Continued use of e-learning technology in higher education: a managerial perspective

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ABSTRACT

This paper develops a managerial-influence perspective in the context of e-learning technology in higher education. Drawing on principal-agent theory and the information systems (IS) continuance model, a new research model is developed and tested. The study finds support for the effects of goal congruence between managers and educators and managerial incentives on educators' intention to continue using e-learning technology. Additionally, the results show that managerial goal congruence reduces the positive relationship between incentives and educators' continuance intention. While the IS continuance model demonstrates an explained variance of 27%, the full model explains 47% of the dependent variable's variance, indicating that the extended model is more powerful in explaining educators' e-learning continuance than the IS continuance model in isolation. By modifying and extending the IS continuance model, this paper fills a gap in the literature by addressing educators' continued use of IS from a personal-use perspective, as well as a managerial-influence perspective.

Introduction

Information technology increasingly affects higher education, and the use of e-learning technology is expected to improve student flexibility and enhance learning output. However, technology's availability does not ensure its acceptance and continued use automatically among students and educators. Identifying ways to understand and ensure educators' utilization of information technology is a challenge for university management. Key questions include how to understand which factors may affect educators' information systems (IS) continuance intentions and how university management may influence educators' use of e-learning technology.

While the continued use of e-learning technology among university educators has received some attention from IS researchers in the past (Larsen, Sørebø, and Sørebø 2009; Sørebø et al. 2009; Hung, Chang, and Hwang 2011; Tao, Cheng, and Sun 2012), scant attention has been given to how management can encourage and influence educators' continued use of e-learning technologies (Nabavi et al. 2016). Digital technologies have proved to be disruptive to various industries, and new challenges are expected in higher education. Management at higher education institutions should be an active driver of this change process, designing strategies to secure successful implementation and continued use of new technologies. One concern related to this is that e-learning technologies enable new 'possibilities' for educators and students, and do not offer a 'ready to use' resource (Sørebø et al. 2009,

1177). This paper studies how implementation of e-learning technology may include key management and governing issues, thereby contributing to a greater understanding of IS continuance from a managerial perspective, i.e. how managers at universities proactively may influence and stimulate educators' attitudes and actions toward meeting their organizations' goals. Implementation of e-learning technology in higher education should not be related solely to individual needs, but rather may be viewed as a prerequisite for obtaining desired university performance following higher-level organizational goals.

The IS continuance model that Bhattacherjee (2001a) developed has been one of the preferred models used by scholars when examining the determinants of intention to continue use of technology in general (Laugesen 2012; Nabavi et al. 2016), as well as in e-learning settings (Sørebø et al. 2009; Hung, Chang, and Hwang 2011; Islam 2012; Jo 2018). A prominent attribute of the IS continuance model is that it offers a robust and parsimonious framework for continuance intention, as only three variables (i.e. satisfaction, confirmation, and perceived usefulness) are needed to establish the core theoretical explanation.

The IS continuance model mainly comprises information and communication technology (ICT)-centric concepts (Alter 2003, 2015), but explaining continuance intention also should include how management could influence and govern educators' continued use of e-learning technologies. Thus, the continuance-intention research field needs frameworks that might explain the impact of managerial tools such as incentives, monitoring mechanisms, and goal-alignment structures (Alter 2015). Our review of the literature found no extension of the IS continuance model with a managerial perspective in e-learning settings (Bhattacherjee and Barfar 2011; Laugesen 2012; Nabavi et al. 2016).

The purpose of this research is to contribute to e-learning literature by integrating complementary aspects of managerial influence that are relevant to continuance intention in e-learning settings. Three specific gaps in research on e-learning continuance intention are addressed. First, Bhattacherjee and Lin (2014) emphasize the need to include alternative theoretical perspectives in combination with established models. Other theories (Islam 2012; Laugesen 2012) previously have extended the IS continuance model, but extensions that utilize a managerial perspective are limited. Thus, core concepts derived from a managerial perspective have been theorized only narrowly and insufficiently tested in e-learning continuance research (Nabavi et al. 2016). It is particularly unclear whether and how educator incentives and goal convergence between management and educators might affect the continued use of e-learning tools. Second, previous studies have argued that incentives may be a critical antecedent to IS use (Hung, Chang, and Hwang 2011; Bhuasiri et al. 2012), but empirical research on continuance intention that includes incentives' influence generally is scant (Nabavi et al. 2016) and is virtually absent in e-learning settings. The implementation of incentive structures in e-learning settings may increase instrumental-user behavior due to potential future rewards, both monetary and non-monetary (Bhattacherjee 2001b; Stolovitch, Clarck, and Condly 2002). However, it is unclear how potential future rewards (i.e. incentives) may affect educators' continuance intention to use e-learning systems. Third, a few previous studies of IS implementations indicate that goal congruence between employees and management can motivate employees to utilize IT as requested by management (Bøe, Gulbrandsen, and Sørebø 2015). However, scant attention has been given to how and why the degree of goal congruence between employees and managers may affect users' continuance intention (Nabavi et al. 2016).

Based on these identified gaps, we argue that a need exists for research that both theoretically and empirically extends existing continuance models with a managerial-influence perspective, thereby providing a complete model of IS continuance in e-learning settings. A model of antecedents of educators' e-learning continuance intention that also mirrors incentives and goal congruence is needed to understand further how work-centric and ICT-centric concepts interact across variations in the continued use of e-learning systems.

The core of principal-agent theory is the theoretical treatment of incentives and goal congruence. Alter (2015) argues that these concepts, derived from managerial literature on agency theory, should

be included in a proposed overall work-system perspective. According to principal-agent theory, an agency problem is present when the principal and agent's goals differ (i.e. degree of goal congruence). The domain of principal-agent theory includes basic agency structures for managers and IS users who are engaged in cooperative behavior, but who may have differing goals, and incentive mechanisms may provide solutions to the agency problem.

Focusing on parsimony, this research will modify the IS continuance model and extend it using incentive and goal-congruence constructs from the principal-agent model. This extended model will offer complementary explanations, support each view's shortcomings, and likely enhance our ability to explain and predict e-learning continuance intention. The formal research question is stated as follows:

> Will the inclusion of incentive and goal-congruence constructs provide a better explanation of continued user behavior in the IS continuance model?

Theory and hypotheses

Motivated by the lack of research on continued IS use, Bhattacherjee (2001a) developed an IS continuance model in 2001 based on an expectation-confirmation theory (ECT) developed by Oliver (1980) and a technology-acceptance model (TAM) developed by Davis (1989). This IS continuance model has been used widely, including in e-learning settings in higher education (Larsen, Sørebø, and Sørebø 2009; Sørebø et al. 2009; Hung, Chang, and Hwang 2011; Tao, Cheng, and Sun 2012; Jo 2018). The set of key constructs comprising the IS continuance model includes confirmation, perceived usefulness, and satisfaction, while the dependent variable is intention to continue IS use. The solid lines in Figure 1 represent the IS continuance model's causal mechanisms.

The principal-agent perspective builds on the original formulation of agency theory and addresses the agency relationship, in which one entity (the principal) delegates work to another (the agent), who performs the work according to a mutually agreed-upon contract (Eisenhardt 1989). Generally, the principal-agent perspective explains transactions between actors with inconsistent goals in situations characterized by uncertainty and inequality in risk preferences, and it theorizes that these agency problems may be resolved via appropriate incentive schemes and control mechanisms. The theory is built on two basic assumptions. First, both the principal and agent are assumed to be motivated by self-interest. Second, the principal and agent hold different interests, and the goal of both is maximum utility. However, the theory supports the utility of the principal, who is assumed to strive for maximum profit, whereas the agent seeks maximum compensation for
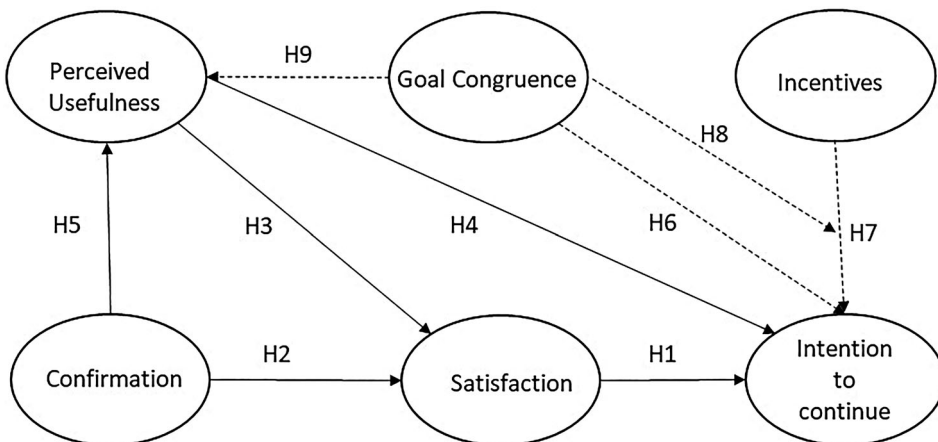

Figure 1. The hypothesized model.

minimum effort (Coughlan and Sen 1989). Principal-agent theory is viewed as a ubiquitous theory that is relevant for different types of relationships and settings, including higher education (Kivistö 2008). The principal-agent model paths are marked with dotted lines in Figure 1 and include the incentive and goal-congruence variables. Together, they comprise the complete research model combining IS continuance model and principal-agent model predictions on IS continuance intention.

IS continuance model

Since its development in 2001, the IS continuance model has been used widely to explain post-adoption use of information systems and tools (Bhattacherjee and Barfar 2011; Laugesen 2012; Nabavi et al. 2016). Bhattacherjee and Barfar (2011) conducted a literature review of 16 empirical papers published in 10 leading IS journals over 10 years (2001–2011). They identified some extant misconceptions about continuance research, highlighting that 'theories designed to explain IT acceptance, such as (the) technology-acceptance model and unified theory of acceptance and use of technology, may be inconsistent with and inappropriate for explaining IT continuance' (Bhattacherjee and Barfar 2011, 5). The authors conclude that the dominant theoretical lens used to explain IT continuance behavior has been expectation-confirmation theory (Bhattacherjee 2001a).

In a recent study, Nabavi et al. (2016) provided a systematic review of 191 research articles on IS continuance intention. The reviewed studies encompass a wide range of empirical settings and several technologies. Of the 191 articles reviewed, 100 used the IS continuance model as a theoretical lens through which to study IS continuance intention, either alone or integrated with complementary theoretical perspectives. The three most-studied constructs were satisfaction, perceived usefulness, and confirmation, and more than two-thirds of the reviewed studies (69%) used satisfaction and perceived usefulness as key factors to establish these antecedents' influence on continuance intention empirically (Nabavi et al. 2016). In sum, extant research has shown that factors that influence users' IS continuance intention are different from initial factors that affect acceptance, and that the IS continuance model, based on a solid theoretical foundation, has emerged as the most valid and widely recognized model within continuance research (Nabavi et al. 2016). The following hypotheses derived from the IS continuance model (ISCM) are based on Bhattacherjee's (2001a) de facto standard conceptualization, which has been verified extensively across a wide range of settings (Laugesen 2012), including educators' continued use of e-learning systems (Larsen, Sørebø, and Sørebø 2009; Sørebø et al. 2009; Hung, Chang, and Hwang 2011; Islam 2011):

> ISCM H1: Educators' satisfaction level with e-learning technologies will affect their continuance intention positively.
>
> ISCM H2: The confirmation level of educators' initial expectations of e-learning technologies will affect their satisfaction level (with e-learning technologies) positively.
>
> ISCM H3: The extent of educators' perceived usefulness of e-learning technologies will affect their satisfaction level with the technologies positively.
>
> ISCM H4: The extent of educators' perceived usefulness of e-learning technologies will affect their continuance intention positively.
>
> ISCM H5: The extent of educators' confirmation with e-learning technologies will affect their level of perceived usefulness of the technologies positively.

Principal-agent theory

Principal-agent theory is viewed as a mature theory with many extensions and nuances, has been applied to a wide range of transactional exchanges (Milgrom and Roberts 1992), and is relevant in all contexts (Eisenhardt 1989), including higher education (Kivistö 2008). However, very few studies have utilized principal-agent theory to explain post-adoption use of information systems,

and the limited number of studies that have used principal-agent theory as part of their theoretical framework has yielded mixed results (e.g. Bhattacherjee 1998, 2001b; Tao, Cheng, and Sun 2009, 2012; Yeh and Tao 2012). Principal-agent theory comprises several concepts beyond those included in our research models, such as monitoring mechanisms, outcome uncertainty, task programmability, and outcomes' measurability (e.g. Eisenhardt 1989; Bhattacherjee 1998). However, in the introductory section, we addressed the need for research that extends existing IS continuance models with a managerial-influence perspective. Based on the identified gaps, we argued that a particular need exists for research that includes the core of principal-agent concepts, incentives, and goal congruence. Accordingly, this study deals with an explicit call for studies that include work-centric concepts that complement traditional ICT-centric concepts in the IS continuance model, especially those that consider how managers can influence IS users' attitudes and actions.

Universities invest in e-learning technologies to reach their defined higher-level goals, and management expects the systems to be implemented and used. Utilizing the principal-agent management perspective (Wright, Mukherji, and Kroll 2001), we argue why and how the degree of goal congruence affects users' continued use of an e-learning system. Principal-agent theory has been criticized because its assumptions discount situations that better reflect real-life principal-agent relationships' realities (Perrow 1986; Eisenhardt 1989; Wright, Mukherji, and Kroll 2001). Following Eisenhardt (1989) and Wright, Mukherji, and Kroll (2001), we redefine the assumption of a universal goal conflict between the principal and agent by introducing this assumption as a variable in the research model. This redefinition enables an extension of the predictions on continued use, i.e. it includes goal congruence as a variable, not as a constant. We define the variable of *goal congruence* as the degree to which educators support higher-level goals that university management sets.

Goal conflicts between management and educators may stimulate educators' opportunistic behavior, and management may lack the ability to monitor educators' behavior and enforce goal alignment (Eisenhardt 1989). IS implementation research shows that users can be motivated to utilize IS by aligning management and users' goals (Bhattacherjee 1998). Thus, the principal-agent theory (PAT) proposal that agents invariably will use their 'autonomy to enrich themselves at the cost of the management' (Eisenhardt 1989, 62) will not apply in goal-congruence situations. Consequently, 'if there is no goal conflict, the agent will behave as the principal would like, regardless of whether his or her behavior is monitored' (Eisenhardt 1989, 62). The motivational imperative for both incentive measures and monitoring arrangements will decrease if management and educators' goals are aligned. Thus, the following hypothesis is proposed:

> PAT H6: Educators' levels of goal congruence with university management positively affect their e-learning continuance intention.

According to the IS continuance model, the system's perceived usefulness and satisfaction with use are the principal drivers of intention to continue use (Bhattacherjee 2001a; Laugesen 2012). The principal-agent model approach emphasizes that in addition to goal congruence, the use of incentives – monetary or non-monetary – may support a positive association between incentives and e-learning continuance intentions (Bhattacherjee 2001b). Educators may act out of self-interest, and moral hazards – e.g. educators' lack of effort – may arise (Milgrom and Roberts 1992). Monitoring such a lack of effort may be difficult or costly. In the absence of incentive structures, it might be convenient for educators not to make the agreed-upon effort. By implementing appropriate incentive mechanisms, university management can encourage e-learning continuance. Thus, the more incentive mechanisms that management offers, the more educators will continue to use an e-learning system. This leads to the following hypothesis:

> PAT H7: The incentive level that university management provides will affect educators' e-learning continuance intention positively.

Goal congruence may reduce the need for costly incentive mechanisms. If goal congruence is established, educators will agree with the higher-level goals that management defines. The educators will

act in the best interest of management, as their desire to feel effective in achieving valued results will be affected positively. Consequently, a higher goal-congruence level between management and educators will decrease incentives' effect on the intention to continue. If low goal congruence exists in management-educator relationships, the educator may act opportunistically, and an increased need will exist for incentive measures to curb opportunistic behavior and increase continued IS use. However, as goal congruence increases, the need for incentive measures will decrease (Wright, Mukherji, and Kroll 2001). Thus, incentives will not explain as much continued use when goal congruence is high as they will when goal congruence is low, i.e. the more aligned the goals are between management and educators, the lesser the effect of incentives on continued use. Thus, we propose:

> PAT H8: Educators' perceived levels of goal congruence with university management will moderate the positive relationship between incentives and educators' e-learning continuance intention negatively.

According to Venkatesh and Davis (2000), theoretical developments based on action theory, work-motivation theory, and behavioral-decision theory 'share the view that the impetus for engaging in specific behaviors stems from a mental representation linking instrumental behaviors to higher-level goals or purposes' (191). Thus, educators will form a mental picture when comparing correspondence between higher-level IS goals and the consequences of using a system. This mental picture will establish the basis for creating assessments of the system's perceived usefulness. Thus, the degree of higher-level goal congruence with university management may affect educators' perceived usefulness of an e-learning technology. Therefore, goal congruence between management and educators may affect the latter's evaluation of the system's usefulness positively. Thus, the following hypothesis is proposed:

> PAT H9: Educators' perceived level of goal congruence with university management affects their perceived usefulness level positively.

Research methodology

Context

The research model was tested in a field study conducted in a Norwegian university with 18,000 students and 1,300 faculty members. University management implemented e-learning initiatives in the strategic plan and has been focusing on motivating faculty members for several years to increase the use of digital tools in teaching, learning, and assessment. However, the continued use of e-learning technology is viewed as voluntary, as university management usually does not intervene in how teaching is conducted. Consequently, the real use of e-learning technology varies. Several reasons exist for this strategic focus on the implementation of e-learning technologies. First, education authorities expect universities to increase the use of e-learning technology in general. Second, faculty want to improve variation in teaching and learning methods by implementing several e-learning technologies and services. Finally, some universities want to offer online education, thereby increasing student recruitment. Continued use of e-learning technology is a prerequisite to reaching these targets.

Measures

The operationalization of the constructs is based mainly on existing and validated instruments and is re-worded to fit the higher education context. The items for perceived usefulness, confirmation, and intention to continue are all adapted from Bhattacherjee (2001a). Satisfaction was measured using four items adapted from Spreng and Mackoy (1996).

Incentives were operationalized as rewards that management offered to stimulate teachers' continued use of e-learning technologies. Such incentives may be monetary or non-monetary (Bhattacherjee 2001b). Accordingly, the first item captures the provision of extra funding to stimulate the

Table 1. Constructs and items.

Theory construct	Item	Wording	Reference
ISCM Perceived usefulness	PerU1	Use of digital tools improves the quality of my teaching	Bhattacherjee (2001a)
	PerU2	Use of digital tools increases my productivity as an educator	
	PerU3	Use of digital tools enhances my effectiveness in my educational work	
	PerU4	Use of digital tools is useful in my educational work*	
ISCM Confirmation	Con1	My experience with e-learning technology is better than expected	Bhattacherjee (2001a)
	Con2	E-learning technology is more supportive in my teaching than expected	
	Con3	Overall, most of my expectations from using e-learning technology were confirmed	
ISCM Satisfaction	Sat1	Very dissatisfied/Very satisfied (1–7)	Spreng and Mackoy (1996)
	Sat2	Very displeased/Very pleased (1–7)	
	Sat3	Very frustrated/Very contented (1–7)	
	Sat4	Absolutely terrible/Absolutely delighted (1–7)	
ISCM Intention to continue	Int1	I intend to use e-learning technology more actively	Bhattacherjee (2001a)
	Int2	I intend to increase my use of digital tools at the expense of traditional teaching methods	
	Int3	If possible, I would like to increase the use of digital tools next year	
PAT Incentives	Inc1	The management offers incentives (extra funding) to stimulate continued use of e-learning technology	Bhattacherjee (2001b)
	Inc2	I am rewarded if I use e-learning technology	
	Inc3	The management treasures the use of e-learning technology	
PAT Goal Congruence	GoaC1	Improve flexibility for the students*	Adapted from Bøe, Gulbrandsen, and Sørebø (2015)
	GoaC2	Improve the quality of teaching	
	GoaC3	Increase student throughput	
	GoaC4	Increase student recruitment*	
	GoaC5	Improve students results	

* The item has been deleted as a result of the measurement validation procedure.

continuous use of e-learning, while the second is the degree of rewards from using e-learning technologies. The third item is the degree to which management treasures educators' use of e-learning technology.

Goal congruence was operationalized as educators' perception of the level of congruence with management's stated higher-level goals related to the use of e-learning technology. If educators' goals coincide with those of management, this is assumed to reflect goal congruence between educators and management. In the survey, introductory text tells respondents to consider whether they share management's higher-level goals (related to the use of e-learning technology). The scale was pretested on a pilot group, and the measures were refined and verified further. Goal congruence was measured using five measures adapted from Bøe, Gulbrandsen, and Sørebø (2015).

All latent variables were measured using reflective scales, and all observed variables were measured using perceptual data. Except for satisfaction, all measures were assessed using a seven-point Likert-type scale ranging from 'strongly disagree' to 'strongly agree.' Satisfaction was measured on a seven-point semantic differential scale. The measures representing latent variables in the theoretical model are presented in Table 1.

Data analysis and results

Sample

The data were collected using an online questionnaire distributed to all faculty members, and two reminders were sent out to increase the response rate. A total of 401 responses were obtained, comprising a high response rate of 30%. This provides a sample that is a good representation of the university's faculty. The distribution of gender (56% female and 44% male), age, and academic rank is an adequate representation across faculty differences (see Table 2).

Table 2. Descriptive statistics of respondents.

Demographics	Values	Percentage
Gender	Female	56
	Male	44
Age	<30	1.6
	30–39	16.3
	40–49	22.8
	50–59	41.8
	≥60	17.4
Position	Professor	11.4
	Associate Professor	27.7
	Assistant Professor	48.9
	College Lecturer	6.0
	Other	6.0

Measurement model results

The two-step approach was applied to validate the measures before testing the hypothesized model (Anderson and Gerbing 1988). Structural equation modeling (SEM; Mplus 8.3) was used to test the measurement model. The initial analysis resulted in the exclusion of one item for perceived usefulness and two items for goal congruence due to lack of unidimensionality. The remaining items provide a good representation of the constructs.

An assessment of discriminant validity was conducted at the items level to assess the extent to which the measures are not the reflections of other constructs in the datamodel. Initially, we identified items that were correlated highly with other items intended to reflect other constructs (Voorhees et al. 2016). Three items have higher correlations to items that are designed to reflect other constructs, compared with their within-construct correlations: CONF1; CONF3; and SAT4 (Table 3). CONF1 is correlated with items that reflect perceived usefulness, and CONF3 is correlated with items that reflect satisfaction and goal harmony. SAT4 is correlated with items that reflect goal harmony.

Items can be highly bivariate-correlated with items from other constructs because of the expected relationships among the constructs in the hypothesized model (Voorhees et al. 2016). To test the measures' discriminant validity, the nested unidimensional proposed measurement model (Table 4) was tested against a measurement model with four cross-loadings. The first two cross-loadings are from goal harmony to CONF3 and SAT4, the third cross-loading is from satisfaction with CONF3, and a fourth cross-loading is from perceived usefulness to CONF1. The four standardized factor loadings are −.03, .01, .16, and −.06, respectively. None of them is significant, and the other factor loadings change marginally. The chi-square difference between the nested models is 3.5, with 4 degrees of freedom, which is insignificant and supports the proposed unidimensional measurement model (Anderson and Gerbing 1988; Green 2016; Voorhees et al. 2016). Accordingly, we conclude that the measures' discriminant validity in this research is satisfactory.

The final measurement model has a chi-square of 329.0, with 135 degrees of freedom ($p < .01$), RMSEA of .06 ($p = .02$), CFI of .96, TFI of .95, and SRMR of .049. The four latter fit indexes meet the suggested cut-offs for good model fit (Hu and Bentler 1999, 27). Composite reliabilities above .7 indicate satisfactory reliability for all constructs (Bagozzi and Yi 1988). Table 4 presents the means, standard deviations, factor loadings, t-statistics, and composite-reliability information.

The procedure suggested by Fornell and Larcker (1981) was used to assess discriminant validity. Each construct's reliability should be higher than the variance shared between that construct and the other constructs in the model (i.e. the squared correlation between constructs). None of the squared correlations for each construct is higher than the composite reliability for that construct. Accordingly, discriminant validity is satisfactory for all constructs (please see Table 5).

Common method variance might occur because all data in this study are self-reported and collected through the same data collection method simultaneously. Common method bias either

Table 3. Item correlation matrix.

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PerU1	1.0																		
PerU2	.73	1.0																	
PerU3	.65	.75	1.0																
Conf1	.41	.48	.42	1.0															
Conf2	.28	.33	.29	.23	1.0														
Conf3	.49	.57	.51	.67	.46	1.0													
Sat1	.50	.58	.51	.50	.34	.60	1.0												
Sat2	.47	.54	.48	.46	.32	.56	.82	1.0											
Sat3	.42	.49	.43	.42	.29	.50	.74	.69	1.0										
Sat4	.41	.48	.42	.41	.28	.49	.73	.67	.85	1.0									
Int1	.34	.40	.35	.22	.15	.27	.34	.32	.29	.28	1.0								
Int2	.37	.43	.38	.24	.16	.29	.37	.34	.31	.30	.77	1.0							
Int3	.38	.44	.39	.25	.17	.30	.38	.35	.32	.31	.80	.86	1.0						
Inc1	.05	.05	.05	.09	.06	.10	.11	.10	.09	.09	.19	.20	.21	1.0					
Inc2	.05	.06	.05	.09	.06	.11	.12	.11	.10	.10	.20	.22	.23	.64	1.0				
Inc4	.03	.03	.03	.05	.03	.06	.06	.06	.05	.05	.10	.11	.11	.33	.35	1.0			
GoaC2	.43	.50	.44	.28	.19	.34	.40	.37	.34	.33	.48	.52	.54	.17	.19	.10	1.0		
GoaC3	.40	.46	.41	.26	.18	.31	.37	.34	.31	.30	.45	.48	.50	.16	.17	.09	.70	1.0	
GoaC5	.44	.51	.45	.29	.20	.34	.41	.38	.35	.34	.50	.54	.56	.18	.19	.10	.78	.72	1.0

Table 4. Item means, standard deviation and reliability.

Item	Mean	Std. dev.	Loading	t-statistic	Composite reliability
PerU1	5.0	1.4	.80	36.7	.88
PerU2	4.7	1.5	.92	64.7	
PerU3	4.7	1.5	.82	41.0	
Con1	4.8	1.2	.89	42.2	.77
Con2	4.3	1.2	.51	12.2	
Con3	4.6	1.2	.75	25.9	
Sat1	4.9	1.2	.94	75.9	.91
Sat2	4.8	1.2	.87	58.1	
Sat3	4.7	1.1	.79	34.2	
Sat4	4.7	1.1	.77	33.8	
Int1	5.2	1.4	.85	52.7	.93
Int2	4.9	1.5	.91	79.5	
Int3	5.0	1. 5	.95	98.8	
Inc1	3.6	1.9	.77	17.5	.73
Inc2	2.7	1.5	.84	18.5	
Inc3	4.5	1.9	.42	8.9	
GoaC2	4.7	1.4	.87	49.9	.89
GoaC3	4.4	1.5	.80	37.8	
GoaC5	4.2	1.4	.89	56.4	

may inflate or depress correlations between constructs, resulting in both Type I and Type II errors (Podsakoff et al. 2003). We included a common latent factor in the SEM measurement model and constrained its paths to all items to be equal. The common latent factor's common variance is 20.6%. The analysis indicates that common method bias is not evident in this study.

Tests on hypotheses

The structural model's fit is good, and the model shows a satisfactory ability to reproduce the sample's observed variance-covariance matrix. Although the chi-square value is insignificant, at 341.6, with 139 degrees of freedom ($p < .01$), the other fit indices meet the recommended cut-off criteria (Hu and Bentler 1999). The RMSEA value is .06 ($p = .02$), CFI is .96, TLI is .95, and SRMR is .05.

Replication
The model proposes that satisfaction affects continuance Intention positively. The result is positive, but insignificant ($\beta = .08$, *ns.*), rejecting H1. Confirmation affects satisfaction positively and significantly ($\xi = .47$, $p < .01$), supporting H2. Perceived usefulness affects satisfaction ($\beta = .34$, $p < .01$) and continuance intention ($\beta = .12$, $p < .05$) positively and significantly, as expected, supporting H3 and H4. Finally, confirmation affects perceived usefulness positively and significantly ($\xi = .52$, $p < .01$), supporting H5. These results verify replication of the five ISCM hypotheses.

Extension
The model proposes that incentives positively affect continuance intention. This result is positive and significant ($\xi = .15$, $p < .01$), supporting H6. Goal congruence impacts continuance intention positively

Table 5. Discriminant validity of the constructs.

	Con	GoaC	Inc	Int	PerU	Sat
Confirmation (Con)	**.77**	.19	.02	.12	.48	.51
Goal Congruence (GoaC)	.43	**.89**	.07	.43	.39	.24
Incentives (Inc)	.15	.26	**.73**	.08	.01	.02
Intention to Continue (Int)	.35	.66	.29	**.93**	.26	.18
Perceived Usefulness (PerU)	.70	.62	.08	.51	**.88**	.45
Satisfaction (Sat)	.71	.49	.15	.43	.67	**.91**

Note: Composite reliability in the diagonal, correlations in the lower off-diagonal, and squared correlations in the upper off-diagonal.

and significantly ($\xi = .50$, $p < .01$), supporting H7. The interaction between incentives and goal congruence on continuance intention has been tested with mean-centered variables and by using the XWITH command in Mplus. It is negative and significant ($\xi = -.08$, $p < .05$), supporting H8. Finally, goal congruence impacts perceived usefulness positively ($\xi = .40$, $p < .01$), supporting H9. These results support the hypothesized, extended ISCM model and the principal-agent model. Figure 2 shows the results from the test of the hypothesized model.

Model comparison

The five hypotheses based on the IS continuance model were first replicated as a separate model before being extended with the principal-agent model. The baseline model explains 27% of the continuance intention and behaves as expected, with significant paths (please see Figure 3).

All results from the two models are reported in Table 6. A comparison of the models shows adjusted explained variances for continuance intention of 46% for the hypothesized model and 26% for the IS continuance model, indicating that the IS continuance and principal-agent models are complementary in explaining variance in continuance intention.

Implications and limitations

In this section, we discuss this study's theoretical implications, then present potential implications for practice, as well as limitations and avenues for future research.

Theoretical implications

The IS continuance model has been used previously to examine and explain drivers of educators' e-learning continuance intentions (Sørebø et al. 2009). However, e-learning studies that include variables covering the managerial perspective remain nonexistent (Nabavi et al. 2016). In our research, we argue that IS continuance model studies of e-learning also should consider the extent to which incentives and goal congruence between management and users is likely to play a role in continuance intention. Thus, we argue that the IS continuance model should be modified and extended with constructs from the principal-agent model to reduce existing shortcomings.
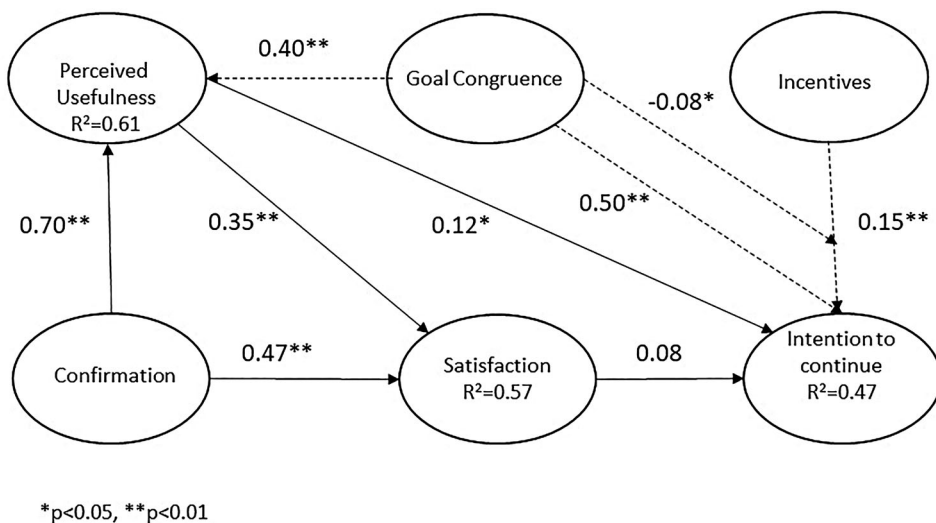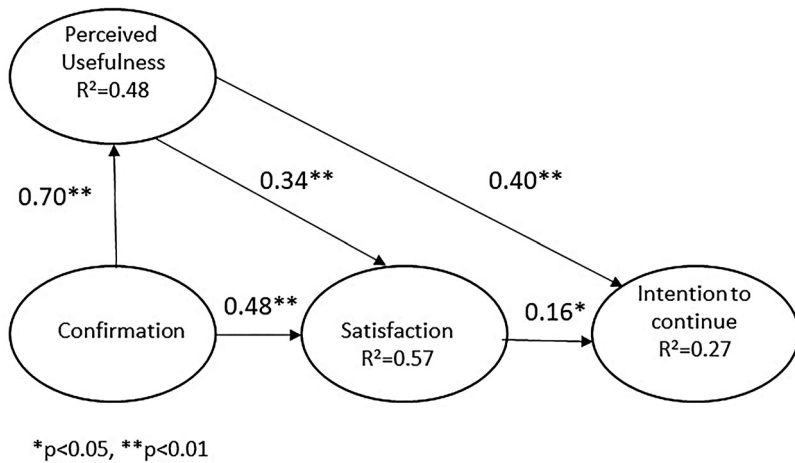

*p<0.05, **p<0.01

Figure 2. The results of the hypothesized model.

*p<0.05, **p<0.01

Figure 3. Replication model – ISCM.

A two-step empirical examination was deployed. First, a replication of the basic model (IS continuance model) was performed. Second, the baseline IS continuance model was extended with the constructs from the principal-agent model, and all hypotheses except H1 were supported. This test of the principal-agent model's influence on users' continuance intention is a new contribution to e-learning continuance research. Additionally, this study finds that goal congruence reduces the effect of incentives on continuance intention by supporting the interaction effect between incentives and goal congruence. The study's findings support the importance of treating these two perspectives as complementary, as both perspectives are needed to explain educators' e-learning continuance sufficiently. Adding the principal-agent model to the IS continuance model increases the explained variance in continuance intentions from 27% to 47%, indicating that goal congruence and incentives play an important role in faculty's continuance intentions. Consequently, this study should stimulate

Table 6. Summary of the results.

Hypotheses			Results	
H	Independent variable	Dependent variable	ISCM model	Hypothesized (extended) model
1	Satisfaction	Intention to Continue	.16*	.08
2	Confirmation	Satisfaction	.48**	.47**
3	Perceived Usefulness	Satisfaction	.34**	.35**
4	Perceived Usefulness	Intention to Continue	.40**	.12*
5	Confirmation	Perceived Usefulness	.70**	.52**
6	Incentives	Intention to Continue		.15**
7	Goal Congruence	Intention to Continue		.50**
8	GoaC*Inc	Intention to Continue		−.08*
9	Goal Congruence	Perceived Usefulness		.40**
R^2		Perceived Usefulness	.48	.61
		Satisfaction	.57	.57
		Intention to Continue	.27	.47
R^2 Adjusted		Perceived Usefulness	.48	.60
		Satisfaction	.56	.56
		Intention to Continue	.26	.46
Chi-square			180.5 (58df)	341.3 (139df)
RMSEA			.07	.06
CFI			.97	.96
TLI			.96	.95
SRMR			.05	.05

Note: *$p < .05$, **$p < 0.01$.

more empirical research that combines the IS continuance and principal-agent models regarding continued use of e-learning technology.

This study adds new understandings of educators' continued use of e-learning technologies and reveals important findings related to the research gaps discussed in the introduction. First, this study extends complementary aspects of the IS continuance and principal-agent models into a parsimonious and holistic view of continuance intentions in e-learning settings. The literature has called for the inclusion of alternative perspectives in the context of established models (Bhattacherjee and Lin 2014). Thus, our study develops a synthesis of the IS continuance and principal-agent models to explain educators' use of e-learning technologies from both IT-centric and work-management perspectives. Second, previous studies have claimed that incentives can be a critical factor in ensuring increased use of an IS. Utilizing the principal-agent model, we find support for a direct effect of managerial incentives on educators' e-learning continuance intentions, as well as for the moderating effect of goal congruence on the relationship between managerial incentives and intended continued use of e-learning. Thus, the study has increased our understanding of how incentives influence educators' e-learning continuance intention. Third, by also drawing on the principal-agent model, the study argues why and how the degree of goal congruence affects educators' continued use of e-learning. The principal-agent theory's assumption of a universal goal conflict fails to consider real-life behavior's very real variance. This study includes this original principal-agent theory assumption as a variable in the research model, and we find empirical support for the direct effect of goal congruence on e-learning continuance intention.

Practical implications

Information technology is vital to organizations' competitiveness, as it affects the mechanisms through which performance is created and captured (Drnevich and Croson 2013). Information technology also has become increasingly pervasive at all education levels, including higher education. Implementation of e-learning technologies is expected to facilitate improvements in teaching quality and learning outcomes, and is viewed as vital to universities' organizational performance and competitive advantage. This study offers university management practical proposals for securing implementation of e-learning technology. First, and according to this study's principal findings, university management should be aware of the strong importance of goal congruence between management and university educators as a predictor of e-learning continuance intention. The higher-level goals regarding implementation of e-learning technologies should be communicated at all levels in the organization to ensure they are anchored and understood among educators, as well as among faculty management. In this communication work, it is important to present the background of and motivation for implementation to both educators and faculty management. According to our study, goal congruence is the dominant antecedent for educators' continued use of e-learning.

Second, our study's results show that incentive mechanisms that university management proposes will affect educators' intention to continue use of e-learning technology positively. University management can increase the level of continued use by establishing appropriate incentive mechanisms, which could be financial support related to e-learning projects. Additionally, the goal-congruence level will moderate incentives' effect negatively, indicating that goal congruence may reduce the need for incentives. Conversely, when goal congruence is high, the use of incentives will exert less influence.

Finally, this study supports the importance of educators' perceived usefulness of e-learning technology when predicting continuance intention among educators. Thus, close cooperation among university management, IT management, and key user representatives when implementing new e-learning solutions is required to secure successful implementation and use. University management must set the ambition level and ensure that the entire academic community, not just enthusiasts, uses the opportunities that digitalization offers to raise education quality and flexibility. Additionally, management should initiate appropriate actions to promote new solutions and guide users'

expectations. It is critical for university management to understand educators' characteristics. When such an understanding is established, the next step is to design systems that promote these characteristics. According to Al-Samarraie et al. (2018), perceived usefulness is 'driven by information quality, task-technology fit, and utility value.' A wide range of e-learning technologies is available, and university management should verify these aspects together with educators when selecting and implementing new e-learning technologies. Additionally, increased perceived usefulness and confirmation, for example, can be obtained through increased competence (Sørebø et al. 2009). A combination of skills within instructional design, curriculum development, and technology is needed, and a training program to strengthen these skills should be initiated. Increased competence within these areas will put educators in a position to evaluate functionality, express perceived usefulness, and increase confirmation level. This focus on increasing perceived usefulness, securing goal congruence, and establishing suitable incentives will contribute to an increased degree of continued use.

Limitations and avenues for future research

Our study has several limitations. First, the use of a synthesis of principal-agent and IS continuance models in e-learning settings is very limited in previous research on e-learning continuance, and replications and extensions are necessary for further research. Second, our research model focuses on parsimony, and only limited parts of the whole principal-agent theory framework have been included. To further enhance our understanding of educators' e-learning continuance, future research should broaden the use of principal-agent theory as a model that complements the IS continuance model. Principal-agent theory is a comprehensive theory that comprises several concepts beyond the ones included in our research models, such as monitoring mechanisms, outcome uncertainty, task programmability, and outcome measurability (e.g. Eisenhardt 1989). According to principal-agent theory, and depending on the context, monitoring mechanisms partly may substitute for incentive mechanisms in terms of reducing user opportunism. Monitoring particularly would be useful when task programmability (i.e. the degree to which appropriate user behavior can be specified in advance) is high, outcome measurability (i.e. the degree to which task outcomes are measured easily) is low, and outcome uncertainty is high (Eisenhardt 1989). Future research should include a classification of system use according to programmability level, outcome measurability, and outcome uncertainty. Table 7 contains a potential guide for future research. In Scenario 1, monitoring is predicted as the most effective governing mechanism. Scenarios 2 and 3 indicate a mix of governing mechanisms, with monitoring as the dominant mechanism in Scenario 2 and incentives as the dominant mechanism in Scenario 3. In Scenario 4, incentives are predicted as the most effective governing mechanism.

Next, the expected positive relationship between satisfaction and intention to continue was not supported, but the basic model is modified and extended, and new antecedents of intention to continue are included in the model, which may neutralize the effect of satisfaction. Additionally, future studies should theorize and test various items related to the measurement of satisfaction. The items on satisfaction implemented in this study initially were developed for the consumer market and, therefore, may not reflect educators' satisfaction related to the use of e-learning technologies sufficiently.

Table 7. PAT constructs and IS-systems classifications.

Scenarios	Task programmability	Outcome measurability	Outcome uncertainty	The mechanism for curbing opportunism
1	High	Low	High	Monitoring
2	Low	Low	High	Mix of monitoring and incentives
3	Low	High	High	Mix of monitoring and incentives
4	Low	High	Low	Incentives

Finally, correlation designs and cross-sectional studies have methodological limitations. The hypotheses developed in this study are based on theory, and further studies should apply longitudinal design and (field) experiments to strengthen the hypothesized model's causality tests and internal validity.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Al-Samarraie, H., B. T. Teng, A. I. Alzahrani, and N. Alalwan. 2018. "E-learning Continuance Satisfaction in Higher Education: A Unified Perspective from Instructiors and Students." *Studies in Higher Education* 43 (11): 2003–19.

Alter, S. 2003. "18 Reasons Why IT-Reliant Work Systems Should Replace 'The IT Artifact' as the Core Subject Matter of the IS Field." *Communications of the AIS* 12 (23): 365–94.

Alter, S. 2015. "A Work System Perspective on Adoption Entities, Adoption Processes, and Post-Adoption Compliaence and Noncompliaence." *Twentieth DIGIT Workshop, Fort Worth, Texas, December 2015*.

Anderson, J. C., and D. W. Gerbing. 1988. "Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach." *Psychological Bulletin* 103: 411–23.

Bagozzi, R. P., and T. Yi. 1988. "On the Evaluation of Structural Equation Models." *Journal of the Academy of Marketing Science* 16 (1): 74–94.

Bhattacherjee, A. 1998. "Managerial Influences on Intraorganizational Information Technology Use: A Principal-Agent Model." *Decision Sciences* 29 (1): 139–62.

Bhattacherjee, A. 2001a. "Understanding Information Systems Continuance: An Expectation-Confirmation Model." *MIS Quarterly* 25 (3): 351–70.

Bhattacherjee, A. 2001b. "An Empirical Analysis of the Antecedents of Electronic Commerce Service Continuance." *Decision Support Systems* 32 (2): 201–14.

Bhattacherjee, A., and A. Barfar. 2011. "Information Technology Continuance Research: Current State and Future Directions." *Asia Pacific Journal of Information Systems* 21 (2): 1–18.

Bhattacherjee, A., and C.-P. Lin. 2014. "A Unified Model of IT Continuance: Three Complementary Perspectives and Crossover Effects." *European Journal of Information Systems* 24 (4): 1–10.

Bhuasiri, W., O. Xaymoungkhoun, H. Zo, J. J. Rho, and A. P. Ciganek. 2012. "Critical Success Factors for E-learning in Developing Countries: A Comparative Analysis Between ICT Experts and Faculty." *Computers & Education* 58: 843–55.

Bøe, T., B. Gulbrandsen, and Ø. Sørebø. 2015. "How to Stimulate the Continued Use of ICT in Higher Education: Integrating Information Systems Continuance Theory and Agency Theory." *Computers in Human Behavior* 50: 375–84.

Coughlan, A. T., and S. K. Sen. 1989. "Salesforce Compensation: Theory and Managerial Implications." *Marketing Science* 8: 324–42.

Davis, F. 1989. "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology." *MIS Quarterly* 13 (3): 319–40.

Drnevich, P. L., and D. C. Croson. 2013. "Information Technology and Business-Level Strategy: Toward an Integrated Theoretical Perspective." *MIS Quarterly* 37 (2): 483–509.

Eisenhardt, K. 1989. "Agency Theory: An Assessment and Review." *Academy of Management Review* 14 (1): 57–74.

Fornell, C. D., and D. F. Larcker. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error." *Journal of Marketing Research* 18 (February): 39–50.

Green, T. 2016. "A Methodological Review of Structural Equation Modelling in Higher Education Research." *Studies in Higher Education* 41 (12): 2125–55.

Hu, L., and P. M. Bentler. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives." *Structural Equation Modeling: A Multidisciplinary Journal* 6 (1): 1–55.

Hung, M. C., I. C. Chang, and H. G. Hwang. 2011. "Exploring Academic Teachers' Continuance Toward the Web-Based Learning System: The Role of Causal Attributions." *Computers & Education* 57 (2): 1530–43.

Islam, A. K. M. Najmul. 2011. "Extending Information System Continuance Theory with System Quality in E-learning Context." *AMCIS Proceedings.* AIS Electronic Library.

Islam, A. K. M. Najmul. 2012. "The Role of Perceived System Quality as Educators' Motivation to Continue E-Learning System Use." *AIS Transactions on Human-Computer Interaction* 4 (1): 25–43.

Jo, D. 2018. "Exploring the Determinants of MOOCs Continuance Intention." *KSII Transactionsn on Internet and Information Systems* 12 (8): 3992–4005.

Kivistö, J. 2008. "An Assessment of Agency Theory as a Framework for the Government-University Relationship." *Journal of Higher Education Policy and Management* 30 (4): 339–50.

Larsen, T. J., A. M. Sørebø, and Ø. Sørebø. 2009. "The Role of Task-Technology Fit as Users' Motivation to Continue Information System Use." *Computers in Human Behavior* 25: 778–84.

Laugesen, J. 2012. "The Role of Confirmation in IS Continuance Theory: A Comprehensive Meta-Analysis." *International Conference on Information Systems*: 1–20.

Milgrom, P., and J. Roberts. 1992. *Economics, Organization and Management*. Upper Saddler River, NJ: Prentice Hall.

Nabavi, A., M. T. Taghavi-Fard, P. Hanafizadeh, and M. R. Taghva. 2016. "Information Technology Continuance Intention: A Systematic Literature Review." *International Journal of E-Business Research* 12 (1): 58–95.

Oliver, R. L. 1980. "A Cognitive Model on the Antecedents and Consequences of Satisfaction Decisions." *Journal of Marketing Research* 17 (4): 460–9.

Perrow, C. 1986. "Economic Theories of Organization." *Theory and Society* 15 (1/2): 11–45.

Podsakoff, P. M., S. B. MacKenzie, J. Y. Lee, and N. P. Podsakoff. 2003. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies." *Journal of Applied Psychology* 88 (5): 879–903.

Sørebø, Ø, H. Halvari, V. F. Gulli, and R. Kristiansen. 2009. "The Role of Self-Determination Theory in Explaining Teachers' Motivation to Continue to Use E-learning Technology." *Computers & Education* 53: 1177–87.

Spreng, R. A., and R. D. Mackoy. 1996. "An Empirical Examination of a Model of Perceived Service Quality and Satisfaction." *Journal of Retailing* 72 (2): 201–14.

Stolovitch, H., R. E. Clarck, and S. Condly. 2002. *Incentives, Motivation and Workplace Performance*. Washington, DC: International Society for Performance Improvement.

Tao, Y., C. Cheng, and S. Sun. 2009. "What Influences College Students to Continue Using Business Simulation Games? The Taiwan Experience." *Computers & Education* 53: 929–39.

Tao, Y. H., C. J. Cheng, and S. Y. Sun. 2012. "Alignement of Teacher and Student Perceptions on the Continued Use of Business Simulation Games." *Educational Technology & Society* 15 (3): 177–89.

Venkatesh, V., and F. D. Davis. 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies." *Management Science* 46 (2): 186–204.

Voorhees, C. M., M. K. Brady, R. Calanton, and E. Ramirez. 2016. "Discriminant Validity Testing in Marketing: An Analysis, Causes for Concern, and Proposed Remedies." *Journal of the Academy of Marketing Science* 44: 119–34.

Wright, P., A. Mukherji, and M. J. Kroll. 2001. "A Reexamination of Agency Theory Assumptions: Extensions and Extrapolations." *Journal of Socio-Economics* 30 (5): 413–29.

Yeh, C., and Y. Tao. 2012. "College Students' Intention to Continue Using a Personal Response System: Deriving a Model from Four Theoretical Perspectives." *Australasian Journal of Educational Technology* 28 (5): 912–30.