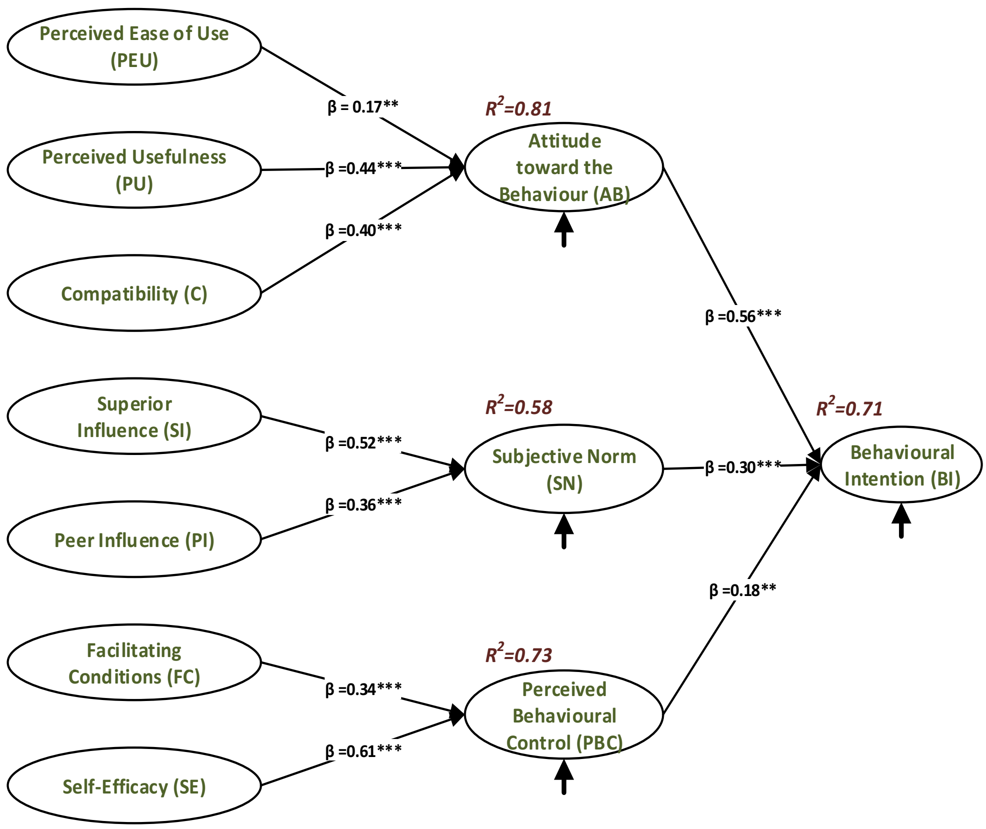
Table 5 Square Multiple Correlations (SMC)

Construct	R^2
Attitude towards the behaviour (AB)	*0.81*
Subjective Norm (SN)	*0.58*
Perceived Behavioural Control (PBC)	*0.73*
Behavioural Intentions (BI)	*0.71*

The squared multiple correlations (SMCs), also known as determination coefficients (R^2), are shown in

Table 5. The R^2 value represents "the proportion of variance that is explained by the predictors of the variable in question" (Byrne, 2010). In other words, SMCs represent the predictive power of the indicators and the strength of the structural relationships. In the measurement model, SMC values indicate how well the indicators measure the latent variables. In the structural equations however the SMC values indicate the strength of structural relationships (Schumacker & Lomax, 2010). The value of SMC is between 0 and 1, with a value closer to 1 meaning a stronger relationship (Tabachnick and Fidell 2013). The highest variance explained by the three exogenous variables to AB was 0.81.

Table 5 shows the subjective norm has a minimum SMC value of 0.58, indicating the strength of the structural relationship of the model. The principal endogenous latent construct, behavioural intention, had a SMC value of 0.71, i.e. 71 percent of the variance among the latent constructs, behavioural attitude, subjective norms and perceived behavioural control, can be explained by behavioural intention.



Note: oval shapes represent a latent variables, arrows with β values represents direct effects, the bold errors pointing toward endogenous latent constructs represents error terms β= standardised coefficients, R2 = squared correlations
** $p < .05$. ** $p < .01$. *** $p < .001$.*
For simplicity, the observed variables and their corresponding paths and errors have been removed from the figure

Fig. 2 Path diagram for the proposed structural model

The 10 hypothesised paths between the exogenous and the endogenous variables, shown in Fig. 2, were statistically significant. Each path from one latent construct to another latent construct shows a relationship between them. All the relationships are positive, with the scores ranging from 0.17 to 0.61, indicating support for the proposed research hypotheses.

Discussion

The theoretical model predicted Behavioural Intention (BI) towards e-portfolio acceptance. The examination of the latent constructs and model fit shows theoretical sufficiency of the hypothetical model. In the proposed model, there were three direct predictors of BI: Attitude towards Behaviour (AB), Subjective Norm (SN) and Perceived Behavioural Control (PBC). All of these predictors were found to have a significant influence on BI, with a SMC value of 0.71. This means that AB, SN and PBC explain 71% of the variance in behavioural intention. The path analyses indicated that AB (β = 0.56), SN (β = 0.30) and PBC (β =0.18) had a significant effect on behavioral intention, such that AB, SN and PBC were able to adequately explain students' BI. These findings are supported by the majority of previous studies conducted into individuals' behavioural intention towards technology (Armitage & Conner, 2001; Ajzen, 2005; Yousafzai, et al., 2007; Ajzen, 2011; McEachan, et al., 2011).

The combination of three antecedents of AB, Perceived Ease of Use (PEU), Perceived Usefulness (PU) and Compatibility (C), explain variance of 81% in AB, with path analysis showing that PU was the strongest factors in determining AB (β = 0.44), followed by C (β = 0.40) and PEU (β = 0.17). Students' attitude towards e-portfolio acceptance was therefore greatly influenced by their usefulness, followed by their compatibility and their ease of use. Students' perceptions about the compatibility of e-portfolios with their existing beliefs had a positive influence on AB. C was found to be correlated with AB, and its influence on AB (β = 0.40) was found to be just below PU (β = 0.44). Both factors were powerful determinants of AB, whilst PEU (β = 0.17) was by far the least important determinant of AB. Greater influence of PU has been reported previously (Davis, 1989; Masrom, 2007; Ramayah, Rouibah, Gopi, & Rangel, 2009; Shroff, Deneen, & Ng, 2011). It means most students will have a positive attitude towards e-portfolio usage if they find it useful and compatible with their studies.

Similarly, the two factors of SN, Superior Influence (SN) and Peer Influence (PI), explained 58% of the variance in SN, which is statistically significant. Path analysis results for each of the determinants of SN revealed that both SI ($\beta = 0.52$) and PI ($\beta = 0.36$) have a significant positive effect on SN. It means students' e-portfolio acceptance behaviour in a university context may rely on the opinions of their lecturers and peers. This finding is similar to research that found SI and PI positively predicted SN (Taylor & Todd, 1995c; Ajjan & Hartshorne, 2008; A Sadaf, et al., 2013). Students' experience with e-portfolios however may assist them in making independent decisions over time, weakening the SN to BI relationship, as previously suggested (Taylor & Todd, 1995a; Morris & Venkatesh, 2000). Finally, the two factors hypothesised to have an influence on PBC, Facilitating Conditions (FC) and Self-Efficacy (SE), explained statistically significant variance in PBC (73%). Path analysis results for each of the factors of PBC showed both factors had a significant positive relationship with PBC, with SE ($\beta = 0.61$) having a greater influence on PBC than FC ($\beta = 0.34$). The greater influence of SE compared to FC has also been observed in many other studies (DR. Compeau & Higgins, 1995; Taylor & Todd, 1995c; Moore & Benbasat, 1996).

The study helps explain the relationship between students' Behavioural Intention (BI) to use e-portfolios and the three proposed determinants, AB, SN and PBC. There is no other study on e-portfolios that has used the DTPB to analyse these relationships, though tests in various contexts and several meta-analysis studies on the TRA, the TBC and the TAM (Sheppard, et al., 1988; Armitage & Conner, 2001; Yousafzai, et al., 2007; Ajzen, 2011; McEachan, et al., 2011) have been undertaken and show the importance of such work. Many comparison studies on the TRA, the TPB, the TAM and the DTPB have reinforced these relationships (Mathieson, 1991; Taylor & Todd, 1995c; Shih & Fang, 2004), adding confidence to the findings in the context of e-portfolios. Meta-analyses of a wide range of behaviours have found good correlation (Ajzen, 2005) and have connected intention with attitude (mean correlation of 0.45 to 0.60), subjective norms (mean correlation of 0.34 to 0.42) and perceived behavioural control (mean correlation of 0.35 to 0.46).

Conclusion

In conclusion, the factors proposed in the present study were found to have an important influence in shaping students' acceptance of technologically-enhanced personal, academic and professional development portfolios. Three factors of BI, namely AB, SN and PBC, and their antecedents, formed by decomposing the belief structure, were found vital for acceptance of e-portfolios. These results agree with other studies of individuals' acceptance of technologies involving both the TPB and the DTPB, and provide for the first time a proven theoretical model which can be used to predict e-portfolio acceptance.

This study provides valuable insight regarding factors which are important to understand when considering e-portfolio acceptance behaviour, offering important implications for educators, system developers and managers. The present research reveals that Self Efficacy (SE) and Facilitating Conditions (FC) have significant influence on Perceived Behavioural Control (PBC). System developers may consider therefore the technical skills required to create e-portfolios and the technical support needed while creating e-portfolios. Similarly, the study shows that Perceived Ease of

Use (PEU) significantly influences Attitude towards the Behaviour (AB). This means, system developers must ensure that the system is not difficult to use. Educational developers can consider the importance of other factors that were identified and tested in the model. By explaining how e-portfolios may fit in with the desired outcomes of a course and emphasising the use of e-portfolios in study guides and course documentation, improvements in students' perception of Compatibility (C) and Perceived Usefulness (PU) may occur. The result of this research study should also be beneficial to higher education institutions where e-portfolios are being used or decisions are being made to consider e-portfolios for academic, personal and professional purposes. The model provides detailed information to guide e-portfolio implementation. The identified factors are important for e-portfolio acceptance and also for institutions seeking to understand the ways in which these factors influence acceptance. Recognising these factors and their impact on adoption can increase the acceptance of e-portfolios, which is important for both students and institutions.

Even though, the study's findings are valuable for higher education institutions, caution needs to be taken when generalising. The study was completed at a single UK university. A more substantial cross-institution multi-national study would be required to show widespread generalisability. In addition, the current study has used a quantitative approach, with a single self-reported survey instrument, to collect data. This method is common in most studies that use behaviour-related models, such as the TRA and the TPB (Armitage & Conner, 2001). However, a cross-sectional survey has understandably not been able to address time and experience related issues, which would be addressed with a longitudinal survey. Further research could also adopt, for example, a more constructivist view using qualitative methods to explore issues in more depth.

Research using behavioural-based theories and models to understand e-portfolio acceptance is still in its infancy. This study was limited to In this study, research was limited to the use of DTPB and its constructs, but additional constructs from other models may be considered in future work. For example, the Task Technology Fit (TTF) model (Goodhue & Thompson, 1995), which focuses on better understanding the connection between individuals' task needs and the available functionality of the information system, may be explored, with the addition of new constructs further enriching understanding of e-portfolio acceptance.

Appendix A

Questionnaire items

Perceived Ease of Use (PEU)

PEU1- Learning to use the e-portfolio is easy for me.
PEU2- My interaction with the e-portfolio is clear and understandable.
PEU3- It is easy for me to become skilful at using the e-portfolio.
PEU4- I find the e-portfolio easy to use.

(Chau, 1996; Davis, 1989; Huang & Chuang, 2007; G. Moore & Benbasat, 1991; Pituch & Lee, 2006; Shroff et al., 2011; Venkatesh & Bala, 2008).

Perceived Usefulness (PU)

PEU1- I believe that using the e-portfolio would enhance my professional development.
PEU2- Using the e-portfolio would increase my academic productivity.
PEU3- I believe that using the e-portfolio would make it easy for me to achieve my academic and professional goals.
PEU4- I find using the e-portfolio useful.

(Ajjan & Hartshorne, 2008; Chau, 1996; Chou, 2012; Davis, 1989; Huang & Chuang, 2007; G. Moore & Benbasat, 1991; Pituch & Lee, 2006; Shroff et al., 2011; Taylor & Todd, 1995c).

Compatibility (C)

C001- Using the e-portfolio is compatible with my study.
C002- Using the e-portfolio fits well with my personal, academic and professional development needs.

(Ajjan & Hartshorne, 2008; Huang & Chuang, 2007; G. Moore & Benbasat, 1991; Taylor & Todd, 1995c)

Attitude towards Behaviour (AB)

AB01- I have a generally favourable attitude toward using the e-portfolio.
AB02- It is a good idea to use the e-portfolio for academic, personal and professional development.
AB03- Overall, I am satisfied with using the e-portfolio.

(Ajjan & Hartshorne, 2008; Huang & Chuang, 2007; H.-P. Shih, 2008; Taylor & Todd, 1995c)

Superior Influences (SI)

SI01- My lecturer thinks that I should use the e-portfolio.
SI02- I want to use the e-portfolio because my lecturer requires it.
SI03- The opinion of my lecturer is important to me.

(Huang & Chuang, 2007; Taylor & Todd, 1995c).

Peer Influences (PI)

PI01- My friends and classmates would think that I should use the e-portfolio.
PI02- The opinion of my friends and classmates is important to me.

(Ajjan & Hartshorne, 2008; Huang & Chuang, 2007; Taylor & Todd, 1995c).

Subjective Norms (SN)

SN01- People who influence my behaviour would think that I should use the e-portfolio.
SN02- People who are important to me would think that I should use the e-portfolio.

(Davis, 1989; G. Moore & Benbasat, 1991; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

Self-Efficacy (SE)

SE01- I would feel comfortable using the e-portfolio on my own.
SE02- There is no gap between my existing skills and knowledge and those required to work on the e-portfolio.
SE03- I have knowledge and ability to make use of the e-portfolio.

(Ajjan & Hartshorne, 2008; Huang & Chuang, 2007; Taylor & Todd, 1995c)

Facilitating Conditions (FC)

FC01- The equipment (computer hardware, software and communication network) is available to me to work on the e-portfolio.
FC02- The resources (guides, time and support) are available to me to work on the e-portfolio.
FC03- The e-portfolio is compatible with the computers and application I already use in my studies.

(Taylor & Todd, 1995c; Thompson, Higgins, & Howell, 1991; Venkatesh et al., 2003; Venkatesh, 2000).

Perceived Behavioural Control (PBC)

PBC1- Using the e-portfolio is entirely within my control.
PBC2- I have the resources, knowledge and ability to use the e-portfolio.
PBC3- I would be able to use the e-portfolio.

(Ajjan & Hartshorne, 2008; Huang & Chuang, 2007; H.-P. Shih, 2008).

Behavioural Intention (BI)

BI01- I intend to use the e-portfolio in the future.

BI02- I intend to use the e-portfolio for personal, academic and professional development.
BI03- I intend to use the e-portfolio during my studies.
(Ajjan & Hartshorne, 2008; H.-P. Shih, 2008; Taylor & Todd, 1995c; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

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