Psychological Ownership and Personal Learning Environments: Do sense of ownership and control really matter?

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Abstract. New power relations and the shift in control have been some of the key topics driving the discussion about Personal Learning Environments (PLE). This paper explores the role of sense of ownership and control in use of technology-enhanced learning environments. The paper is rooted in the theory of psychological ownership and reports on empirical findings from a joint study conducted at universities in Berlin and Augsburg (Germany). The study encompasses the results of an online survey with 50 students from three different university courses, exploring multiple relationships between ownership, control and learning in context of web-based ePortfolios. The results of the study indicate that control of intangible elements of ePortfolio, such as control of content or personal data, is more related to the feeling of ownership of one's ePortfolio than control of tangible elements, such as technical tools. Based on the example of web-based ePortfolios, the paper argues that the perception of a learning environment as a Personal Learning Environment is related to perceived ownership of intangible elements.

Keywords: Personal Learning Environment, ePortfolio, psychological ownership, control, web 2.0, TEL, autonomy.

1   Introduction

Personal Learning Environments emerged as a concept related to the learner-controlled uses of technologies for learning (Downes, 2007; Attwell, 2007a). Similarly, the discussion on ePortfolios in education has emphasised the shift from teacher control towards greater learner control of learning, at the same time addressing the tension between self- control and external control in ePortfolio practice (Mayrberger, 2011). From this perspective, both Personal Learning Environments and ePortfolios can be seen as alternative approaches, highlighting the shift from the view of students as recipients of knowledge to active participants, autonomously taking control of their learning. The view of students as recipients of knowledge has been replicated in the design of externally controlled learning environments, be it classic textbooks, technology-enhanced systems and other uses of educational media "in which all learners follow a specified path

established by the instructional designer" (Lawless & Brown, 1997). One of the most prominent examples of education technologies based on the principle of external control have been early Learning Management Systems, which focused on central administration of learning content, activities and assessment rather than supporting open collaboration and active learner participation. Such systems have been also termed as "institutional walled gardens in cyberspace" to emphasise the underlying principle of isolating formal and informal learning contexts and posing authoritative constraints on what learners can do in digital environments in terms of activities, resources and tools (Attwell, 2007b). Alternatively, learner-controlled uses of technologies, as embodied in the concepts of Personal Learning Environments and ePortfolios, have been postulated as means of crossing and merging multiple learning contexts by learners themselves, giving learners greater control of their learning experience in terms of learning objectives, activities, resources, tools and outcomes (Downes, 2007; Attwell, 2007b). In fact, learner control and ownership of the learning environment have been identified as core defining attributes of Personal Learning Environments (Buchem, Attwell & Torres, 2011).

This paper explores the role of ownership and control linking current discussion on Personal Learning Environments to the theoretical framework of psychological ownership by Pierce et al. (2001, 2003), exploring how individual perception of possession and control of the learning environment may influence ePortfolio practice. The paper is based on the outcomes of the review of current PLE literature (Buchem et al., 2011) and on the explorative study on control and self-control in context of ePortfolios (Mayrberger, 2011). It reports on the empirical findings from a joint study conducted at the Beuth University of Applied Sciences in Berlin and at the University of Augsburg at the beginning of 2012. The study encompasses the results of an online survey with 50 students from three different university courses, exploring the multiple relationships between ownership, control and learning in context of web-based ePortfolios.

Due to the low maturity level of the current theoretical discussion related to the role of perceived control and ownership of a learning environment for learning, as well as to the small sample size, the study has an explorative character and does not claim to be representative. The results merely demonstrate some general tendencies in the sample population linking psychological ownership to the notion of "agency" in terms of the human capacity to make choices and to impose those choices on the world. From this perspective, psychological ownership is associated with such concepts as autonomous and self-directed learning. The theoretical foundation and the empirical results of the study presented in this paper aim to further research on Personal Learning Environments.

2   Ownership and Control

The issue of learner control as the underlying principle of Personal Learning Environments has been discussed in terms of changes in ownership and control in comparison to previous educational uses of technologies. The shift towards greater learner control encompasses learners taking on responsibility for creating and using own learning environments, being more independent in their choices related to the goals, process and outcomes of learning, as well as being able to take decisions about connecting to different

communities and forging social relationships as part of the learning process (Attwell, 2007a, 2007b; Schaffert & Hilzensauer, 2008; Buchem et al., 2011). The existing literature, however, provides little clarity about what types of ownership and control, and in relation to what elements of the learning environment may be effective and meaningful for learners (Buchem et al., 2011).

In general, ownership and control can be seen as related concepts, both linked to the notion of agency in terms of the human capacity to make choices and to impose those choices on the world (Buchem at al., 2011). While "control" is associated with the (perceived) possibility to manipulate an environment, "ownership" expresses the feeling of being an owner of an environment. The learner can be "an owner" of a learning environment in a technical sense (e.g. uses an own server), in a legal sense (e.g. has legal rights over data and content) and in a psychological sense (e.g. has a feeling of possession). The learner can also "control" an environment without actually owning it, be in in technical, legal or psychological sense (e.g. can select sources of information, reuse and remix content within an externally controlled service). In this sense, managing an environment within certain, externally imposed constraints can be associated with personalisation or adaptation of a system rather than ownership and autonomy as proposed by the Personal Learning Environment approach (Buchem et al., 2011).

This paper focuses on the psychological perspective of ownership and control of a learning environment, exploring how the feelings of possession and perceived control of ePortfolio, in sense of a learning environment, may influence the ePortfolio use and perception of this environment as a Personal Learning Environment. The understanding of ownership and control and the relation between the two concepts underlying this paper is rooted in the theory of psychological ownership by Pierce et al. (2001, 2003). The next two sections discuss the concepts of ownership and control in context of Personal Learning Environments, and introduce the theory of psychological ownership as the theoretical foundation of the conceptual model (Section 3) and the empirical study (Section 4).

2.1   Ownership and Control in Personal Learning Environments

The varying degrees of control and ownership and the relationship between the two concepts are seldom distinguished in current literature related to Personal Learning Environments. There is also little clarity about what type of ownership and control (e.g. technical, legal, psychological, social) and over which elements (e.g. information, resources, data, services, etc.) are inherent to Personal Learning Environments. Some of the first attempts to analyse the concepts of ownership and control related to PLE have been undertaken by Attwell (2007b) and later by Buchem et al. (2011).

Attwell (2007b) examined the issue of ownership for different processes of ePortfolio development. The proposed threefold distinction is between (a) ePortfolio processes which are clearly "owned" by the learner (such as recognising, reflecting and presenting learning), (b) processes which are "negotiated" between learners, teachers, educational organisations (such as planning, validating, assessing and recording learning), and (c) processes which are "owned" by educational organisations and systems (such as accrediting and certifying learning).

The comparative PLE literature review by Buchem et al. (2011), based on the analysis of over 100 publications related to Personal Learning Environments, explored different conceptualisations of PLE in current literature and showed that ownership and control emerge as core categories explaining stable, latent patterns in current PLE research and practice. The study examined the concepts of "ownership" and "control" within the activity theory framework as different degrees of learner autonomy. The study distinguished between five analytic dimensions of both ownership and control in Personal Learning Environments, i.e. control and ownership of (a) learning objectives (e.g. being able to determine own learning needs, goals and outcomes), (b) learning tools (e.g. being able to can select, exploit, aggregate, organise, modify, orchestrate learning tools), (c) learning rules (e.g. being able to establish rules for storing information and content, can decide about copyright and reuse), (d) learning community (e.g. being able to create and join communities and networks), and (e) learning tasks (e.g. being able to plan own learning activities).

The conceptualisation of ownership and control as different degrees of learner autonomy have been revised for the purpose of the current study. As it appears, the five dimensions may relate to the varying degrees of control of different elements of a learning environment. Therefore, for the purpose of the study presented in this paper, the five dimensions of control related to Personal Learning Environments distinguished by Buchem at al. (2011) were used to establish a measure of perceived control. The ownership measure, however, was based on the theory of psychological ownership.

2.2   The Theory of Psychological Ownership

The theory of psychological ownership has been originally developed and applied in the organisational context exploring the "feeling of ownership" among employees and the link to employee engagement. Psychological ownership is defined as the psychologically experienced phenomenon in which a person develops possessive feelings for the "target" (Van Dyne & Pierce, 2004). Psychological ownership relates to the sense of possession and control (it is "mine"). Targets encompass a range of "objects of psychological attachment", such as an organisation someone belongs to, a set of tools and technologies someone uses, designs or ideas that someone has developed (Avey, et al., 2009). As such psychological ownership has a symbolic character as it develops through the connection between the self and tangible and intangible targets (Dittmar, 1996). Psychological ownership can be also viewed as a cognitive-affective state of the human condition rooted in the Western culture, in which possessions are part of the extended self (Pierce et al., 2003). From the perspective of the developmental psychology, the close connection between 'me' and 'mine' is viewed as an innate human motive to control objects, demonstrated in experiencing a psychological connection between the self and various targets of possession such as home, territory, objects, and other people (Pierce at al., 2003).

Psychological ownership as concept related to the state of being an owner and having the feeling of possession has received increased attention in a wide variety of fields, including organisational development and leadership, child development and consumer behaviour (Van Dyne and Pierce, 2004; Jeswani and Dave, 2011). A number of authors

addressed the links between psychological ownership and self-identity, self-adjustment, well-being, organisational accountability, sense of belonging, association with organisation and organisational citizenship (Pierce at al., 2001; Van Dyne and Pierce, 2004). Psychological ownership has been viewed as a positive resource for impacting attitudes (e.g. higher commitment, responsibility), self-esteem, self-efficacy, motivation, accountability, performance, sense of belongingness and self-identity (Avey, et al., 2009; Pierce et al., 2001, 2003; Van Dyne & Pierce, 2004). The results from a number of studies conducted in organisations demonstrate positive links between psychological ownership towards the organisation and employee attitudes, such as organisational commitment, job satisfaction and self-esteem, as well as positive behaviour, such as improved performance and organisational citizenship (Pierce et al., 2001, 2003; Van Dyne & Pierce, 2004).

The theory of psychological ownership conceptualises control as a prerequisite of ownership (Pierce et al., 2001, 2003). Based on the control model of ownership by Furby (1978), it is assumed that the greater the amount of control a person can exercise over certain targets, the stronger psychologically experienced ownership for those targets (Pierce et al. 2001, p. 14). Controlling targets is seen as one of the three mechanisms through which psychological ownership can emerge, besides "coming to know the target intimately", and "investing the self into the target" (Pierce et al., 2001). The theory of psychological ownership explains the motivation to control an environment in an innate need for experiencing self-efficacy: "Due to the innate need for feelings of efficacy and competence, individuals are propelled to explore and manipulate their environment. These person environment interactions may result in the exercise of control and subsequent feelings of personal efficacy and competence." (Pierce et al., 2001, p. 10).

The theory of psychological ownership considers ownership as a multi-dimensional construct encompassing (1) sense of responsibility, (2) sense of identity, (3) sense of accountability, (4) sense of self-efficacy and (5) sense of belongingness (Pierce et al., 2001). These five dimensions of psychological ownership are described below:

- Sense of responsibility for a target is viewed as an inherent part of a sense of ownership. As Van Dyne and Pierce (2004) point out, possession causes individuals to protect and defend their ownership rights. Protecting and enhancing possessions are closely related to the sense of responsibility, which may include improvements and controlling or limiting access by others. This can be observed in the organizational context, where employees having a strong feeling of ownership in an organization tend to engage in certain protective behaviors driven by the sense of responsibility (Avey et al., 2009). When people feel responsible for a target, they invest themselves into that target through energy, time and concern: "When an individual's sense of self is closely linked to the target, a desire to maintain, protect, or enhance that identity will result in an enhanced sense of responsibility" (Pierce et al., 2003, p. 30).
- Sense of identity is viewed as part of the self-concept and manifestation of psychological ownership (Avey et al., 2009). Avey et al. (2009) point that self-identity is established, maintained, reproduced and transformed through interactions with tangible and intangible possessions. Targets of ownership are often used as descriptors of self-identity, e.g. "this is my profession". In context of organizational identity, the feelings of ownership related to such targets as a job or a work team, are

closely linked to establishing identification with an organization and thus gaining a sense of meaningfulness and connectedness (Avey et al., 2009). Also possession rituals, such as displaying and personalizing own possessions, transform the culturally prescribed meaning of objects to the self-identity (Pierce et al., 2003).

- Sense of accountability defined as ''the implicit or explicit expectation that one may be called on to justify one's beliefs, feelings and actions to others'' (Lerner & Tetlock, 1999, p. 255 cited in Avey et al., 2009) is considered as an important component of psychological ownership. Accountability is manifested in expected rights and responsibilities (Pierce et al., 2003), such as the expected right to hold others accountable and at the same time in the expectation for oneself to be held accountable: "When targets of ownership are seen as an extension of the self, accountability for what happens to and with those targets has implications for what happens to and with the self" (Avey et al., 2009, p.6).

- Sense of self-efficacy, as originally defined by Albert Bandura, relates to the belief in own competencies enabling successful performance in a specific task (Bandura, 1997). The feeling of ownership is both rotted in efficacy, as the ability to control an environment gives rise to feelings of efficacy, and is accompanied by self-efficacy (Pierce et al., 2001). Avey et al. (2009) points to a number of conceptualizations of ownership and possession linking to the individual's need for self-efficacy and control of objects. In general, self-efficacy concerning a particular task, process and procedure promotes a sense of psychological ownership (Avey et al., 2009).

- Sense of belongingness is understood as a fundamental human need to belong. This encompasses both the need for a home or a place to dwell as well as the need for belonging to a group or organization (Avey et al., 2009). Feelings of psychological ownership are closely related to the attachment to places, objects and people (Pierce et al., 2001; Avey et al., 2009). Belongingness is viewed as a need to belong in the organization or in the work place: "When people feel like owners in an organization, their need for belongingness is met by 'having a place' in terms of their social and socio- emotional needs being met" (Avey et al., 2009).

Both the five dimensions of perceived control from the study by Buchem at al. (2011) and the five dimensions of psychological ownership by Pierce et al. (2001, 2003) have been used to develop the measures of control and ownership related to technology-enhanced learning environments. The conceptual model of the study is described below.

3   Conceptual Model and Hypotheses

This paper incorporates the concept of psychological ownership to educational context, focusing on the links between perceived control, sense of ownership of the learning environment and the quality of learning expressed in different forms of ePortfolio use. The concept of psychological ownership in Personal Learning Environments builds on the theoretical framework by Pierce et al. (2001, 2003) and on empirical studies related to psychological ownership, including Blau & Caspi (2009), Englisch et al. (2010), Gaskin &

Lyytinen (2010).

The conceptual model underlying the empirical study presented in this paper is an Antecedents-Consequences Model (ACM), in which psychological ownership is influenced by a number of factors (antecedents) and leads to certain outcomes (consequences). The AC model of psychological ownership has been successfully applied in a number of empirical studies, especially in context of organisational ownership (Mayhew et al. 2007; Englisch et al., 2010). In the proposed model, the antecedents of psychological ownership include students' perceived control of different elements of the learning environment including tools, content, design, planning and data. Thus "perceived control" is a measure of subjective perception of the degree of control of ePortfolio elements. This subjective perception is to a certain extent influenced by the instructional design of ePortfolios in formal educational settings. The consequences of psychological ownership in the conceptual model encompass different ePortfolio uses. The sense of ownership if ePortfolios is expected to be reflected in different uses of ePortfolio such as different levels of engagement and participation. At the same time higher levels of engagement, time and effort invested in ePortfolio development are considered as indicators of the quality of learning. Finally, the conceptual models is used in the study to explore the relation between the sense of ePortfolio ownership and perception of ePortfolio as a Personal Learning Environment.

Based on the assumptions described above, the Antecedents-Consequences Model, as visualised in Figure 1, encompasses three main groups of variables, i.e. (a) ePortfolio design influencing the level of perceived control (antecedents), (b) psychological ownership as a multi-dimensional construct, and (c) different ePortfolios uses indicating different qualities of learning (consequences).

Fig. 1. The Antecedents-Consequences-Model (ACM) of the study

The study presented in this paper focused on the three central research questions reflecting antecedents and consequences of psychological ownership in relation to Personal Learning Environments:

1. Can the measure of psychological ownership derived from research in organizational context be effectively applied to ownership of learning environments?
2. Can perceived control of the learning environment be considered as an antecedent of psychological ownership and to what extent is perceived control influenced by

ePortfolio design?

3. Can different ePortfolio uses be considered as a consequence of psychological ownership and to what extent can different ePortfolio uses indicate the quality of learning?

As the study attempts to empirically arrive at the answers to these three questions, six hypotheses were formulated:

H 1. The measure of psychological ownership derived from the field of organisational research can be effectively applied to the field of Personal Learning Environments to capture the ownership of the learning environment, such that the questions quality and reliability estimate for the survey show a good fit the context of the study.

H 2. ePortfolio design will be related to students' perception of control of the learning environment, such that learner- centered ePortfolio design will be positively related to perceived control of different elements of the learning environment.

H 3. Perceived control will be positively related to the concept of psychological ownership with its key five dimensions, i.e. responsibility, self-identity, accountability, self-efficacy, and belongingness, such that the higher the degree of perceived control, the greater the sense of ownership of ePortfolio.

H 4. Psychological ownership will be positively related to the uses of ePortfolios, such that the greater the sense of ownership of ePortfolio, the more time, energy and effort is invested in ePortfolio development and use.

H 5. ePortfolio use will be positively related to the quality of learning, such that the more time, energy and effort invested, the higher the interest and intrinsic motivation to learn.

H 6. The perception of ePortfolios as Personal Learning Environments will be positively related to the levels of psychological ownership, such that the greater the sense of ownership of ePortfolio, the stronger the perception of ePortfolio as a Personal Learning Environment.

4   Method and results

The results of the study presented in this paper originate from an online survey conducted at the end of winter semester, in February 2012, at the universities in Berlin and Augsburg. The survey employed items derived from the studies on Personal Learning Environments and Psychological Ownership in organisational settings. The measures employed in the study was adjusted to the context of ePortfolio use in higher education. The sections below summarise the information about study participants, measures of psychological ownership, its antecedents and consequences.

4.1   Study sample

The primary sample for this study was comprised of a heterogeneous sample of 67 bachelor and master students from three different courses in Berlin (two courses) and

Augsburg (one course). The two courses in Berlin[1] encompassed altogether 55 bachelor and master students of engineering and economics. The course in Augsburg[2] encompassed 12 master students of media and communication. 50 out of the 67 students invited to the survey (75 percent response rate) participated and completed the survey questions. Of those 50 participants, 45 provided information on their university course (35 from Berlin, 10 from Augsburg). 43 indicated their semester of study (63 percent studied in a semester range from 5 to 9, out of those 35 percent from 8 to 9 semesters), 43 provided information on their age (56 percent between 20 and 25 years old), gender (33 percent female) and mother tongue (93 percent German). 50 respondents indicated their highest degree (34 percent had a bachelor's degree, 32 percent a university-entrance diploma).

4.2   Psychological Ownership (PO)

Based on the multi-dimensional concept of psychological ownership by Pierce et al. (2001, 2003), a new measure of psychological ownership as the central concept of the study related to the sense of ownership of ePortfolios was developed using a measure proposed by Van Dyne and Pierce (2004). This instrument requires respondents to rate the extent they agree or disagree with a series of statements related to the individual employees' feelings of possession towards the organization (such as "this is my organization"). Item generation for the measure of psychological ownership towards ePortfolios was based on the comprehensive literature review on psychological ownership and discussions about the applicability of the concept in context of technology-enhanced learning.

The following five dimensions of psychological ownership related to ePortfolios were identified and measured: (1) sense of responsibility, (2) sense of self-identity, (3) sense of accountability, (4) sense of self-efficacy, and (5) sense of belongingness. The survey items were generated to represent the five theory-driven components of psychological ownership. Individual items were assigned to respective categories and five items were selected for the survey as best capturing the concept of psychological ownership in context of ePortfolio use. Students were required to indicate the extent to which they agree or disagree with a series of statements measured via a 6-point Likert-type scale (1 = strongly agree; 6 = strongly disagree). The table below summarises the five dimensions of psychological ownership (Table 1).

Table 1. The measure of Psychological Ownership (PO)

No.	Dimensions of PO	Survey items
1	Sense of responsibility	1.1 I was happy to take the responsibility for creating my ePortfolio.
2	Sense of self-identity	1.2 I can identify with my ePortfolio. This is my creation.

3	Sense of accountability	1.3 I am proud of my ePortfolio.
4	Sense of belongingness	1.4 I have a feeling that the ePortfolio I created is mine. It belongs to me.
5	Sense of self-efficacy	1.5 In my ePortfolio work I had the feeling I could handle difficult situations (tools, topics).

Descriptive statistics reveal values indicating middle to upper levels of psychological ownership with the average value $m = 2.34$ across all five dimensions of psychological ownership. The highest values were reached for "sense of belongingness" with $m = 2.10$ and "sense of self-identity" with $m = 2.24$ and. The lowest values were reached for "sense of accountability" with $m = 2.64$. In general, it can be assumed that students developed a sound sense of ownership of their ePortfolios and felt it was something that belonged to them and something they could identify with. In order to explore the underlying component structure of psychological ownership, bivariate relationships between all five items have been examined. All bivariate correlations proved significant at the 0.01 level (2-tailed). The five- dimensional construct was validated by means of the factor analysis, i.e. Principal Component Analysis based on Eigenvalues greater than 1 and Varimax rotation. Only one component was extracted. Extraction communalities were all high ranging from .783 for "sense of self-efficacy" to .947 for "sense of responsibility", indicating that the extracted component represents the variables well. This component (FAC1_1) was used as the measure of psychological ownership in further analysis. The alpha coefficient (Cronbach's alpha) for the scale based on the reliability analysis was $\alpha = .94$, indicating a high internal consistency of the psychological ownership scale.

4.3 Perceived Control (PC)

The ePortfolio design in all three courses participating in the study was learner-centered, strongly oriented towards granting a high level of autonomy to learners. The overall aim of working with ePortfolios in the three courses was to enhance self-directed learning and learner control of the learning environment. However, the intended learner-centered design may be perceived differently by different students. Thus perceived control of ePortfolios was measured to explore subjective perceptions of students. The concept of perceived control (PC) encompassed seven dimensions of control of a learning environment and was measured with items derived from the research by Buchem et al. (2011). The seven dimensions were: (1) control of technology, (2) control of objectives, (3) control of content, (4) control of planning, (5) control of design, (6) control of access rights, and (7) control of personal data. Originally, eight items were generated to measure the concept of perceived control. There were two items measuring access rights, i.e. "I could decide about who can read my ePortfolio contributions", and "I could decide you can see my ePortfolio". However, the second item was removed as it contributed little to the explanation of the overall variance. Table 2 summarises the measure of perceived control.

Table 2. The measure of Perceived Control (PC)

No.	Dimensions of PC	Survey Items
1	Control of technology	2.1 I could decide about the technical tools for my ePortfolio.
2	Control of objectives	2.2 I could decide about the objectives of my ePortfolio contributions.
3	Control of content	2.3 I could decide about the content of my ePortfolio contributions.
4	Control of planning	2.4 I could decide about the when I post my contributions and how long I do ePortfolio work.
5	Control of design	2.5 I could decide about the visual and structural design of my ePortfolio.
6	Control of access rights	2.6 I could decide about who can read my ePortfolio contributions.
7	Control of personal data	2.7 I could decide about what happens to my personal data in my ePortfolio.

In general there were high values for all variables representing the construct of control and thus indicating that the ePortfolio design, which was aimed at supporting learner-centered and autonomous technology-enhanced learning, was reflected in students' perceived high control of the elements of the learning environment. The level of perceived control of ePortfolio was between high ("2" = agree) and very high ("1" = strongly agree). The average value (mean) across the seven items was $m = 2.1$ indicating a relatively high level of perceived control. The highest values were reached for "control of content" and "control of planing" with $m = 1.70$, and for "control of design" with $m = 1.84$. The lowest values were reached for "control of technology" with $m = 2.82$ and "control of personal data" with $m = 2.51$. These results indicate that students felt they could to a high degree decide about the planing of their ePortfolio work and the content of their ePortfolio contributions, but had less sense of control of the technical tools they used and of their personal data, which may be both related to one another.

This seven-dimensional construct was validated using factor analysis (Principal Component Analysis with Eigenvalues greater than 1 and Varimax rotation). In the first analysis two components were extracted, i.e. Component 1 related to the control of tangible targets (encompassing item 1.1 "I could determine the technical tools for my ePortfolio") and Component 2 related to the control of intangible targets (encompassing all other items, including objectives, content, planning, design, access rights and personal data. The new analysis indicated that the extracted Component 2 (FAC1_2) represents the variables well. The two components were used as measures of perceived control of tangible and intangible targets in further analysis. The alpha coefficient for the scale of control of intangible targets was $\alpha = .86$, indicating a high internal consistency of the scale. The calculation of Cronbach's Alpha indicated that no significant improvement in the internal consistency could be reached if any of the six items was removed from the scale.

4.4 ePortfolio Use (PU)

The Antecedents-Consequences-Model of the study considers ePortfolio use as a consequence of personal ownership. This is based on the assumption that the sense of possession or feeling an owner of a target contributes to the ePortfolio owner's engagement, creativity, intrinsically-oriented and interest-based motivation. The concept of ePortfolio use comprised six dimensions, i.e. (1) time invested, (2) engagement, (3) creative design, (4) interest orientation, (5) self- direction, (6) intrinsic motivation, (7) continued ePortfolio use, and (8) new ePortfolio use (Table 3).

Table 3. The measure of ePortfolio Use (PU)

No.	Dimension of PU	Survey Items
1	Time invested	3.1 I was happy to invest time and energy to my ePortfolio.
2	Engagement	3.2 I worked more on my ePortfolio than was required by my course leader.
3	Creative design	3.3 I was creative in designing my ePortfolio (e.g. realising my own ideas, trying out something new).
4	Interest orientation	3.4 I worked with my ePortfolio based on my interests within the context of the seminar.
5	Self-direction	3.5 I have a feeling, with my ePortfolio I was learning for myself rather than for the course leader.
6	Intrinsic value	3.6 The ePortfolio work was more important for me that the grade at the end of the course.
7	Continued use	3.7 I will probably keep working with my ePortfolio after the course.
8	New use	3.8 It is probable that I will create a new ePortfolio after the course.

On the average, the quality of ePortfolio use across all eight items reached the average mean of $m = 3.05$. The highest values were reached for "interest orientation" with $m = 2.33$, "creative design" with $m = 2.44$ and "self-direction" in ePortfolio use with $m = 2.63$. The lowest value was reached for the intrinsic motivation to use ePortfolio with $m = 3.79$ indicating that ePortfolio use in the context of the university course is guided more by external awards rather than by the inner value of ePortfolio work itself. The low value of $m = 3.61$ for the "continued use" indicates that students do not plan to use a course ePortfolio after the course is finished. The values for "new use" are not much higher with an average of $m = 3.33$, showing that it is not very likely that students will create new ePortfolios after the course. The reasons could be multifold, such as perceiving ePortfolios as time-consuming or missing motivation to create ePortfolios outside of the requirements of the course. However, these aspects could not be explored within the study.

The eight-dimensional construct of ePortfolio Use (PU) was validated using factor analysis. First, bivariate relationships between all five items have been examined. All bivariate correlations proved significant at the 0.01 level (2-tailed). The Principal

Component Analysis based on Eigenvalues greater than 1 and Varimax rotation extracted only one component with high communalities (Table 10). The alpha coefficient for the scale was $\alpha = .92$, indicating high internal consistency. The calculation of Cronbach's Alpha indicated that the internal consistency of the scale would deteriorate if any of the eight items was removed from the scale. Based on these results, the component FAC1_3 was used as the measure of ePortfolio use in further analysis.

4.5 Antecedents and Consequences of Psychological Ownership

The Antecedents-Consequences-Model of the study as described in Section 2 included a number of antecedent and consequence variables of Psychological Ownership (Table 4).

Table 4. Antecedents and Consequences of Psychological Ownership

Antecedents Perceived Control (PC)	Psychological Ownership (PO)	Consequences ePortfolio Use (PU)
2.1 Control of technology 2.2 Control of objectives 2.3 Control of content 2.4 Control of planning 2.5 Control of design 2.6 Control of access rights 2.7 Control of personal data	1.1 Sense of possession 1.2 Sense of self-identity 1.3 Sense of accountability 1.4 Sense of self-efficacy 1.5 Sense of belongingness	3.1 Time investment 3.2 Engagement 3.3 Creativity and design 3.4 Interest-orientation 3.5 Self-direction 3.6 Intrinsic motivation 3.7 Continued use 3.8 New use
Two Components: 1.1 and FAC1_2	One Component FAC1_1	One Component FAC1_3

The two central hypotheses related to the relation between Antecedents and Consequences of PO were:

- H2: Perceived Control (PC) will be positively related to Psychological Ownership (PO).
- H3: Psychological Ownership (PO) will be positively related to ePortfolio Use (PU).

These two hypotheses were tested using correlation and regression analysis. The results are discussed below:

Perceived Control (PC) as predictor of Psychological Ownership (PO). In the first step, bivariate correlations between the single variables representing the constructs "Perceived Control (PC)" and "Psychological Ownership (PO)" were computed to explore the relationships between the single dimensions. However, there were only a few significant correlations, such as between "control of content" and "sense of responsibility" (r = .582), "control of personal data" and "sense of self efficacy" (r = .563), "control of personal data" and "sense of belongingness" (r = .542), "sense of belongingness" and

"control of access rights" (r = .567), "sense of belongingness" and "control of planning" (r = .560). These results indicate that psychological ownership of the learning environment is related especially to the perceived control of content, planning, personal data and access rights.

In the second step, correlations of antecedent components and the combined measure of psychological ownership component were computed to explore the relationship between perceived control and ownership of the learning environment. The correlation between the component "control of intangible targets" (FAC1_2) and "psychological ownership" (FAC1_1) is significant at the 0.01 level with the correlation coefficient $r = .642$. On the contrary, the correlation between the one-dimensional component "control of tangible target" (technical tools) and "psychological ownership" (FAC1_1) is not significant at the 0.01 level.

In the third step, regression analysis with the measure of personal ownership as dependent variable (FAC1_1) and the antecedent components "control of tangible targets" and "control of intangible targets" were computed. The regression model explains almost 45% of variance (R Sq = .440). The component "control of intangible targets" alone explains 41% of variance (R Square = .412). The analysis of the scatterplot for the regression analysis of Model 1 with "control of intangible targets" (FAC1_2) and "psychological ownership" (FAC1_1) shows a clear positive relation between these two variables. The positive slope of the regression line indicates the positive relation between perceived control of intangible ePortfolio elements (content, planning, design, access right and personal data) and psychological ownership.

Prediction: The results of the correlation analysis indicate that control of technology does not have any significant effects on the sense of ownership of the learning environment. This prediction was tested using linear regression analysis. The results of the regression analysis seem to support this prediction, indicating that perceived control of technical tools used to create ePortfolios is a poor predictor of the sense of ownership of ePortfolio (R *Sq = .034)*.

Key findings (1): Given the data, it appears that Hypotheses 2: Perceived Control will be positively related to Psychological Ownership, can be confirmed only for perceived control of intangible ePortfolio elements such as content, planning, design, access rights. At the same time, there seems to be no significant relation between the control of the tangible targets, such as technical tools, and the sense of ownership of ePortfolio.

Psychological Ownership (PO) as predictor of ePortfolio Use (PU). In the first step, bivariate correlations between the single variables representing "Psychological Ownership (PO)" and "ePortfolio Use (PU)" demonstrate a number of highly significant positive correlations. Strong relationships were measured between the following variables:

- "Sense of responsibility" (PO) and "time invested" (PU) with $r = .817$, indicating that the more responsible students feel for their ePortfolios the more time they invest in ePortfolio work; "Sense of self-identity" (PO) and "time invested" (PU) with $r = .758$, indicating that the more students identify with their ePortfolios the more time they invest in ePortfolio work;
- "Sense of accountability" (PO) and "creative design" (PU) with $r = .786$, indicating

that the more students feel accountable, e.g. they take pride in their ePortfolios, the more creative they are designing own ePortfolios;

- "Sense of responsibility" (PO) and "self-direction" (PU) with *r = .753,* indicating that the more responsible students feel for their ePortfolios, the stronger the feeling that they learn to meet own goals rather than the requirements of the course.
- "Sense of self-identity" (PO) and "self-direction" (PU) with *r = .753,* indicating that the more students identify with their ePortfolios, the stronger the feeling that they learn to meet own goals rather than the requirements of the course.

In the second step, correlations of component "psychological ownership" (FAC1_1) and "ePortfolio Use" (FAC1_2) were computed to explore the relation between these two components. The result was a highly significant correlation coefficient *r = .845* at the 0.01 level.

Prediction: The results of the correlation analysis indicate that especially sense of responsibility, sense of self-identity and sense of accountability as components of psychological ownership contribute to the quality of ePortfolio use. In general, psychological ownership may have a significant influence on the quality of ePortfolio use. This prediction was tested using linear regression analysis. The results indicate that psychological ownership is a good predictor of the quality of ePortfolio use (R *Sq = .71),* explaining over 70% of variance.

In the third step, three linear regressions were computed for the variables of psychological ownership and ePortfolio use based on the strength of the correlation coefficients. The first model tested sense of responsibility, sense of self-identity and sense of accountability as predictors of invested time in ePortfolio use (R *Sq = .65)* The second model tested sense of self-identity and sense of accountability as predictors of creative ePortfolio design (R *Sq = .59).* The third model tested sense of responsibility and sense of self-identity as predictors of self-direction in ePortfolio use (R *Sq = .56).* These results indicate that there are a number of strong relationships between psychological ownership of the learning environment and the way this environment is used for learning.

Key findings (2): Given the data, Hypotheses 3: Psychological Ownership (PO) will be positively related to ePortfolio Use (PU), could be confirmed in the study. In particular, sense of responsibility, sense of self-identity and sense of accountability appear to be strong predictors of how much time is invested in creating own ePortfolios, creative design and self-directed ePortfolio use.

ePortfolio Use and Quality of Learning (Hypothesis 4). In order to explore the relationship between ePortfolio use and the quality of learning, bivariate correlations were computed for the component "ePortfolio use" (eight variables) and the variables measuring the interest for the subject matter, perceived appropriateness of presentation of own competencies, demonstration of what one has learned, fairness of ePortfolio as an assessment method and perceived appropriateness of rate of personal investment to the personal benefit of ePortfolio use. The results indicate significant relationships, between ePortfolio use and (1) the increase of interest in subject matter (r = *821),* (2) the perceived possibility to present own competencies well (r = *.739),* (3) the possibility to demonstrate what one has learnt in an appropriate way (r = *.689)* and (4) the rate of personal

investment to the personal benefit of ePortfolio use (r = *587)*. Based on the results of the correlation analysis, four models were tested using regression analysis, with each analysis indicating a good model fit with R Sq > .580.

Key findings (3): The results indicate that the measure of ePortfolio Use proves to be a good predictor of the increase of interest in subject matter, perceived appropriateness of ePortfolio to present own competencies and demonstrate of what one has learned.

5   Discussion of results and further research

The research presented in this paper focused on three central questions in relation to the antecedents and consequences of psychological ownership in relation to Personal Learning Environments based on the example of ePortfolio use in higher education. The three questions were:

1. Can the measure of psychological ownership be applied to describe ownership of learning environments?
2. Can perceived control predict psychological ownership, i.e. to what extent is ownership influenced by control?
3. Can psychological ownership predict ePortfolio use and how is ePortfolio use related to the quality of learning?

The data obtained from a survey with 50 students in three different university courses was analyzed based on the Antecedents-Consequences-Model (ACM) of Psychological Ownership (PO). Based on this model, five hypotheses derived from the three questions were empirically tested by capturing perceived control of the learning environment as an antecedent and ePortfolio use as a consequence of psychological ownership. The results of the study and recommendations for further research are discussed below in relation to the five hypothesis tested in the study:

- **Measure of psychological ownership:** The first hypothesis was that the measure of psychological ownership derived from the field of organisational research can be effectively applied to the field of Personal Learning Environments to capture the ownership of the learning environment, such that the questions quality and reliability estimate for the survey show a good fit the context of the study. The five-dimensional measure of psychological ownership used in the study proved to be a reliable instrument capturing psychological ownership of a learning environment. The reliability of the scale was based on the measure internal consistency (Cronbach's alpha). The estimates for the scale of psychological ownership based on the reliability analysis was $\alpha = .94$, indicating a very good reliability of the scale. The scale was based on reliable research instruments already applied in the research related to psychological ownership in organisational settings. The survey items were adjusted to fit the context of the study, including the focus on ePortfolios, the target group of students and the context of higher education. In sum, the fit of the questionnaire appears to be very good and sufficient for the purpose of the study.

However, replication in further research and other measures of reliability would be necessary to validate the qualities of the proposed scale. In general, the results show that the measure of psychological ownership as applied in the study and derived from research conducted in organizational context can be effectively applied to capture psychological ownership of technology-enhanced learning environments such as ePortfolios in context of higher education.

- **ePortfolio design and perceived control:** The second hypothesis was that ePortfolio design will be related to students' perception of control of the learning environment, such that learner-centered ePortfolio design will be positively related to perceived control of different elements of that learning environment. This hypothesis could not be systematically tested in the study. However, the high values reached for all variables representing Perceived Control (PC) indicate that learner-centered ePortfolio design as intended by course leaders was reflected in students' perceived control of different elements of the learning environment. The single values and the mean across the seven items measuring perceived control (m = *2.1)* indicate that students felt in control of their ePortfolios, especially in terms of content and planing (m = *1.70)* and design (m = *1.84)*. At the same time, students felt they had less control of their personal data (m = *2.51)* and of the technical tools they used to create ePortfolios (m = *2.82)*. As students in the three courses participating in the study used different web-based tools, such as externally hosted blogs (e.g. WordPress) and wikis (e.g. PBWiki) but also an ePortfolio system hosted at the university (i.e. Mahara), the results could indicate that students feel in general less in control of technology and personal data when using web tools. Further analysis, which is not included in this paper, will be conducted to explore differences in perceived control in relation to media used.

- **Control and ownership:** The second hypothesis was that perceived control will be positively related to psychological ownership, such that the higher the degree of perceived control, the greater the sense of ownership of ePortfolio. The results of the study indicate that there is a difference between control of tangible (technology) and intangible ePortfolio elements. On the one hand, the tangible ePortfolio elements such as technical tools that students used to create their ePortfolios (WordPress, PBWorks, Mahara), do not influence the sense of ownership of one's own ePortfolio. This means that students may feel owners of their ePortfolios, even if they do not feel in control of technology they use. On the other hand, the intangible ePortfolio elements, such as control of learning objectives, content, planning and design of one's ePortfolio have a significant influence on whether students feel as owners of their ePortfolios or not. This is an intriguing result, which is contradictive to the assumption that perceived control of technology influences the sense of ownership of a learning environment. This could mean that it is more important for students to be able to take decisions about planing, content or design of their ePortfolios rather than be able to decide which tools to use to create and develop their ePortfolios. In the present study, the control of technology was conceptualised as the ability to take decision about which tools to use to create ePortfolios. However, there are certainly other forms of control of technology in learning environments. Therefore the preliminary results indicating no significant influence

of perceived control of technology on the sense of ownership of a learning environment should be tested in further studies in order to cast some more light on what forms of technology control can be distinguished and whether they influence the sense of ownership of a learning environment and in consequence its use for learning.

- **Sense of ownership and ePortfolio use:** The fourth hypothesis was that psychological ownership will be positively related to the uses of ePortfolios, such that the greater the sense of ownership of ePortfolio, the more time, energy and effort is invested in ePortfolio development. The result of our study indicates the overall strong relationship between psychological ownership and ePortfolio use. Based on the theoretical ACM model of psychological ownership, it was assumed that psychological ownership can predict ePortfolio use. Indeed, the results of the regression analysis indicate a good fit in a number of postulated models. In particular, sense of responsibility, sense of self-identity and sense of accountability as dimensions of psychological ownership prove to be strong predictors of how much time is invested in working with ePortfolios, designing ePortfolios in a creative way and following a self-directed learning path rather than creating ePortfolio only to meet the requirements of the course. These results indicate that it is important for educators to support students in developing a sense of ownership of their ePortfolios in order to foster a more intrinsically- oriented and self-directed ePortfolio practice. Besides educational implications, there remains an open questions about whether it is psychological ownership that influences ePortfolio use. For example it seems plausible that both creative design influences the sense of self-identity and that the sense of self-identity influences creative design. It may be that these are reciprocal effects which cannot be measured using simple linear regression models. The fact remains, however, that there exist a number of highly significant relations between psychological ownership and ePortfolio use. The direction of influence should be tested in further research studies.

- **ePortfolio use and quality of learning:** The fifth hypothesis was that ePortfolio use will be positively related to the quality of learning, such that the more time, energy and effort invested, the higher the interest and intrinsic motivation to learn. The results show that the eight-dimensional component "ePortfolio Use" proves to be a good predictor of the increase of interest in the subject matter, perceived appropriateness of ePortfolio to present own competencies and demonstrate what one has learned. ePortfolio use was also related to students' perception that their personal investment was adequate to their personal benefit from ePortfolio use (i.e. positive "return on investment"). On the whole, the results seem to confirm the hypothesis indicating that the more time, energy and effort invested in ePortfolio work, the higher the interest in subject matter, intrinsic motivation to learn and personal benefit, be it in terms of presenting own competencies or demonstrating what one has learnt in an effective way.

- **ePortfolio as Personal Learning Environment:** The sixth hypothesis was that the perception of ePortfolios as Personal Learning Environments will be positively related to the levels of psychological ownership, such that the greater the the sense of ownership of ePortfolio, the stronger the perception of ePortfolio as a Personal

Learning Environment. The results indicate that psychological ownership of a learning environment is related especially to the perceived control of content, planning, personal data and access rights. Based on these results it can be assumed that students may perceive their ePortfolios as (part of) their Personal Learning Environments, especially when they feel in control of intangible aspects, e.g. when they can take decisions about the objectives and the content of their contributions, when they can decide about planning, as well as management of personal data and access rights. At the same time, the results indicate that students perceive their ePortfolios as (part of) their Personal Learning Environments even if they do not feel in control of the technical tools as tangible aspects of ePortfolio practice. This finding seems plausible, if we consider that in most cases the users of web-based tools do not in fact have full control over the technology they use. For example having an own blog at wordpress.com means being able to decide about such intangible aspects as content, access or frequency of contributions, but having less control over the system itself. Nevertheless, this finding should be tested in further studies in order to explore in more detail what types of technology control may influence the perception of a learning environment as a Personal Learning Environment.

To summarise, the research study presented in this paper demonstrated some significant relationships between perceived control, sense of ownership and uses of a learning environment based on the example of ePortfolios in context of higher education. To the best knowledge of the author of this paper, this is the first study which incorporates the research on psychological ownership from organisational to educational settings. In doing so, the study succeeds in adapting and applying the measure of psychological ownership to capture students' sense of ownership of ePortfolios. At the same time, the study employs two further measures, i.e. the measure of perceived control and ePortfolio use, both showing a good fit with the goals and context of the study. All three measures can be used and improved in further studies in order to progress research on Personal Learning Environments. Moreover, it is recommended to explore the role of psychological ownership for the perception of other technology-enhanced learning environment as (parts of) Personal Learning Environments. Further research should focus on the influence of psychological ownership of a learning environment on the use of this environment and consequently on the quality of learning.

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