Students' conceptions of eportfolios as assessment and technology

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Abstract

Student beliefs about assessment and technology play an important role in deploying technology-enabled assessments. Using eportfolios to develop and assess the achievement of curricular outcomes is a global trend, yet little research has investigated student technology and assessment perceptions around eportfolios. This paper examines the interaction of students' perceptions of technology and assessment and impact on performance. Survey data (n=360) was gathered from multiple faculties at one university in Hong Kong. Confirmatory factor analysis and structural equation modeling determined relationships among the two conceptual areas and as predictors of educational achievement. Results showed a positive attitude towards eportfolio use led to positive views about eportfolios as contributing to assessment for learning. Endorsing intention to actively engage with eportfolios and rejecting assessment as irrelevant contributed to a moderate, statistically significant increase in students' self-reported GPA. Implications for continued research into how eportfolios can be designed to promote learning-oriented assessment are discussed.

Keywords: assessment, eportfolios, higher education, technology-enabled assessment

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Introduction

Eportfolios are of great interest in higher education (HE) because of presumed benefits to teaching, learning, assessment, and curricula. Eportfolios are perceived as useful forms of technology-enabled assessment (TEAs) supporting sophisticated assessment of, for, and as learning (Cummings & Maddux, 2010; Ralston, 2015). Adoption is driven by institutional aspirations but seldom accompanied by a careful examination of challenges (Ayala, 2006; Deneen, 2013). Empirical research suggests complexities in eportfolio initiatives are significant and impact academic learning and performance (Cummings & Maddux, 2010; Deneen & Shroff, 2014). Many challenges have been well documented, ranging from scoring accuracy to integration of technology. Less comprehensively explored is the role of students' conceptions in eportfolio use. Stakeholder conceptions influence outcomes and use of both assessment and technology (Brown & Hirschfeld, 2008; Teo, 2009); it is therefore valuable to explore their influence on eportfolios as HE assessment.

Technology acceptance modelling (TAM) is a well-validated means to understand users' conceptions of educational technologies (Venkatesh, Morris, Davis, & Davis, 2003). TAM provides insight into intentions to use a particular technology, including eportfolios (Cheng, Chen, & Yen, 2015; Shroff, Deneen, & Ng, 2011). Modelling conceptions of assessment (CoA) maps relationships between stakeholders' understandings and their engagement with assessment (Brown, 2011). There is evidence that CoAs significantly impact learning outcomes (e.g. Brown & Hirschfeld, 2008; Brown, Peterson, & Irving, 2009). Since the experience of using eportfolios for assessment simultaneously requires engagement with technology and assessment, an analysis of this engagement using TAM and CoA modelling should reflect this simultaneity.

This paper contributes to eportfolios as assessment by examining student conceptions eportfolios as assessment and technology (CEAT). Student conceptions of eportfolio use in eight courses within three disciplines at a research-intensive university in Hong Kong provided insights into the relationship of CEAT components to each other and to self-reported GPA. Implications for research into and practices of using eportfolios as assessment are discussed.

Review of literature

Any attempted assessment or technology change sits within a complex web of variables from any number of theoretical sources within the literature. This paper situates eportfolios as assessment within three intersecting areas discussed below: first, priorities for assessment change in HE; second, how eportfolios may, or may not meet these priorities; and third, the value of exploring user-conceptions as a means to understanding eportfolios more deeply.

HE Assessment priorities and challenges

Improving the practice of assessment is central to modern quality enhancement and assurance agendas (MacDonald & Joughin, 2009). HE has been undergoing a shift from a highly examination-dependent system aimed at within-discipline achievement to a system that balances disciplinary competencies with interdisciplinary attributes and life-long learning (Deneen & Boud, 2014). Enhancing the formative and sustainable value of

assessment is of special importance to fulfilling these intentions; equally important are the determination and support of graduate competency achievement (Boud & Soler, 2015). Achieving these priorities demands broad-reaching changes to inputs, learning practices, intended outcomes, and the means of supporting and determining outcome achievement. Perhaps most importantly, the challenge is to get students to be actively involved in learning what quality is and developing the capability of judging how their work relates to disciplinary standards (Sadler, 2010). In effect, this is expecting students themselves to become assessment literate (Smith, Worsfold, Davies, Fisher, & McPhail, 2013). Assessment change initiatives in Hong Kong resonate with these global priorities.

The promise of eportfolios

Eportfolios are digitally mediated, learner-centred, deliberate collections of work aimed at embodying sophisticated achievement (Cummings & Maddux, 2010). They carry significant potential as a productive form of technology-enabled assessment (TEA), holding the promise of expanding representations of, and engagement with, student work towards sustained, complex, sophisticated outcomes, increased efficiency, and enhanced student ownership (Deneen, 2013; Redecker & Johannessen, 2013). These sustained engagements theoretically allow learners to demonstrate progress from novice to expert status in achieving disciplinary outcomes and graduate competencies (Ralston, 2015). Eportfolios are therefore promoted as a response to two key issues: how to best operationalize TEA and how to sustain and promote sophisticated outcome achievement. In Hong Kong as elsewhere, eportfolios have been promoted as a means to implement some of these wider aspirations for change.

Eportfolios consist of operational frameworks (e.g., Mahara, WordPress,etc.) that hold work objects in multiple formats (e.g., text, video, etc.) allowing the student to annotate, disseminate, and curate content to elicit feedback about progress toward learning outcomes or to demonstrate accomplishment of certain required standards or criteria. A core benefit of eportfolios is their capacity to generate formative, student-regulated continuous engagement (Deneen, 2013). Students who conceptualize assessment as guiding learning tend to achieve more and make greater effort to demonstrate that achievement (Brown, 2011). However, for students whose secondary and tertiary assessment careers are based on periodic summative examinations in which there is little feedback or opportunity to improve performance, it may be difficult to perceive and use assessment as a self-regulating tool of learning (Brown & Wang, 2013). This is of special concern with student populations coming from educational cultures deeply rooted in external validation of merit through high-stakes testing.

The challenges for eportfolio use

Achieving or even determining positive results in eportfolio use is difficult. Literature on eportfolios reflects a disproportionate focus on interest, enthusiasm, and potential rather than accounting for key variables in success (Ayala, 2006; Cummings & Maddux, 2010; Deneen, 2013). Ayala's (2006) review of 300 eportfolio studies found that less than 5% of studies adopted a critical perspective. This is slowly changing (e.g. Cheng et al., 2015; Deneen, 2013; Yang, Tai, & Lim, 2015). Emerging research shows eportfolio benefits are achievable but with many accompanying challenges. What has not

yet emerged is research that together investigates the key conceptual areas of assessment and technology.

Assessment is one of the most difficult areas of HE in which to achieve change (MacDonald & Joughin, 2009). Stakeholders' conceptions of assessment may cultivate particular practices and resistances in the face of change (Deneen & Boud, 2014). Similarly, stakeholders' conceptions of a particular technology play a key role in adoption, continued use, resistance, or abandonment. This applies to TEA generally and eportfolios specifically (Deneen & Shroff, 2014; Teo, 2009). Thus, understanding and realizing the potential of eportfolios may be contingent on appropriately accounting for stakeholders' conceptions of eportfolios as assessment and as technology, the impetus for this study.

Conceptions of assessment

Students have multiple beliefs about the nature and purpose of assessment that elicit different levels of endorsement (Brown & Hirschfeld, 2008; Brown, Irving, Peterson, & Hirschfeld, 2009). Generally, student conceptions of assessment (SCoA) have been evaluated by their impact on learning outcomes; those that contribute to higher test scores or performance are considered adaptive, while those that inhibit desirable outcomes are maladaptive (Brown, 2011). Adaptive conceptions of assessment include those that foster personal agency, responsibility for learning, and accepting the legitimacy of being assessed. Maladaptive conceptions include those that attribute responsibility externally or which reject the validity and meaning of assessment results because they are seen as unfair or illegitimate.

Qualitative research with Hong Kong university students suggests that they are very critical of the negative, life-long, and burdensome impact of assessment upon their lives (Brown & Wang, 2013). This negative view of assessment is tempered by a strong sense of agency in which students act diligently to achieve the socially desired consequences of assessment (e.g., access to opportunities and approval from families) (Wang & Brown, 2014). Additionally, it seems Hong Kong university students endorse the idea that teachers use assessment to improve instruction (Brown & Wang, 2016).

SCoA has been successfully operationalized around four different purposes for assessment through a survey instrument (i.e., the Students' Conceptions of Assessment (SCoA) inventory). Instead of reporting one overall conception of assessment score, the SCoA generates scores for four major purposes of assessment, only one of which is considered adaptive to outcomes (i.e., assessment contributes to improvement in the student's learning and teacher's teaching-*Improvement*). Three maladaptive CoA are: (i) Assessment exerts social and emotional influence on my class (*Affect*), (ii) Assessment is associated with external factors outside my control including school quality and students' futures (*External*), and (iii) Assessment is a process which interferes with, or is unconnected, to students' learning (*Irrelevant*).

A previous SCoA inventory study with Hong Kong university students (Brown, 2013) found acceptable fit. When compared to university students in China and New Zealand, statistically equivalent models were found for the Improvement and Affective factors, and equivalent metric weights for the Irrelevance and External factors (Brown, 2013). These similarities suggest that the SCoA inventory and statistical model could be used effectively in this study of Hong Kong university students.

Acceptance of technology

TAM is designed specifically to predict intention to use a particular technology (Teo, 2009; Venkatesh et al., 2003). The basic and well-validated TAM model used in this study consists of three interrelated factors that predict intention to use a particular technology (i.e., perceived usefulness, perceived ease of use, and attitudes towards usage) (Teo, 2009). TAM is robust in predicting technology adoption in educational contexts, with a variety of technologies, including eportfolios (Shroff, et al., 2011; Teo, 2009; Venkatesh et al., 2003). However, educational technology serves a purpose (e.g., assessment or teaching) that influences responses to the TAM (Teo, 2009). Thus, conceptions of eportfolio technology acceptance used for assessment are likely to exhibit not only factors relevant to technology, but also those relevant to assessment. Hence, this study examines student conceptions of technology and assessment simultaneously.

Methodology

A cross-sectional convenience sample of eight classes (*n*=445) using eportfolios as course-based assessments were surveyed at a research-intensive university. The aim of this study was to examine participants' conceptions of eportfolio assessment and determine how the joint conceptions of assessment and technology might impact self-reported achievement. The following research questions were posed within the context of students' use of eportfolios in their courses:

1. What are students' CoA?
2. What are students' technology attitudes?
3. What are the inter-relationships of CoA and TAM conceptions to each other and to GPA?

Participants

Surveys were administered in eight different classes: two in Education; three in Law, two in Common Core Course (a mandatory shared undergraduate programme emphasizing interdisciplinary study) and one in Masters in Information Technology in Education. Courses were chosen based on two criteria: 1) commonly recognizable subjects that have antecedents at many universities and 2) availability and willingness of instructor and student participation.

Within each class, a course-level eportfolio assessment instrument was used. Paper-based surveys were administered in class and electronic survey forms were sent to students not present on the day of administration. A total of 474 survey forms were returned out of the 552 students surveyed (response rate = 86%). Of those, 19 cases were removed for having more than 10% missing data in either the TAM or the SCoA. Cases with <10% missing answers had missing values estimated using the expectation maximization (EM) procedure. Thus, valid responses for TAM and SCoA analyses came from *n*=455 participants or 82% of the intended sample (Table 1). Structural analyses predicting GPA were conducted with a subset who had provided their GPA (*n*=363).

The most frequent self-reported GPA (60%) fell in the grade B range, with just 7% reporting a D (considered a low pass in Hong Kong). Demographic differences between those who provided GPA and those who did not were tested using chi-square tests of statistical significance. A greater proportion of first year students and those taking the course for personal interest declined to provide their GPA, while the difference for

sex was ignorable. This indicates that the results depend more on the voluntary participation of experienced students taking required courses and may fail to generalise to newer students or to courses taken for personal interest. While this is not a direct threat to the legitimacy of the results, it does impose some limitations on the generalisability of the results.

Table 1. Demographic characteristics of valid participants

| Demographic characteristic | GPA status | | Total (*N*=455) |
	Present (*n*=363)	Absent (*n*=92)	
Sex			
Female	227	67	294
Male	131	22	153
Year			
1	54	68	137
2	241	18	259
3	2	0	2
4	43	0	43
Masters	14	2	16
Course status			
Required	277	41	318
Elective/ Personal interest	67	41	108
Other	11	3	14
Actual self-reported GPA category			
>3.70 (A+)	26	—	
3.5-3.7 (A)	56	—	
3.0-3.4 (B)	217	—	
2.5-2.9 (C)	56	—	
<2.50 (D)	26	—	

Note. Missing information frequencies not reported.

Instruments

The survey used a common positively-packed, six-point agreement response rating scale which has four positive and two negative options. Positively packed scales have been found to be appropriate generally in conditions of expected bias towards the object being rated and specifically with Hong Kong students (Deneen et al., 2013; Lam & Klockars, 1982).

The TAM items focused on four factors (i.e., Perceived Ease of Use, Perceived Usefulness, Attitudes towards Usage, and Intention to Use) each of which has five items. Although recent modelling suggests that the factors should be ordered as a linear, predictive path (Shroff et al, 2011), such linearity may be less well-fitting than a simpler inter-correlated factors model.

The SCoA inventory consists of 33 items in eight factors grouped in pairs under four inter-correlated higher-order factors of Improvement, External, Affect, and Irrelevant. Each factor had two paired first-order factors. Generally the four second-order factors have weak to moderate inter-correlations, with the factor 'Irrelevant' is inversely correlated with the three other factors.

Analyses

A two-stage quantitative process was used to derive results. First, a measurement model for the two underlying models (TAM, SCoA) was established using exploratory and confirmatory factor analyses. The two inventories were first analysed separately with confirmatory factor analysis to determine if they fit the pre-existing models. When this was shown not to be the case, dimensionality was first determined (Courtney, 2013) and then exploratory factor analysis was used with maximum likelihood estimation and oblique rotation (Costello & Osborne, 2005). The resulting model had theoretically sound item groupings, loadings >.30 on their intended conceptual factors, and no cross loadings >.30 on other factors. This model was subsequently tested for fit using confirmatory factor analysis; models were not rejected if multiple fit indices suggested the model corresponded well with the data (Fan & Sivo, 2007; Marsh, Wen, & Hau, 2004).

Structural equation modelling (SEM) was then used to identify the relationships of the TAM and SCoA to each other and to GPA. This process determines the strength and effect of causal paths among the three constructs. Only regressions with statistically significant values were retained. Models were tested in which technology acceptance predicted assessment conceptions and vice versa. The model with smaller Akaike Information Criterion (AIC) was adopted (Burnham & Anderson, 2004). All analyses were carried out in AMOS (IBM, 2011).

Results

Technology Acceptance Model

After removing the perceived ease of use factor and items with weak loadings, a trimmed three-factor intercorrelated model (i.e., utility, acceptance, and intention) with 11 items (Appendix A) had good psychometric properties (Table 2). Factors were strongly inter-correlated and had high estimates of reliability. Mean factor scores based on averaging the observed values for each item belonging to a factor, were not statistically different between those who did or did not provide GPA. The highest mean, perceived utility almost reached 'moderately agree' (4.00), though the differences to attitude towards eportfolio were trivial ($|d|$<.20).

Student Conceptions of Assessment

After rejecting inadmissible SCoA models, five inter-correlated factors with 15 items (Appendix A) were recovered with good psychometric properties (Table 2). The three self-regulating factors (Teacher Improve, Student Improve, and Class Environment) were moderately inter-correlated (.50<r<.75) and these were zero correlated with the two negative factors (Bad and Ignore). Scale estimates of reliability were acceptable to good. Mean factor scores, based on averaging the observed values for each item belonging to a factor, were statistically equivalent for those providing or not providing their GPA. The highest mean was for Student Improve, which reached 'moderately agree' (4.00). There was a trivial difference to Teacher Improve (d=.20) and large differences to the three other attitudes ($|d|$<.60).

Table 2. TAM and SCoA scale descriptives

Construct and factors	# of items	*M*	*SD*	Within Construct Inter-correlations			Between construct inter-correlations		
				I	II	III	I	II	III
TAM factors	Fit: χ^2=171.41, *df*=41; χ^2/df=4.18, *p*=.04; CFI=.98; gamma hat=.95; RMSEA=.084; SRMR=.024								
I. Attitude	4	3.65	1.22	(.94)					
II. Perceived Utility	3	3.81	1.23	.83	(.92)				
III. Intent to Use	4	3.75	1.30	.82	.85	(.95)			
				I	II	III	IV	V	
SCoA factors	Fit: χ^2=192.08, *df*=80; χ^2/df=2.40, *p*=.12; CFI=.96; gamma hat=.97; RMSEA=.053; SRMR=.047								
I. Teacher Improve	3	3.80	1.02	(.84)				.54	.51	.46
II. Student Improve	3	4.00	1.02	.71	(.87)			.53	.49	.48
III. Class Environment	3	3.40	1.03	.52	.50	(.80)		.46	.43	.40
IV. Bad	4	3.03	0.92	-.15	-.16	.04	(.73)	-.01	.002	.06
V. Ignore	2	2.59	1.10	-.13	-.25	.01	.54	(.69)	.00	-.04	.01

Note. Alpha estimates of reliability in parentheses on diagonal; all correlation values >.40 are statistically significant.

Structural equation modelling: TAM, SCoA, and GPA

After attempting alternate models and deleting statistically non-significant paths, a structural equation model was developed in which the three inter-correlated TAM factors predicted the five inter-correlated SCoA factors and both constructs in turn predicted GPA (Figure 1). Attitude to eportfolio factor was a significant predictor of three self-regulating SCoA factors (i.e., Teacher Improve, β=.54; Student Improve, β=.53; and Class Environment, β=.46). These regression weights produce large effect sizes (f^2>.28; Cohen, 1992). Two of the factors had statistically significant relationships to GPA (i.e. Intention to Use eportfolio, β=.16 and Ignore assessment, β=-.23). The combined weight of these two predictors generated a small effect (f^2=.08) on GPA.
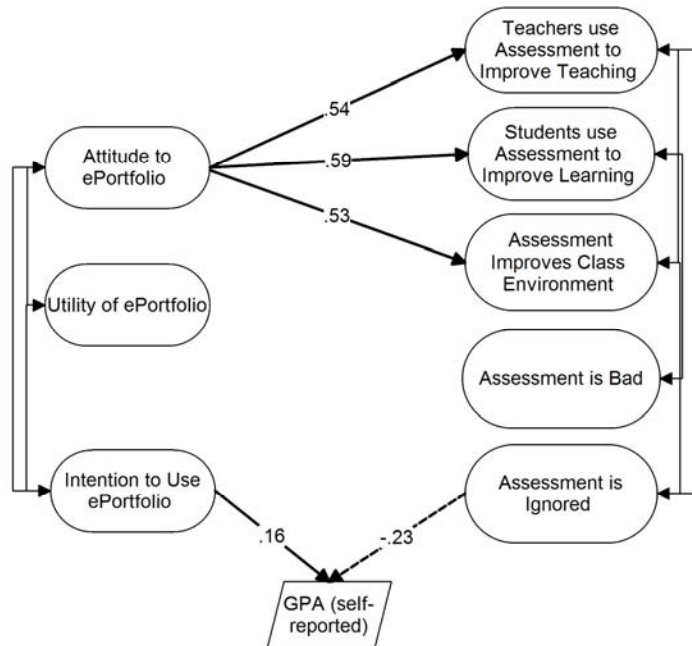
Note. Values are standardised beta regression weights; correlation values removed for simplicity; dashed line indicates negative effect; fit indices: χ^2=617.23, df=307; χ^2/df=2.01, p=.16; CFI=.96; gamma hat =.94; RMSEA=.053; SRMR=.050.

Figure 1. Schematic Model of TAM, SCoA, and GPA relationships.

Discussion

Students experienced technological and assessment aspects of eportfolios simultaneously. Previous research shows that the TAM factors interact with related experiential and perceptual factors (Cheng et al., 2015; Cummings & Maddux, 2010; Shroff et al., 2011; Teo, 2009). Our results are significant in that they are the first to show how two core areas of assessment and technology interact around eportfolios. This analysis indicates a causal, conceptual relationship between eportfolios as assessment and as technology. Greater acceptance of eportfolios from a technology perspective seems to lead to enhanced conceptions that eportfolio assessment functions formatively. Furthermore, positive attitude toward technological aspects of eportfolios triggers increased confidence that teachers are using assessment formatively to modify their own instruction, and similar self-regulatory use by students and contributes to greater social inter-personal cooperation when being assessed.

The students in this study clearly endorsed the formative functions of assessment; having a positive attitude to eportfolio technology enhanced these. This study demonstrates that use of eportfolios for assessment requires active consideration of how students understand both the technological and assessment aspects of an eportfolio system.

The relationship of student attitudes towards eportfolio technology and assessment also contributed to increased GPA. This result is consistent with the notion that active cooperation with assessment methods contributes to better results (Brown, Peterson & Irving, 2009). Furthermore, conceptualizing assessment as something to be

ignored contributed to reduced GPA; clearly, a maladaptive response to assessment carries appreciable consequence. Taken together, these findings provide evidence suggesting that how students conceptualize technology-enabled assessment tasks impacts achievement outcomes. Hence, the conceptual spheres of technology acceptance and conceptions of assessment interact, and are significant to overall academic achievement, albeit with modest effect.

Balancing summative and formative priorities is a key priority in assessment. These findings present a strongly adaptive perception of assessment, moderately stronger than the previous survey of university students in Hong Kong (Brown, 2013). This greater endorsement may arise because in this study, students were asked to evaluate a specific form of assessment (eportfolio) rather all assessments as in the previous study. It is significant that students appear to conceptualize assessment on a case-by-case basis, evaluating each on its particularities, rather than treating all assessment as a holistic phenomenon. This aligns with research into TAM, suggesting that acceptance of technology innovations is best evaluated on a case-specific basis (Teo, 2009; Venkatesh et al., 2003). These findings extend this case-specific research into assessment. Given the growing importance of technology-enabled assessment, further research on this specific finding is warranted.

This study was conducted at a single, research-intensive university and data were provided by older students in compulsory courses. Thus, future work should investigate multiple sites, course status, experience, and other regions. This would be especially useful in locations where students may express contrasting conceptions of assessment, such as Brazil or New Zealand (cf. Brown, 2013). Similarly, use of interviews to explore the interplay of SCoA and technology acceptance attitudes may produce a more detailed picture of these relationships. This could have special significance for eportfolio pilot initiatives. The moderate but present effect of conceptions on self-reported GPA also warrants further exploration. More detailed relationships between conceptions and performance should be explored by analyzing varied outcome data, such as eportfolio quality and specific student outcome achievements.

Conclusions

Students' conceptions of both assessment and technology are fundamental to using eportfolios, yet these are usually examined separately, if at all. Thus, student conceptions remain less understood than the mechanical aspects of technology adoption or assessment change management. Understanding the simultaneous intersection of technology and assessment in eportfolios is beneficial to understanding the phenomenon of eportfolios as assessment, determining what changes might be needed in the implementation of technology for assessment, and suggesting directions for research using the CEAT model.

In eportfolio adoption and use, it matters how students understand assessment, how they relate to technology and how those conceptions interact. A better understanding of eportfolio success or failure factors will come by including awareness of both technology and assessment beliefs. It may be a salutary practice to establish student conceptions as part of early, detailed planning around eportfolios and TEA, generally to enhance likelihood of success and diminish wasted expense and policy effort. Further research into this area might be well-served by examining whether different types of

eportfolios and different assessment intentions produce different conceptions of eportfolio as well as variation in tangible outcomes.

Bio notes

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