

Professional identity and teachers' learning technology adoption: a review of adopter-related antecedents

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Abstract: This paper reviews adopter-related antecedents of learning technology adoption by higher education teachers. We, drawing on findings from Management and Psychology, Computing, and Education, suggest an adopter-centered perspective on teachers' learning technology adoption and identify work-related, technology-related, and teaching-related antecedents, which reflect aspects of teachers' professional identity. We further argue that teachers' professional identity shapes their perceptions of innovation characteristics, which in turn affects learning technology adoption. The paper concludes by highlighting that future research and practice should explore aspects of professional identity in order to more fully explain learning technology adoption, and should facilitate the adoption process through addressing the reconstruction of professional identity.

Keywords: learning technologies, technology adoption, teacher, professional identity, antecedents

Introduction

Learning technologies are being implemented by universities (Browne et al., 2006) with the aim of enhancing learning experience and transforming educational practice (Coates et al., 2005). The adoption of learning technologies by universities, like other organisations, occurs at two levels (Frambach and Schillewaert, 2002): at an organisational level and then at an operational unit or individual level. Universities make an institution-wide decision to invest in a learning technology and then, to varying degrees, academic staff make their own decisions regarding how they will use it. Teachers may behave differently even though they are exposed to similar technologies (Stein et al., 2011); some may leap to use new technologies while others shy away or resist identical innovations (Quinn, 2012).

Extant research on technology acceptance and teachers' integration of educational technologies takes an innovation attribute-centered perspective which proposes that a technological innovation will be adopted if it is perceived to be superior to its predecessors. This approach proposes that the perceived innovations' attributes are the critical antecedents of technology adoption (Frambach and Schillewaert, 2002). Adoption failures are interpreted in terms of inadequate features and it is assumed that further developments of a technology should lead to enhanced take-up. Such an approach does not incorporate subjective interpretations and cannot explain differences in adoption between individuals who, at least on paper, have very similar work tasks to complete and very similar experiences of predecessor technologies.

In recognising subjective interpretations and individual differences in learning technology adoption, we take an adopter-centred perspective. An adopter-centred perspective acknowledges that individuals are different and actively engage with new technologies. Individuals "seek innovations, experiment with them, evaluate them, find (or fail to find) meaning in them, develop feelings (positive or negative) about them, challenge them, worry about them, complain about them, 'work around' them, gain experience with them, modify them to fit particular tasks, and try to improve or redesign them –often through dialogue with other users (Greenhalgh et al., 2004, p. 598)". This perspective highlights the individual and contextual dynamics in the adoption process, and contrasts markedly with the "early adopter" and "laggard" classification that oversimplifies the individual's adoption process (Greenhalgh et al., 2004).

In this paper, we first review adopter-related antecedents, then present the notion of professional identity and demonstrate how it can be used for understanding teachers' adoption of learning technologies.

Work-related orientations as antecedents

Work-related psychological orientations refer to consistent complex of cognitive, motivational, and moral orientations to a given situation that serves to guide behaviour (Deutsch, 2011). Four teachers' work-related orientations are considered below.

Personal innovativeness

Personal innovativeness is probably the most frequently included work-related orientation in information systems research. It refers to willingness to adopt innovations in general (Kirton, 1976), and was initially depicted as an outcome variable to segment consumers into 'innovators' and 'non-innovators' (Rogers, 1995). Later on, it was regarded as a personality trait, an antecedent of innovation adoption behaviour (Flynn and Goldsmith, 1993). Agarwal and Prasad (1998) found that personal innovativeness in IT moderated adopter's intention to use a new technology. A recent study also confirmed that personal innovativeness in IT moderated the relation between contextual triggers and system use (Sun, 2012).

Change orientation

Change-related orientations concern attitudes to alterations in practice or policy at work (Parker et al., 2006). Since technological innovations impose a change to the workplace, individual's change orientation may affect the adoption process. In organisational research, change orientation is found to be an antecedent of employees' proactive behaviour (Strauss and Parker, 2014) and employees' participation in planned organisational change (Miller et al., 1994). One empirical study in education (Vannatta and Nancy, 2004) suggests that teachers' "openness to change" affects teachers' classroom technology use.

Control orientation

Control orientation describes the general belief that one is in control of important issues at work and includes: control aspiration, perceived opportunity for control, and control self-efficacy (Frese et al., 2007). Parker et al. (2006) further propose "control appraisal" which they define as individuals' expectation on taking charge of the situation, as an alternative to measuring control orientation. Other works assess locus of control (Rotter, 1966), which is the extent that an individual perceives events to be under his or her control, or under the control of powerful others, to capture control beliefs. In general, control orientation has been found to be predictive of employees' taking charge (Morrison and Phelps, 1999) and employees' commitment to organisational change (Chen and Wang, 2007). Within information systems research, coping theory suggests that individual perception of control over the environment, along with the perception of the environment, affects employees' behaviour towards technological innovation (Beaudry and Pinsonneault, 2005; Elie-Dit-Cosaque and Straub, 2011). When an individual has lower level of perceived control, they may adopt either a self-preservation strategy or a benefits satisficing strategy. In contrast, when an individual has higher level of perceived control, they may take either a disturbance handling strategy or a benefits maximizing strategy (Beaudry and Pinsonneault, 2005). Hsia et al. (2014) integrated locus of control into the technology acceptance model. They report that locus of control was associated with perception of innovation attributes, such as usefulness and ease of use.

Autonomy

Autonomy refers to the desire for self-initiation and is purported to contribute to intrinsic motivation along with other psychological needs (Gagné and Deci, 2005). Intrinsic motivation, the motivation for doing an activity for its own sake, is associated with a number of important work outcomes such as effective performance, flexibility, and uncertainty (Gagné and Deci, 2005). Roca and Gagné (2008) incorporated autonomy into the technology acceptance model to investigate employees' e-learning continuance intention in the workplace. They found that autonomy was positively related to perceived innovation attributes, which in turn affected employees' e-learning continuance intention. Sørebo et al. (2009) included autonomy as a hypothesised antecedent of teachers' e-learning technology continuance intention. Their findings were consistent with Roca and Gagné (2008)'s research. Autonomy was positively associated with teachers' perceived usefulness of the e-learning technology and their intrinsic motivation, which affected teachers' e-learning continuance intention.

Summary

Four psychological work-related antecedents to technology adoption have been examined: personal innovativeness, change orientations, control orientations, and autonomy. They are similar in that they all concern work-related orientations which guide behaviour towards change or uncertainty. They contrast in several aspects. Personal innovativeness emphasises general tendency or attitude towards innovations whereas change orientation includes perceptions of change in organisational settings. Control orientation captures desire for and perception of control and has been found to predict change-related attitudes and behaviour towards technological innovation. Autonomy reflects intrinsic motivation and is associated with perceptions of innovation attributes. Given their predictive power and theoretical importance in change management and information systems and their relative neglect in learning technology adoption, work-related orientations warrant further investigation.

Technology-related antecedents

The section below considers technology-related antecedents. They are: attitude and emotions towards technology, experience and habit with technology, knowledge and computer self-efficacy.

Attitude towards technology

Attitude refers to the summary evaluation of an object of thought and may encompass affective, behavioural and cognitive responses (Vogel and Wanke, 2016). Attitudes are stored in memory and retrieved for evaluation of an object in question (Eagly and Chaiken, 2007). Since technological innovations are novel and adopters may not possess information to evaluate the specific innovation, they are likely to retrieve general attitudes towards technologies to assess or interpret innovation novel technology. Information systems research tends to examine attitude towards a specific technological innovation, rather than attitude towards technology in general. For instance, the technology acceptance model (Davis, 1989) incorporated attitude towards computer, a specific attitude towards technology, as an antecedent of computer use. Within education, Somekh (2008), argues that teachers' attitudes towards ICT (a general attitude), along with their confidence and competence, remained central to their adoption of technologies. Similarly, several literature reviews (e.g. Mumtaz, 2000) and empirical research (e.g. Drent and Meelissen, 2008) have demonstrated that teachers' views about ICT in education are positively related to their use of ICT.

Emotions associated with technology

Emotions tend to be short-lived and are the affect that is related to a specific object (Rosenberg, 1998). Some research has included emotions as antecedents of technology acceptance. Researchers report that feelings of anxiety around computers negatively influences computer use (Compeau and Higgins, 1995a). Baudry and Pinsonneault (2010) classified emotions into four categories and examined the effect of four representative emotions: excitement, happiness, anger, and anxiety, on technology acceptance. They found that excitement positively affected IT use through task adaptation; happiness positively affected IT use but was negatively associated with task adaptation; anger was positively associated with seeking support which in turn positively affected IT use; anxiety was negatively associated with IT use both directly and indirectly.

Experience and habit associated with technology

Taylor and Todd (1995) compared determinants of computer usage between experienced and inexperienced users. They found that behavioural intention was a better predictor of use for the experienced group whereas perceived usefulness was a better predictor for the inexperienced group. Limayem et al. (2007) defined habit as the extent to which people tended to perform behaviours automatically because of learning. They found that habit moderated the influence of intention to use on use behaviour. With the importance of intention decreasing over time, usage behaviour takes on a more habitual nature. Similar support can be found in education where experience with computers or ICT, especially for educational purposes, is predictive of the use and integration of educational technologies in the classroom (Drent and Meelissen, 2008; Mumtaz, 2000).

Knowledge associated with technology

Aggarwal et al. (2015) examined the impact of self-perceived and actual IT knowledge on technology use. They found that self-perceived IT knowledge was predictive of individual adoption of technological innovation whereas actual IT knowledge was predictive of continuance. The research highlighted the role of general computer-related knowledge on the use of specific technological innovation. Recent studies in education have shown a similar pattern: computer knowledge and skills are associated with teachers' classroom technology use (Petko, 2012; Ertmer and Ottenbreit-Leftwich, 2010).

Computer-related self-efficacy

Self-efficacy refers to subjective assessment of capability to perform a course of action to achieve a desired outcome (Bandura, 1977). Within technology acceptance, some research (Downey and McMurtrey, 2007) viewed computer self-efficacy as a general construct, other research studied specific computer self-efficacy such as spreadsheet self-efficacy (Johnson and Marakas, 2000) and internet self-efficacy (Hsu and Chiu, 2004). Findings suggest that general computer self-efficacy is a strong predictor of computer anxiety, outcome expectation and computer use (Compeau and Higgins, 1995b). In addition, Agarwal et al. (2000) found that general computer self-efficacy is an antecedent of specific computer-related self-efficacy. Anderson et al. (2011) and Kreijns et al. (2013) found that teachers' self-efficacy beliefs about technology was positively associated with their intention and willingness to use ICT in classroom. Cigdem and Topcu (2015)'s research on learning management systems also confirmed that teachers' self-efficacy beliefs about technologies were antecedents of their intention to use learning management system.

Summary

Technology-related antecedents have been considered as variables which differ between individuals and are predictive of technology adoption. It is clear from the above that they are closely related and synergistic. Prior experience with computers or technologies serves as a source of technology-related attitudes and emotions. These attitudes and emotions will be referenced subsequently in the individual's adoption of new learning technologies. However, research has indicated that relationships among technology-related antecedents are complex. Habit may hinder technology adoption when the technological innovation requires a change of behaviour. Knowledge does not always facilitate the adoption of technological innovation either. Given their predictive power and complexity, technology-related antecedents are worth exploring in teachers' adoption of learning technologies.

Teaching-related antecedents

This section reviews three categories of teaching-related antecedents of teachers' learning technology adoption. They are: teachers' pedagogical beliefs, approaches to teaching, and commitment to teaching.

Pedagogical beliefs

Pedagogical beliefs refer to the way teachers view teaching (Ertmer, 2005). It concerns teachers' suppositions and ideologies of teaching and resides in teacher's larger belief system (Pajares, 1992) along with other educational beliefs. Terms like "conception of teaching" (Chan and Elliott, 2004) and "teaching philosophy" (Becker, 2000) depict similar ideas as pedagogical beliefs. Research on pedagogical beliefs generally confirms that teachers hold two types of beliefs about teaching. Teachers with traditional beliefs view teaching as an information transmission process where teachers need to make sure that students acquire knowledge and apply what is learned (Becker, 2000). Teachers with constructive beliefs, on the other hand, understand teaching as a facilitation process where students construct their own knowledge and initiate conceptual change (Chan and Elliott, 2004). Research has explored the role of pedagogical beliefs on teachers' technology usage, but findings are inconsistent. Anderson et al. (2011) suggests that constructive beliefs are predictive of teachers' technology integration but reports that they did not lead to the use technology in a constructive manner. Similarly, Owens (2012) found that teachers who held constructive beliefs did not necessarily teach online in a "facilitating learning" manner. Petko (2012), however, found that teachers' constructive beliefs had a positive influence on their use of technology though the impact was small. Therefore, the impact of pedagogical beliefs on teachers' technology usage needs to be further explored.

Approaches to teaching

Approaches to teaching (Prosser and Trigwell, 2014), assesses how teachers approach teaching in practice. Two main approaches are proposed: the teacher-centred approach and the student centred approach. The teacher-centred approach emphasizes "acquisition of content and skills through drills and practice". The student-centred approach involves "the prolong engagement of the learner in relating new ideas and explanations to the learner's prior belief" (Jacobson et al., 2010). Although it is suggested that traditional beliefs are closely related to the teacher-centred approach while constructive beliefs are closely related to student-centred approach (Norton et al., 2005), pedagogical beliefs are more of teachers' orientations whereas approaches to teaching emphasize how teaching takes place in practice. Liu (2011) found that teachers' belief about teaching could be quite different from their approaches to teaching in practice. Teachers with constructive teaching beliefs adopted constructive or traditional transmissionist teaching approach and teachers with traditional teaching beliefs took traditional teaching approach. Niederhauser and Stoddart (2001) suggested that the design of educational technologies was influenced by different educational theories: instructional technologies that involve more teacher centred (information transmission) approach which requires students to master and replicate the knowledge and skills;

learning technologies that involve more learner-centred (constructive, transformative) approach which helps students to use the technology as a tool to seek and update their knowledge. They found that teachers chose different educational technologies based on their approaches to teaching although most of the educational software being chosen reflected a transmission approach. Drent and Meelissen (2008) found that student-centred approach was related to the innovative use of information communication technologies. Similarly, Tarling and Ng'ambi (2016)'s qualitative study indicated that transmission pedagogies were correlated with regulated, restrictive ways of educational technology usage; transformative pedagogies was correlated with unregulated, dispersed ways of educational technology usage.

Commitment to teaching

In organisational research, commitment refers to the psychological state that individual feels a desire to remain, an obligation to remain, a cost of leaving the organisation (Herscovitch and Meyer, 2002). Similarly, commitment to teaching could be perceived as a force that binds a teacher to a course of action deemed necessary for the effective teaching. Mumtaz (2000) proposed that teacher's motivation and commitment to student learning as an antecedent of teacher's ICT use. This is confirmed by Vannatta and Nancy (2004) who found that time spent beyond the contractual work week, along with openness to change and intensity of technologies use, was one of the best predictors of classroom technology use. The notion of time spent beyond contractual work week reflects the idea of commitment as it relates to teachers' engagement and dedication to teaching. Given that commitment has been regarded as an important predictor of workplace behaviour (Peccei et al., 2011), commitment to teaching may affect teachers' learning technology adoption.

Summary

Pedagogical beliefs and approaches to teaching are both concerned with how teachers teach and have been treated as antecedents of teachers' adoption of learning technology. However, they differ from each other as pedagogical beliefs describe how teachers view teaching whereas approaches to teaching describe how teachers teach in practice. Commitment to teaching is concerned with effective teaching but also reflects a teacher's desire to teach. It is relatively neglected in teachers' use of ICT. However, since higher education teachers are faced with competing priorities (Skelton, 2012), commitment to teaching may prove to be a powerful predictor of adoption.

Professional identity in learning technology adoption

The preceding three sections covered individual differences in work-related, technology-related and teaching-related antecedents which are related to technology adoption. By taking an adopter-centred perspective, we move beyond innovation attributes and ask what makes individual teachers perceive introduced learning technology differently and how they form their subjective meaning of, and position themselves towards a technological innovation. However, adopter-related antecedents identified in this paper are derived from concepts borrowed from several disciplines. There is a lack of theoretically sound elaboration which can capture aspects of adopter-related antecedents and provide insights into practice.

The sections below attempts to integrate these categories of adopter-related antecedents into an adopter-centred perspective with the assistance of the notion of professional identity. We first present the notion of professional identity and discuss aspects of a teacher's professional identity. Thereafter, we highlight the way professional identity shapes educational change and its implication for learning technology adoption.

Professional identity as the image of self

Identity refers to meanings attached to a person by oneself and others (Gecas, 1982). The notion of professional identity stems from social identity theory (Ashforth and Humphrey, 1993) which suggests that identity is shaped socially. Professional identity is understood to be part of social identity and relates to work-based self-concepts (Slay and Smith, 2011). Professional identity is different from role in that roles are externally defined by others' expectations but professional identity is defined by the individual internally as they accept or reject social expectations as part of who they are (Colbeck, 2008). Trede et al. (2012) reviewed research on professional identity in higher education and found the term 'professional identity' was conceptualised in many forms. For instance, Sachs (2001) defined professional identity at the professional level as a set of attributes that were imposed on teachers. By contrast, Van Veen and Slegers (2006) viewed professional identity as a personal conception at the individual level. Professional identity here is defined as the subjective appraisal of self-concepts (Beijaard et al., 2000). However, since self can only arise in social communication where one learns to assume the role of others, and subsequently monitor his or her own (Mead, 1934), teachers' professional identity is not entirely formed by individual's perception. This perspective echoes the idea that a teacher's professional identity is influenced by negotiations with social situations, expectations of others, and formed by the teacher's

personal landscape and experiences, which eventually defines what is meaningful for himself or herself in professional work (Beijaard, 1995).

Aspects of professional identity

Teachers' professional identity is multi-dimensional and hierarchical in that it relates to aspects of the teaching profession (Beijaard et al., 2004), and is prioritised by individual preferences (Colbeck, 2008). Beijaard (1995) suggested that professional identity includes the subject of teaching, the relationship with students, and the role conception, and needs to be understood as subject experts, pedagogical experts (emotional and ethical), and didactic experts (Beijaard et al., 2000). Van Veen and Slegers (2006) found two orientations related to professional identity. The first being the distinction between the learner-centred versus the teacher-centred orientation. The second being the restricted versus the extended orientation. A restricted orientation focuses primarily on the pedagogical content of teaching whereas an extended orientation allows the teacher to involve in the school as an organisation and takes teaching more than just within the classroom. A more recent study (Lamote and Engels, 2010) measures professional identities against four dimensions: commitment to teaching, professional orientation (the extended or restricted self), teaching methods, and teachers' self-efficacy. This implies that teachers' professional identity is about teachers' values and beliefs about teaching (commitment to teaching), how they see themselves as teachers (professional orientation), how they teach in practice (teaching methods), and capabilities required for being a teacher (self-efficacy). The hierarchy of professional identities may have more profound implications for higher education where university teachers experience with dual professional identity (Nixon, 1996). They are placed by universities as teachers with an emphasis on pedagogical and curriculum change but are also required to work as researchers, attracting external funds and carrying out and publishing research.

It might be difficult to depict what the professional identity of a university teacher should look like as professional identity as such is multi-dimensional and hierarchical, and subject to individual's perception of priorities. However, what is agreed is that professional identity is not fixed, it involves the ongoing interpretation and reinterpretation of experiences. It represents the process by which individual teacher integrates various statuses and roles into a 'coherent image of self' (Sachs, 2001).

Professional identity and educational change

Eilam and Shamir (2005) suggests that professional identity influences employees' reaction to change. A change is likely to be resisted if it is perceived as a threat to professional identity. Professional identity, therefore, in the context of resistance to change, is viewed as attempts to maintain self-image. Following this notion, resisting teachers are said to fear change (Kirkup and Kirkwood, 2005) and develop strategies to protect their professional identity from being forced to be perceived differently by themselves (Beijaard, 1995). Schilling et al. (2012) indicated the positive effect of professional identity and argued that successful organisational change depends on employees' ability to enact certain professional identities. This perspective acknowledges that change needs to be perceived in accordance with employee's professional identity. It implies that technological innovations convey structures and expectations promoted by the technology and by the organisation. However, an employee's professional identity may not necessarily align with the new structures and identity expectations. Therefore, the fit between an employee's professional identity and structures and expectations brought by the technological innovation is the key to the employee's adoption of the technological innovation.

The notion of professional identity may facilitate understanding of the reactions of higher education teachers when confronted with their university's decision to adopt learning technologies. Educational innovations may represent particular interests and expectations that are not necessarily aligned with teachers' professional identity (Goodson, 2001). This misalignment may result in the differential adoption of learning technologies because each individual teacher learns about and makes use of the technological innovation in practice through their professional identity (Trede et al., 2012). In a study of the effect of professional identity on educational innovation, Ketelaar et al. (2012) argue that teachers do not just simply accepting or rejecting what is being imposed. Instead, teachers actively position themselves in relation to the innovation. Three identity-related mechanisms are identified in teachers' adoption process: the feeling of ownership, the feeling of agency, and sense-making. Ownership refers to a sense of involvement and purpose, and is suggested to promote change as it is the fusion between the object of ownership and the self (Pierce et al., 2001). Teachers would likely to adopt technological innovation when they feel that the technology is aligned with their self-concepts. Agency refers to a sense of control and empowerment, and is strengthened by the heightened awareness of professional identity (Beauchamp and Thomas, 2009) which allows teachers to actively shapes their activities. Sense-making refers to the process by which individual teacher interprets the innovation, in which professional identity is used as a reference (Hotho, 2008).

Professional identity in learning technology adoption

We propose that professional identity may be used to understand learning technology adoption by higher education teachers. However, there seems no reason to propose that professional identity should be inevitably associated with resistance. Professional identity involves teachers evaluating who they are and where they should be (Van Veen and Slegers, 2006), which can potentially be a source for initiating change or supporting change if the change is seen to be concordant with their “should-be” status.

Therefore it is proposed that teachers’ professional identity in relation to the adoption of learning technologies should encompass work-related identity, how they prefer to work and how they see themselves as a teacher; teaching-related identity, how they perceive and conduct teaching; and technology-related identity, how they perceive the role of and use technology at work (Liu and Geertshuis, 2016). For instance, a teacher who is positive about change and seeks control over his or her work is likely to experience agency. A teacher who has an extended view about being a teacher and has a higher degree of commitment to teaching may feel a sense of involvement when adopting learning technologies. In cases where a teacher finds that the learning technology aligns with his or her pedagogical beliefs and enacts his or her desired teaching approach, sense-making is easier.

Applying professional identity theory to an analysis of behavioural differences in the take-up of technologies may afford the research enhanced explanatory power. However this approach has practice implications too. It follows that because teachers’ professional identity is a combination of several sub-identities which work synergistically to shape their perceptions of the learning technology, effort to facilitate learning technology adoption need to attend to aspects of teachers’ professional identity. Universities need to not only prepare teachers with capabilities to use the technology but also support teachers in changing how they view the job of a teacher and how a teacher should teach in practice.

Implications

This paper presents an alternative perspective on teachers’ learning technology adoption and reveals three types of adopter-related antecedents of teachers’ adoption behaviour. We argue that these adopter-related antecedents together reflect teachers’ professional identity through which teachers perceive the relevance of the introduced learning technology and decide how they will make sense of, learn about and make use of the learning technology. Given the multi-dimensional and hierarchical nature of higher education teachers’ professional identity, future empirical research could explore aspects of professional identity that work synergistically to teachers’ learning technology adoption; how professional identity is changed over time in the context of learning technology adoption; and how universities can facilitate the professional identity reconstruction process. The notion of professional identity also suggests that training that attends at an individual level to professional identity including orientations to teaching, technology and change is likely to be more successful in facilitating take-up than training which simply briefs staff on how to operate a new tool.

Conclusion

This paper reviews adopter-related antecedents of learning technology adoption, examining work-related, technology-related, and teaching-related antecedents. We argue for a shift from the over-reliance on innovation attributes to an adopter-centred perspective which acknowledges individual agency, social influence and the dynamics in the adoption process. We present the notion of professional identity as a unifying approach to individual difference and an approach to fostering change.

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