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Investigating Student Behavior in Adopting Online Formative Assessment Feedback

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***Abstract*—**In this paper we describe one critical research program within a complex, ongoing multi-year project (2010 to 2014 inclusive) with the overall goal to improve the learning outcomes for first year undergraduate commerce/business students within an Information Systems (IS) subject with very large enrolment. The single research program described in this paper is the analysis of student attitudes and decision making in relation to the availability of formative assessment feedback via Web-based real time conferencing and document exchange software (Adobe Connect). The formative assessment feedback between teaching staff and students is in respect of an authentic problem-based, team-completed assignment. The analysis of student attitudes and decision making is investigated via both qualitative (firstly) and quantitative (secondly) application of the Theory of Planned Behavior (TPB) with a two statistically-significant and separate trial samples of the enrolled students. The initial qualitative TPB investigation revealed that perceived self-efficacy, improved time-management, and lecturer-student relationship building were the major factors in shaping an overall favorable student attitude to online feedback, whilst some students expressed valid concerns with perceived control limitations identified within the online feedback protocols. The subsequent quantitative TPB investigation then confirmed that attitude towards usage, subjective norms surrounding usage, and perceived behavioral control of usage were all significant in shaping student intention to use the online feedback protocol, with these three variables explaining 63 percent of the variance in the behavioral intention to use the online feedback protocol. The identification in this research of perceived behavioral control as a significant determinant in student usage of a specific technology component within a virtual learning environment (VLE) suggests that VLEs could now be viewed not as a single, atomic entity, but as a spectrum of technology offerings ranging from the mature and simple (e.g., email, Web downloads) to the cutting-edge and challenging (e.g., Web conferencing and real-time document exchange). That is, that all VLEs should not be considered the same. The results of this research suggest that tertiary students have the technological sophistication to assess a VLE in this more selective manner.

***Keywords*—**Formative assessment feedback, virtual learning environment, theory of planned behavior, perceived behavioral control.

I. Introduction

THIS paper describes one critical research program within an overall complex multi-year project spanning January 2010 to November 2014 inclusive that aims to improve the learning outcomes for first year undergraduate business students within an Information Systems (IS) subject. The IS subject is titled "Computer-based Information Systems" and is a core unit within a Bachelor of Commerce degree program. The subject runs in both 13 week semesters of each calendar year, and has enrolments exceeding 1500 students per calendar year (semester 1/2013 enrolment was 912 students and semester 2/2013 enrolment was 650 students). Undergraduate first year students comprise approximately 98% of the IS subject's enrolment. The male/female enrolment demographic is evenly split within the subject, and approximately 40% of enrolled students do not have English as a first language. Curriculum delivery comprises a weekly 2 hour lecture supported by a weekly 2 hour tutorial and consultation time from each of the 12 teaching staff. Each 2 hour lecture is audio/video recorded and made available to students for download via a Web-based content server. The IS subject's learning outcome for all enrolled students is stated as follows: "By completing this course students will attain a basic level of computer and information literacy, a strong knowledge of computing fundamentals, as well as an awareness of the possibilities and limitations of existing technological solutions". The two major components of the subject's pedagogical content are: (1) a 50% assessment weighting on IS theory; and (2) a 50% assessment weighting on practical demonstration via advanced Excel spreadsheet theory and practice and Microsoft Visio representation of Business Process Modelling analyses (i.e., BPMN within Visio).

The original motivation for the overall project was the goal to pedagogically manage the stark difference in results achieved by a majority of students in IS theory assessment, as compared with student results in the practical analysis via Excel/Visio/BPMN. In simple terms, the IS theory results were strong, whilst the practical results were below expectation. Preliminary research of this situation revealed that student attitudes to Excel and BPMN problem solving were quite negative. Student focus groups revealed a significant wariness of end-user programming and this in turn had caused a lack of confidence in a large percentage of the enrolled cohort. Further research revealed that students could not relate the overall learning outcomes of the subject to the specific challenge of Excel and BPMN problem solving. Students saw problem solving as a "black box" – they could not see a learning path which would take them from beginner knowledge level to near-professional competency. To date, the pedagogical management of this challenge has unfolded via discrete research programs realized over several calendar years – and ongoing.

The first stage of the project (calendar year 2010) was to review and re-define more precisely student learning outcomes in relation to Excel theory and practice. This review and re-

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definition of learning outcomes utilized the Four Resources Literacy Education model described in [1], [2] as a normative, diverse-method (i.e. inclusive of many practices) literacy education model designed to apply across many disciplines (not just English courses). Excel theory and practice would now be presented to students as a new literacy competence with an associated spectrum of achievement levels as assessment milestones. The adoption of these learning outcomes, tightly coupled with newly designed assessment protocols, significantly motivated and empowered a majority of students within the subject, and this in turn produced improved learning outcomes – measured both qualitatively and quantitatively. The second stage (calendar year 2011) involved replacing the printed set text via the development and delivery of additional scaffolding of in-house developed pedagogical content via audio/visual (MP4) streaming/ download, delivered to students by a Web content server (Blackboard). These two stages have been described comprehensively in [3], [4].

The combination of these 2011 and 2012 initiatives positioned the subject delivery within a blended learning environment, that is, a combination of a *face-to-face learning environment* and a *virtual learning environment (VLE)*. This blended learning for the subject which has been consistently described by students as producing a richer, more flexible and more engaging learning environment and this is producing measurably improved learning outcomes. The significant success of this blended learning environment led logically into stage three (calendar years 2012/13) of the project in which formative assessment feedback to a student is delivered via face-to-face contact (that is, the traditional delivery method) and via Web-based real time conferencing and document exchange software (Adobe Connect). It is this 2012/13 initiative and the student attitudes to it that are described comprehensively in this paper.

This research reported within this paper is predicated upon a three-tiered foundation: (1) virtual learning environments (VLEs), (2) formative assessment, and (3) digital recording/ streaming video technology within education. Consequently this paper will firstly provide in the next section a concise treatment of these this three-tiered foundation. The paper will then describe the research methodology that has underpinned the project and this paper. From this point, the paper will then describe the operational stages of the project, together with the analysis of results from each stage.

II. Three-Tiered Foundation

The foundation components of this research are virtual learning environments (VLEs), formative assessment, and digital video technologies within education. This section will review education sector developments with respect to these three areas and highlight where the literature points to a need for further research to extend existing theory and practice. This project has aimed to provide just such an extension.

A. Virtual Learning Environments

Virtual learning environments (VLEs) have been described in the literature since the late 1990s. Initially VLEs were described as "computer-based environments that are relatively open systems, allowing interactions and encounters with other participants" and providing access to a diverse range of resources [5, p. 8]. A VLE is distinguished from a computer micro world where the students individually enter a self-contained computer-based learning environment and classroom-based learning environments where various technologies are used as tools in support of classroom activities [5]. VLEs are broader than computer aided instruction (CAI) because the VLE adds the communication dimension to a previously individualized learning experience. VLEs can therefore foster communities of learners and encourage electronic interaction and discussion [5]. VLEs have expanded the traditional learning environment dimensions of time, place, and space to now include the very important dimension of *control* – the extent to which the learner can control the instructional presentation [6, pp. 403, 404].

B. Formative Assessment

Formative assessment and summative assessment comprise the two components of student assessment, defined by [7], [8] as the measurement of the learners' achievement and progress within a learning process. These two forms of assessment have a critical role in higher education [9, pp. 70-82]. Summative assessment (assessment of learning) measures what students have learned at some defined point within an educational course [10]. Formative assessment (assessment for learning) occurs during the course of instruction with the aim of supporting learning [9, pp. 76-77], [11]. Research in [12, p. 9] has described formative assessment as: "Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited".

The convergence of formative assessment with Web-based technologies produces the concept of online formative assessment. This term is defined as "the use of ICT to support the iterative process of gathering and analyzing information about student learning by teachers as well as learners and of evaluating it in relation to prior achievement and attainment of intended, as well as unintended learning outcomes" [13, p. 716]. The discussion in [14, p. 2337] defines online formative assessment very similarly.

A most comprehensive literature review of the value and practice of formative assessment in online and blended higher education [14, p. 2335] can only identify 18 empirical studies "drawn from a wide range of publications in Europe, Australasia and North America". This "paucity of studies" is available from a narrow discipline spread where "half of the selected studies were teacher education courses" [14, p. 2335, p. 2347]. The review suggests that further empirical research about online formative assessment via a systematic and rigorous approach is required in order to achieve useful

findings that can inform effective practices, and that "one way forward would be to conduct research within real-world contexts that focuses on in-depth investigation in the design and embedding of formative assessment within online courses" [14, p. 2348]. Reference [15] describes that online student assessment is one of the three major unresolved challenges in relation to MOOCs courses (the other two being the lack of appropriate business models, and the certification appropriate for a MOOCs course).

C. Digital Video Technology within Education

Digital video technology for tertiary education use has been consistently reported in several studies [16], [17] as experiencing very rapid growth. The major educational/ pedagogical benefits of video technology in the classroom are also increasingly documented. Video-based content (accessing both aural and visual senses simultaneously) allows students to have multiple entry points into the learning material [18]. Educational video reinforces reading material and lectures, enhances student comprehension and discussion, increases student motivation and enthusiasm, and supports a greater range of learning styles [19]. Reference [20] is one of several recent studies within the literature reporting how video technology is used in higher education in diverse classroom situations – however none of the described strategies includes online formative assessment, and indeed the literature review for this paper could not identify any study relating to video use in online formative assessment. It should also be noted that of the 18 empirical formative assessment studies identified in [14], none involved the use of digital real-time document exchange/conferencing technology for conveying feedback in relation to an assessment deliverable between student and teacher.

III. Research Methodology

In overview, this research was conducted as an exploratory, interpretive study using qualitative and quantitative data collection and analysis. This research is defined by the bounded system [21] of student participants' involvement over the consecutive semesters of delivery of the IS subject. In general form, the interpretive methodology aims to provide insights as to how a particular phenomenon has been rationalized by a person or group of persons. In general form, the interpretive methodology requires initial data collection followed by the construction of insights via the researcher's analysis of the collected data. Interpretive research is considered most appropriate when it is necessary to consider the "often complicated relationship between people, ideas and institutions" [22]. The interpretative approach is appropriate where the research has a descriptive, exploratory focus [23]. It is acknowledged that the exploratory nature of this interpretive case study restricts the broad applicability of the research results obtained to date. Whilst this suggests a lack of external validity within this research, it is stressed that the exploratory findings from the first two earlier stages of the research have since been used to generate a suitably scaled pedagogical strategy for the total enrolled student cohort, and this strategy has been operationally delivered and quantitatively assessed during 2011, 2012, 2013 and 2014

All qualitative feedback and reflections within the project were coded and analyzed using the Glaser-Strauss' constant comparison method [24] to allow interpretive themes to emerge. In this coding and analysis process conceptual categories are initially generated by a comparison between/ across data observations. The formulation of a category is an attempt to find a concept of a slightly higher level of abstraction than the data itself. The category labels a set of observations that describe the same phenomenon – the category is a separate element of a theory, that is, a concept [24, p. 36]. Categories must be meaningful, that is, they should generate interest in, and assist understanding of what issue is being studied [24, p. 36]. Whether or not a category is appropriate cannot be judged solely from the correctness of the underlying data – the usefulness of a category must be decided from its ability to contribute to the emerging theory. New data are constantly compared with evolving categories – with the ongoing generation of new categories. Comparisons between categories generate hypotheses, which are defined as categories related to one another [24, pp. 39-40]. The collection of data will continue until no further properties can be found or added to categories – a stage called theoretical saturation [24, p. 61].

Additionally, the qualitative and quantitative analysis underpinning this paper was shaped via the Theory of Planned Behavior or TPB [25] which is a well-known social psychological theory of human behavior. The constructs and dependencies of the TPB are illustrated in Fig. 1, and discussed below.

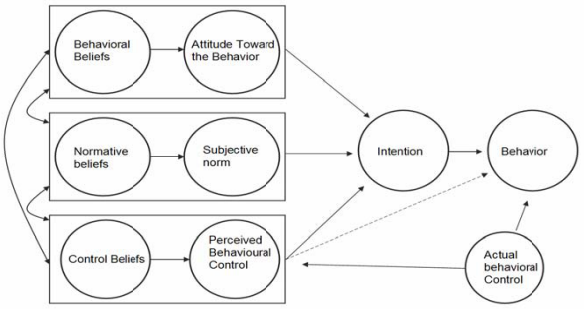

Fig. 1 Theory of Planned Behavior

The TPB assumes that the actions of a person in a given context (a behavior) result from the formation of an intention to perform the behavior. In [25] behavioral intentions (Intention in Fig. 1) are factors that capture how hard a person is willing to try to perform a behavior. This has been supported by [30] who examined 185 empirical studies that had been published up to the end of 1997. Reference [26] found that the TPB accounted for 27 percent and 39 percent of the variance in behavior and intention respectively. The TPB identifies the antecedents to intention as three motivational influences: attitudes, subjective norms, and perceived behavioral control. Relevant attitudes represent the "degree to

which a person has a favorable or unfavorable evaluation or assessment of the behavior in question. Subjective norms represent "the perceived social pressure to perform or not to perform the behavior". Perceived behavioral control is the "perceived ease or difficulty of performing the behavior…assumed to reflect past experience as well as anticipated impediments and obstacles" [25, p. 188]. In the context of technology-based behaviors, perceived behavioral control has been found to correlate well with perceived ease or difficulty of use related to a particular technology [31]. It was postulated in [31] that the easier a system is to use, the greater the belief that the system will support information needs – and this mapping is reflected in perceived behavioral control. Underpinning each of these concepts are the person's beliefs about the outcome of performing the behavior, about the expectations of other people, and about their own capabilities to successfully complete the behavior.

IV. Operational Overview and Analysis Results

A. Operational Overview

In early 2013 a decision was taken to undertake a limited trial of on-line formative assessment in relation to the subject's single assignment worth 20% of the overall subject assessment. The on-line formative assessment protocol (Fig. 2) is described in the following dot points.

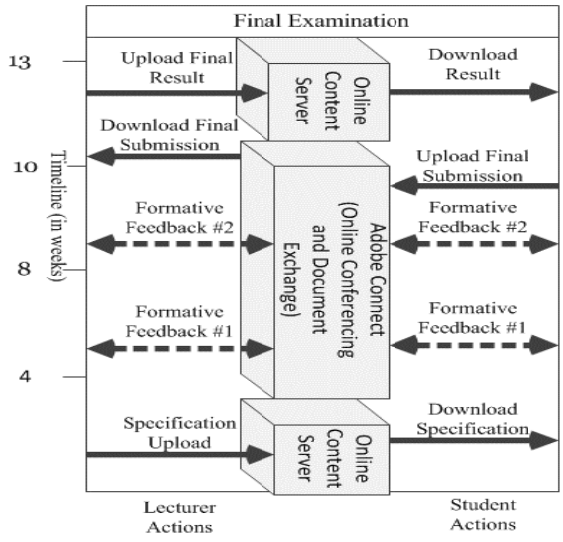

Fig. 2 Online Formative Assessment Protocol

1) The assignment specification is released digitally in week 1, via a Blackboard content server, as an Excel template file (with raw data) supported by a PDF description of an authentic, case based problem scenario. The assignment must be completed and submitted (as a completed Excel spreadsheet comprising several specialized worksheets) by the end of week 10 (within a 13 week semester).
2) All students enrolled within the subject are introduced to the software application that would subsequently underpin the formative assessment trial (Adobe Connect) during the first tutorial (week 2 of the course) – this is a 20 minute familiarization program within the tutorial.
3) Each student is invited to optionally discuss assignment work-in-progress at two negotiated dates within this 10 week timeline. There is a suggested four week period between these two submission dates. The work-in-progress discussions may be conducted *face-to-face* or *online*. The online discussion was conducted only by the subject coordinating lecturer and this resourcing decision therefore capped the number of students who could participate in the trial (this cap was set at 40 students). The online discussion was via Adobe Connect, an on-line conferencing and document exchange/viewing application. Adobe Connect centers upon a Web-based meeting room concept. The lecturer establishes and retains control of the Web-based meeting room. Each student enters the Adobe Connect meeting room via his/her browser and an advertised URL (using logon and password credentials). This action in turn loads an Adobe '*thin-client*' into the student browser, and it is this thin-client which then facilitates the online interaction. There is no need for the student to explicitly load or configure any software on his/her computing device. The meeting room allows text-based exchange, audio exchange, and shared document viewing (this last capability requires the sharing of the student desktop between lecturer and student). Multiple parties may be within the meeting room simultaneously or the lecturer may choose to admit students on a single basis (with other students awaiting entry). The meeting room allows rich formative feedback based on discussion and document (Excel spreadsheet) display with a single student or a group of students.
4) The final completion and electronic submission of the assignment (an Excel file) occurs in week 10, and a final mark and feedback (via a marking rubric/video) is provided before commencement of the exam block period.

B. Results – Qualitative TPB Analysis

A total of 40 students (the maximum possible) self-selected into the online formative assessment trial. Of the 40 students, 33 contributed to an evaluation of the process. For this evaluation, a semi-structured script containing open-ended questions and probes was used to guide the data collection. The script centered upon the Theory of Planned Behavior (TPB) constructs (i.e. attitudes, subjective norms, and perceived behavioral control – see Fig. 1). Transcripts were coded and analyzed as discussed in the Research Methodology section of this paper. The subordinate categories relating to attitudes, subjective norms, and perceived behavioral control are presented in the following paragraphs and visualized in Fig. 3.

Attitudes: When students were asked about the good things associated with online assessment feedback, three dominant categories were revealed.

1) All students made clear and strong statements about *time management*. All students described the time costs associated with attending face-to-face sessions and the

difficulties in optimizing a timetable comprising face-to-face lectures, tutorials, and paid-employment obligations. Online access to teaching staff considerably improved student time management opportunities. A total of 21 students also discussed the dollar cost of additional on-campus attendance as a frequent complicating factor in seeking face-to-face consultation.

2) A total of 15 students described how the online feedback assisted *reflective learning*. These students described how online feedback fitted well within an extended study session (either university-library or home-based) – and this allowed greater focus on the feedback topic both immediately before and after the online session. These students described that this extended focus produced greater understanding and more satisfaction from the study session.
3) A total of 13 students described how the online feedback assisted in *building a relationship* with the lecturer. These students (all in first year) described how meeting with a lecturer was not always relaxed, and that the online interaction was in some ways more an equal exchange. All 13 students described how they would much prefer to have online interaction before they initiated face-to-face interaction.
4) A total of 20 students were very critical of potential student-work *privacy breaches*. This concern centered upon a student's work (i.e. the developing assignment) being seen by other students in the Adobe meeting room. Whilst these students were very supportive of shared discussions (i.e. online audio within Adobe Connect), all were equally strong in not wanting to show individual assessable work to other students via Adobe Connect document display. All students outlined how this was a minimal privacy requirement in *face-to-face contact* and that this issue would be a major determinant in adopting online consultation alternatives.

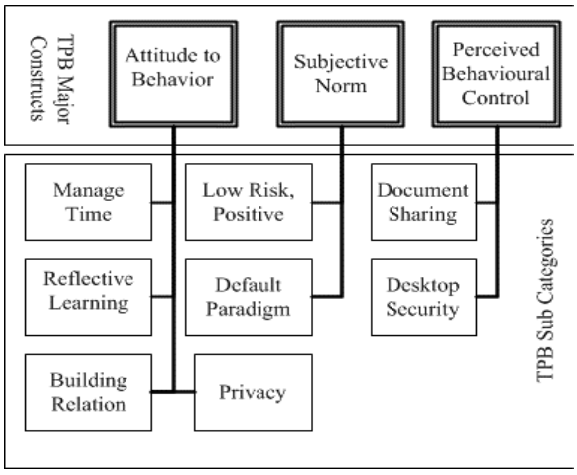

Fig. 3 TPB Major Constructs and Sub Categories

Subjective Norms: When asked how they felt about the offering of online feedback opportunities, all students were positive (no negative comments received). Two clear categories were revealed:

1) All students agreed that feedback in respect of an assessable item of work was a totally positive event. All students described the online interaction as a low risk, potentially positive for the individual student and that this viewpoint was shared by all their friends. A total of 27 students added that formative assessment feedback (not in an online mode) had been a core component within their senior years at high school.
2) All students outlined how online interaction with friends and other contacts was very much the preferred and default communication channel for their generation. Students commented that this trend was increasingly popular within their demographic.

Perceived Behavioral Control: Two obstacles had challenged all students.

1) A total of 23 students expressed difficulties in sharing a document within the Adobe meeting room. This is a core component of Adobe Connect and allows the same document to be viewed (via a Web browser) in real time across all participants in the online meeting. All participating students had attended the tutorial training session in teaching week 2 where they felt they had understood all aspects of the Adobe Connect application. Subsequently, however, they had experienced difficulties in terms of sharing their work-in-progress with the lecturer in the Adobe Connect meeting room. All these difficulties had been resolved via audio assistance from the lecturer. However all students still considered the activity as technically challenging.
2) A total of 5 students (not in the first set of 23 above) commented that the sharing of the student desktop (required by Adobe Connect for shared viewing of documents and annotation by lecturer) introduced a security concern for the student. These 5 students were technically advanced and this is a very valid concern. It is stressed that desktop sharing gives desktop control of the student machine to the lecturer – the reverse arrangement is not required in delivering the feedback.

C. Results – Quantitative TPB Analysis

The identification within the qualitative TPB analysis of perceived behavioral control as a significant criticism of student adoption of the online formative feedback protocol raised the need to further investigate behavioral control more broadly within the enrolled cohort. The popularity with students of online content had been formally accepted at the University of Queensland (UQ) as early as mid-2012 when a UQ survey of 5000 students confirmed that on-campus numbers during a routine teaching week lag (on every day of the week) those student accesses to the content web-server used across the university (a Blackboard system). This is shown in Fig. 4.

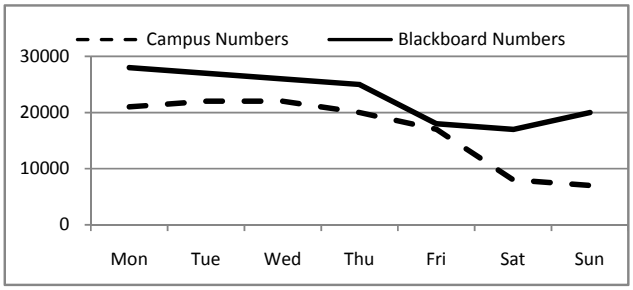

Fig. 4 University of Queensland Blackboard v On-Campus Data

The University of Queensland survey revealed that 80% of students used the Blackboard content management system - the highest access statistic of any University or external service, exceeding web-mail (79%), Facebook (74%), university library database access, and YouTube (49%). This very much endorsed the findings in the literature review of [33] which "observed two complementary movements in the educational landscape: the merging of online teaching and learning into the stream of everyday practices at universities, and the increasingly salient role of distance programs in institutions of higher education".

During second semester 2013 it was decided to quantitatively survey via a TPB questionnaire the entire student cohort in the IS subject *excluding those students who had already participated in the qualitative TPB trial*. A survey questionnaire comprising trial-validated items was used. Students were asked to provide demographic information and respond to nine statements on the major constructs of the TPB model. The distribution of questions was as follows: attitudes to usage (ATU) – three questions; subjective norm (SN) – two questions; perceived behavioral control (PBC) – two questions; and behavioral intention to use (INT) – two questions. Each question requested student measurement on a seven-point Likert scale with 1 = strongly disagree and 7 = strongly agree. Participation in the survey was voluntary and subsequently 161 students contributed a completed survey (approximately 30% of enrolled cohort). Of all participants, 56% were female with 44% male; 34% were aged under 19, 51% were aged between 19 and 21, whilst 15% were above 22 years of age. Of all participants, 51% were Australian, 37% were Asian/Indian, and 15% were European.

The overall statistical analysis of the survey data initially focused upon examining the descriptive statistics of the measurement items and assessing the reliability and validity of the instrument in this study. This process was then followed by testing of the TPB hypotheses by assessing the model fit via various fit indices. Finally, the research model was evaluated.

Descriptive statistics: The mean value of all variables is above the midpoint. The standard deviations range from 1.29 to 1.6 and this indicates a medium spread of values around the mean. The skew index ranges from -0.82 to 0.22 and kurtosis index ranges from -.86 to 0.7 which meets the recommendations in [26] for the purpose of structural equation modeling.

Convergent validity: Within this study, the following three procedures proposed [27] to assess convergent validity of the measurement items have been used:

1) item reliability of each measure;
2) construct reliability;
3) the average variance extracted.

The item reliability of an item was assessed by evaluating its factor loading onto the underlying construct. A factor loading of 0.70 is described in [28] as being acceptable. Construct reliability was measured using Cronbach's alpha, with [29] recommending a value of 0.7 or greater. Average variance extracted (an indicator of convergent validity) measures the overall amount of variance that is attributed to the construct in relation to the amount of variance attributable to measurement error. Average variance extracted is calculated by averaging the square of the factor loadings across the number of factors for the underlying construct. Convergent validity is deemed to be acceptable when average variance extracted equals or exceeds 0.5. Table I shows that all indicators – excepting PBC factor loadings – met the recommended guidelines and therefore indicating that the convergent validity for the proposed measurement model is adequate.

TABLE I
CONVERGENT VALIDITY RESULTS

Latent variable / Item	Standardized factor loading (>0.70)[a]	Average variance extracted (> 0.50)[a]	Cronbach's alpha (> 0.70)[a]
Attitude		0.69	0.87
ATU1	0.85		
ATU2	0.88		
ATU3	0.76		
S.Norm		0.62	0.76
SN1	0.81		
SN2	0.77		
Control		0.51	0.57
PBC1	0.61		
PBC2	0.66		
Intention		0.84	0.91
BIU1	0.87		
BIU2	0.97		

[a] :Indicates an acceptable level of reliability or validity

The research model in this project was tested using IBM AMOS 22. A variety of indices have been used to measure how well the proposed model reproduces the observed data. Firstly an absolute fit index value *chi-square* χ^2 was used to evaluate the overall discrepancy between the implied and observed covariance matrices. Next the parsimonious index *root mean square error of approximation* (RMSEA) was used to take into account the model's complexity. Finally the incremental fit index, the *Tucker-Lewis Index* (TLI) was used to assess the overall model fit relative to an alternative baseline model. The results of these tests were as follows: *chi-square* (χ^2) = 30.329, *chi-square/degree of freedom* (χ^2/df) = 1.443; RMSEA = 0.060; TLI = 0.983). All these values satisfied the recommended level of acceptable fit.

Fig. 5 shows the TPB model with all path coefficients. The

paths to INT from ATT (β = 0.37), SN (β = 0.29) and PBC (β = 0.39) are significant at ρ < 0.1. A total of 63 percent of the variance of the endogenous variable INT (Behavioral Intention to Use) was explained by the exogenous variables ATT (Attitude to Behavior), SN (Subjective Norm) and PBC (Perceived Behavioral Control). This suggests that the TPB is an efficient model to predict the behavior of undergraduate students to use online Web technology to participate within a formative assessment feedback protocol.

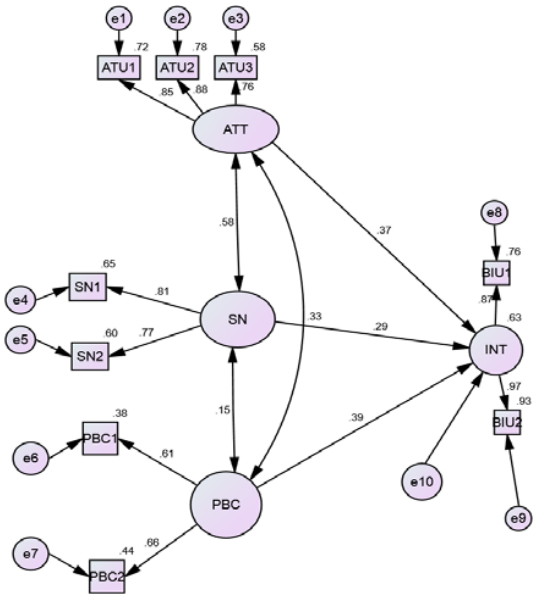

Fig. 5 Results from the structural model testing

The significant values (0.37) shown for ATT -> INT and for SN -> INT (0.29) are not surprising. These significant mappings are reported in other studies (e.g. [32]) and it should also be noted that the qualitative TPB analysis in this research had identified that many students were well used to formative assessment from their high school experience and that they also positively rated its value in teaching/learning. Clearly these beliefs transfer across to online formative assessment feedback in the quantitative TPB study. However it is a little surprising to the researchers that PBC -> INT produced such a strong weighting (0.39) – a value that clearly confirms that in this study the students decision to adopt the online formative assessment feedback protocol was positively shaped by their self-belief to use the technology productively. There have also been several other studies (e.g. [32]) which have reported that PBC has no significant effect on INT. However [32] did also suggest in terms of future research that: "attempts could be made to unpack and clarify the role and properties of perceived behavioral control as a variable in the TPB." It should also be remembered that one of the few previous studies [31] to examine the mapping of PBC -> INT had reported a significant correlation between the two variables but had postulated that the easier an information system is to use, the greater the belief is that the system will support information needs. On any reasonable assessment Adobe Connect is not mainstream or frequently encountered software – but still the students in this study (after a one-tutorial training session) were confident and positive about using it to obtain formative feedback. This suggests that virtual learning environments (VLEs) could now be viewed by researchers and practitioners not as a single, atomic entity, but as a spectrum of technology offerings ranging from the mature and simple (e.g., email, Web downloads) to the cutting-edge and challenging (e.g., Web conferencing and real-time document exchange). That is, that all VLEs should not be considered the same. The results in this paper suggest that the sampled first-year tertiary business students have the technological sophistication to assess a VLE in this more selective manner.

This study is limited on several grounds. Firstly, data-collection was via self-reporting. This may have led to a situation where the associations between variables tend to become inflated. Our continuing research in this project will address this issue. Secondly, the sample students in this study were mostly Commerce/Business students undertaking an information system subject. This could have resulted in questionnaire being interpreted in terms of an expected "technology positive" response. This possibility could also limit the broad applicability of these findings to other student populations.

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