

## The Spread of ICT Innovation in Accounting Education

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This paper conveys the findings of a study conducted to evaluate the initiation of an interactive online computer-assisted learning module, called WEBLEARN, in an undergraduate introductory accounting course at an Australian university. The purpose was to aid students in the preparation of cash flow statements, a topic that from the student perspective is usually considered fairly difficult. Following the pilot of the module, student responses were collected via questionnaire in order to evaluate their perceptions regarding the WEBLEARN module. Diffusion of innovations theory was utilized as a framework for assessing student responses and to guide further development of modules in other topics within the accounting unit. The results proved to be significant in relation to all four independent variables: relative advantage, compatibility, ease of use, and result demonstrability. The combination of quantitative and qualitative findings indicates that the majority of students formed favourable perceptions regarding the relative advantage, compatibility, and ease of using the module, which further translated into positive intentions regarding prospective use of the module as a learning resource.

Strategies for facilitating the spread of e-learning innovations are important to educational administrators around the world. The surge of an 'information revolution' has forced developed economies into an era that demands effective utilisation of information and communication technologies (ICT) in education to prepare 'knowledge workers' for the 'knowledge economy' (Drucker, 1998; Maier & Warren, 2000; OECD, 1996). As a result, educational institutions must reassess their methods of practice, adapting and improving teaching and learning for the changing needs of a global, digital, and networked economy.

The literature indicates that the use of ICT in teaching and learning has the potential to enhance student learning outcomes and stimulate their motivation (Pugalee & Robinson, 1998). Furthermore, it has been argued that the application of ICT can provide a more student-centred approach, which would encourage students to take some responsibility for their learning and, through this greater autonomy, would lead to the acquisition of skills that would enhance their lifelong learning (Lage, Platt, & Tregalia, 2000; McCourt Larres & Radcliffe, 2000).

In the context of accounting education, Holt, Boyce, Carnegie, Lourens, and Bigelow (1995) suggest that the use of computer-assisted learning in accounting education will substantially contribute to the development of technical competencies and, furthermore, will allow greater emphasis to be placed upon accounting concepts, issues, and ideas within the classroom. They contend that where employed effectively, computer-assisted learning enables additional student contact time to be directed towards accounting case study deliberations and similar discussions, thereby assisting in fostering a learning environment that would promote the development of

crucial competencies such as communication, interpersonal skills, and critical and analytical thinking skills. Holt et al. (1995) argue that to be effective, computer-assisted learning software should exhibit the following characteristics: skill development orientation, being holistic/integrative, allowance for customisation, being interactive and user/event driven, providing multi-layered feedback, and making use of hypertext content-related systems. Instructional software possessing these characteristics should not be confused with commercial general ledger computer packages that are frequently utilised in introductory accounting units. Holt et al. (1995) claim that packages of the latter style typically emphasise the application of knowledge acquired in the classroom to produce financial outputs rather than concentrating on the development of in-depth understanding of the accounting processes, as can be achieved via the use of instructional computer-assisted software packages.

In response to the limited amount of existing research on the impact of ICT on student learning in accounting education, Rebele et al. (1998) and Apostolou, Watson, Hassell, & Webber (2001) called for further investigation that would address the issues of whether learning is enhanced by the use of ICT and whether students find courses that make use of this technology more interesting or informative. McCourt Larres and Radcliffe (2000) examined the extent to which computer-based instruction is effective in promoting student learning by focusing on students' perceptions regarding their experience. They found that students expressed enthusiasm for the software and welcomed the opportunity to organise their study independently. The majority of the students considered computer-based instruction to be more interesting and stimulating than alternative mediums of instruction

such as lectures and tutorials. However, they considered the software package to contain an insufficient level of technical detail, which is something that can be adjusted in the future to meet the student needs. Adopting an outcome-based perspective, Green, Reinstein, and McWilliams (2000) instead chose to concentrate upon whether or not the use of interactive courseware affected the level of student performance, with respect to students' understanding of procedural material. They found that students' interest in accounting increased in greater proportion for the group of students that used the interactive courseware than for the group that used the traditional lecture/problem-solving methods.

In response to Rebele et al. (1998) and Apostolou et al. (2001), and with the recommendations of Holt et al. (1995) in mind, we developed an online interactive computer-assisted learning module (hereafter referred to as WEBLEARN) for an introductory undergraduate accounting unit, with the view of supporting students in the process of preparing cash flow statements. The module was designed in conjunction with a commercial e-learning vendor and specialist instructional designers. WEBLEARN was an expensive and time-consuming resource to develop and we felt it important to assess students' perceptions regarding its utility, particularly in terms of whether they would respond favourably to future use of the module through its extension to other key topics in the unit.

We identified that one method of assessing whether students would respond favourably to future extensions of WEBLEARN was to utilise Rogers' (1983) Diffusion of Innovations (DOI) theory, as modified by Moore and Benbasat (1991) for an ICT context. The theoretical concepts from the innovations literature fit in well with our study since WEBLEARN, as a specific computer-assisted instructional tool targeting procedural accounting material, could also be classified as an innovation within the scope of accounting education. The main point is that the idea does not need to be novel per se but it is classified as an innovation because it would be perceived as such by prospective users (Rogers, 1995, p. 11), in this case the students. Rogers contended that response to an innovation, or intentions of its future use, depended on several attributes of the innovation: relative advantage, compatibility, complexity, trialability, and observability. By gaining insight into student perceptions of the various attributes of WEBLEARN in relation to Rogers' and Moore and Benbasat's attributes of innovations, we could work on improving the module and student perceptions of the module with respect to future use. The chief aspect of this research is to assist future developers in streamlining the spread of computer-assisted learning innovations in their preliminary adoption stage and to provide insight into

the elements that may explain initial inertia or resistance to acceptance of the innovation by the pool of potential adopters.

This paper reports the results of our assessment. Specifically, we investigate the extent to which perceptions of the attributes or characteristics of an innovation, as identified in DOI theory, explain students' self-reported intentions to use WEBLEARN in the future as a learning supplement and complement to traditional teaching and learning methods. If student perceptions of the DOI attributes or characteristics have significant explanatory power with respect to students' intentions, this will provide direction for future improvements of the WEBLEARN innovation.

## Theory Development

### Theory of Innovation Literature

Over the last two decades, considerable research has been conducted, in a variety of contexts, into individuals' adoption of new technology (e.g. Bradley, 1997; Davis, 1989, 1993; Moore & Benbasat, 1991; Taylor & Todd, 1995; Warshaw & Davis, 1985; Venkatesh, 1999; Venkatesh & Davis, 1996; Venkatesh & Morris, 2000; Venkatesh et al., 2003). Many of these studies focus on the manner in which potential users' perceptions of the new technologies influence its subsequent adoption (Moore & Benbasat, 1991).

Much of the research in this field draws on Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA). TRA posits that an individual's behaviour is a function of both the individual's attitude toward a specific behaviour and the social influences and norms surrounding that behaviour. Consistent with TRA, Rogers' (1995) DOI theory acknowledges an individual's attitude towards particular characteristics of an innovation as one of the major factors influencing the innovation's rate of adoption. Rogers defines rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" (1995, p. 250). DOI theory posits that the rate of adoption of an innovation is influenced by the following sets of factors: (1) the individual's perception of the attributes of the innovation; (2) the nature of the communication channels diffusing the innovation; (3) the nature of the social system; and (4) the extent of change agents' efforts in diffusing the innovation. In this study we investigate the first set of factors and control for the other three by drawing our sample of respondents from the same social system, an undergraduate accounting unit in a university setting.

Rogers (1995) defines five attributes or characteristics of innovations that influence an individual's attitude towards an innovation during the adoption process. *Relative advantage* is the degree to

which an innovation is perceived as better than the idea or practice it supersedes. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. *Complexity* is the degree to which an innovation is perceived as difficult to understand and use. *Trialability* is the degree to which an innovation may be experimented with on a limited basis. *Observability* is the degree to which the results of an innovation are observable to others.

Drawing directly on DOI theory and TRA, Moore and Benbasat (1991) developed an instrument to measure individuals' perceptions of these attributes as they pertain to a particular information and communication technology (ICT) innovation. They renamed Rogers' 'complexity' construct *ease of use*, consistent with Davis (1989) as the dominant measurement paradigm in ICT research. Moreover, during the process of developing the instrument, Moore and Benbasat (1991) found that the observability attribute separated into two factors: result demonstrability and visibility. Result demonstrability "concentrated on the tangibility of the results of using the innovation, including their observability and communicability" (1991, p. 203). Visibility, on the other hand, focused on the physical presence of the innovation in the organisational setting.

Rogers' (1995) commended the Moore and Benbasat instrument as a valuable tool for research in the spread of technology innovations. He further noted that the use of consistent instruments or measures of innovation attributes across various settings will provide a significant contribution to innovation diffusion research. Rogers discussed the importance of utilising this approach in a variety of contexts and pointed out that although much effort has been spent in examining people-related differences in innovativeness, relatively little effort has been devoted to studying the manner in which the attributes of innovations affect their rate of adoption. Therefore, in this study we seek to investigate the relations between attributes of an ICT innovation and students' perceptions about future or extended use of the innovation in a teaching and learning context.

Research into the adoption of innovations is concerned with individuals' behaviour during the innovation diffusion process, as opposed to diffusion research per se, which focuses on the social system as a whole. Consequently, adoption can be viewed as a subset of the spread process, but one that takes place at the individual level rather than at the social group level. Of relevance to the present investigation is that Moore and Benbasat (1991) designed their instrument specifically to capture user perceptions about using the innovation, which differs from Rogers' (1995) DOI theory that focuses on user perceptions of the

innovation itself. According to Moore and Benbasat, "it is not the potential adopters' perceptions of the innovation itself, but rather their perceptions of using the innovation that are key to whether the innovation diffuses" (p. 196). This is because attitudes of individuals towards an object can frequently differ from their attitudes regarding particular behaviour. Hence, when considering potential adoption of an innovation, the central focus is not on the innovation itself but on what the potential adopter thinks about the use of that innovation. Thus, in the present study we are not concerned with students' perceptions regarding the primary characteristics of the ICT innovation but instead focus on students' perceptions of *using* the innovation as a complementary learning tool.

### **The Web as an Innovation in Accounting Education**

The profound impact that ICT can have on student learning has been discussed in various literature domains. Pugalee and Robinson (1998) suggest that, in general, technology applications have been found to improve students' motivation to learn and to expand their self-confidence. With specific reference to the Web, they suggest that the Internet can provide students with a learning environment that is compatible with the way they prefer to learn. Likewise, Leidner and Jarvenpaa (1995) argue that long-term student interaction with the Web will result in: greater student control over the pace and content of learning; greater focus on knowledge creation as the purpose of instruction; a long-term impact on self variables including motivation, interest, and self-efficacy; a move towards conceptual learning as opposed to merely factual/procedural learning; and cognitive impacts leading to greater development of higher-order thinking. Pugalee and Robinson (1998) state that students are increasingly adept and comfortable with technology; it is imperative, therefore, that educators capitalise on knowledge about students' preferences. Such knowledge can stem from measuring student perceptions regarding particular attributes of an ICT innovation, as defined by Rogers (1995) and Moore and Benbasat (1991).

Specifically within the scope of accounting education, McCourt Larres and Radcliffe (2000) monitored student perceptions regarding the effectiveness of utilising ICT as a learning tool, with specific focus on taxation. They argued that the taxation software was to be used as a supplement to traditional lectures and tutorials in order to generate more enthusiasm for the subject and to promote greater student-centred study (p. 245). The findings indicate that the students perceived ICT as an effective learning tool, and their enthusiasm, along with the frequency with which they utilised it, suggests that it is a valuable

teaching resource. Furthermore, McCourt Larres and Radcliffe contended that adoption of ICT would promote students' understanding of practical aspects by facilitating repetition of practical examples in an interactive environment and would thus increase their propensity for autonomous study. This is particularly relevant to the present study, as we are attempting to facilitate independent learning in order to combat various factors, such as ever-increasing classroom sizes and overstretched teaching staff, that place a strain on the depth of understanding and learning that can be achieved in the traditional classroom environment.

The ICT innovation that is the focus of this study is an online interactive computer-assisted learning module called WEBLEARN, which we developed in conjunction with a commercial e-learning company as well as specialist instructional designers. It was decided that the topic of cash flow statement preparation in the first-year accounting course was the one in which students were most likely to benefit from supplementary online interactive instructional materials. The rationale for this choice was that the preparation of cash flow statements involves the use of a number of technical skills, and it is significant in terms of course hours devoted to it as well as its final assessment weighting. Furthermore, the topic of cash flows is generally considered fairly difficult from the student perspective.

Based on prior discussion with reference to Holt et al. (1995) and their recommended characteristics of computer-assisted learning software, WEBLEARN was designed with the following aims in mind: (1) to create improved student understanding of the content through more student-centred learning; (2) to generate higher-order discussions in tutorial workshops rather than focusing on basic technical skills, which would have been mainly supported by the module; and (3) to increase student enthusiasm and motivation towards learning due to the flexibility of the program, the immediacy of the feedback, the increased variety of problems, and the enhanced graphics used to represent these problems on Web pages.

Based on these aims, the software was developed to provide students with over 20 examples of fully worked questions ranging in level of difficulty from relatively easy to very difficult. It is logistically impossible for tutors and lecturers to provide so many examples in a face-to-face context. It would be particularly valuable in large classes, where it is often difficult to provide much individual attention. The software gives the students the opportunity to try the example and receive immediate feedback as they progress, without needing to change their location. Furthermore, it then allows tutorial time to be spent on discussion of the underlying concepts of the topic and any problems students had encountered during the

completion of the exercises, as opposed to working on the exercises from scratch. This structure would be difficult to emulate using hard-copy formats for revision.

WEBLEARN is a good candidate for Rogers' (1995) DOI analysis, and thus the Moore and Benbasat (1991) instrument for measuring the students' perceptions about utilising WEBLEARN, because it conforms to the definition of an ICT innovation. Rogers defines an innovation as "an idea, practice, or object that is perceived as new by an individual" (1995, p. 11). He points out that newness is not an objective measure based on time elapsed since the innovation's first use or discovery. Rather, it is a subjective perception: If the idea, practice, or object is new to the individual, it is an innovation. The very reason for developing the custom-made WEBLEARN module stemmed from the lack of equivalent computer-assisted packages on the market that would be suitable in the accounting teaching and learning context. Indeed, two online packages were available; one involved multiple choice question banks for students to practise, and the other involved note summaries of chapters from the various textbooks. Neither of these was recognised as exhibiting the characteristics that were necessary to support our instructional requirements for the quantitative problems involved in the topic of cash flows. Therefore, since the module could not be emulated at the time, WEBLEARN would be perceived as a new computer-assisted learning and teaching tool by individuals in the accounting education sphere.

Even though numerous scholars have advocated the benefits of ICT in education, there appears to be little research focusing on the effectiveness of ICT adoption in a practical domain or on student perceptions of these computer-assisted learning tools. Hence, the aim of this study is to provide additional insight into this area of research by monitoring student perceptions with respect to the use of ICT in accounting education.

### **Development of the Hypothesis**

Our research proposition emerges from the preceding discussion. Specifically, we propose that one or more of the ICT adoption attributes (relative advantage, compatibility, ease of use, result demonstrability, visibility, and trialability) based on Rogers' (1995) DOI theory and measured by the Moore and Benbasat (1991) instrument will have significant explanatory power with respect to future intended use of WEBLEARN for learning purposes.

We restrict our focus to the attributes relative advantage, compatibility, ease of use, and result demonstrability because pilot studies and prior discussions with students revealed that the attributes visibility and trialability were not relevant for students

in the present context due to the WEBLEARN exercise being a compulsory component of student learning in the unit. As far as visibility is concerned, the students were made aware of the innovation in lectures, and thus it was thought inappropriate to test the visible pervasiveness of the innovation within the classroom context. The task was made compulsory, and thus it would have been evident to all the students. Furthermore, the students were not given the option of trialling the WEBLEARN module at their discretion, again due to its compulsory nature, thus making examination of trialability irrelevant in the present setting. However, it was believed that the relative advantage, compatibility, ease of use, and result demonstrability factors would be important in predicting the future 'voluntary' use of WEBLEARN if extended to other topics in the unit. Therefore, given the above reasoning for the exclusion of certain factors, the hypothesis tested in this study is posited as follows:

Hypothesis 1: The innovation attributes of relative advantage, compatibility, ease of use, and result demonstrability will be associated with students' intentions for future use of WEBLEARN for learning purposes.

### Procedures

Data were gathered from an anonymous survey questionnaire administered to students in an undergraduate accounting unit at a major university in Sydney, Australia, at the end of the first semester 2003 (July 2003). The students had used WEBLEARN for learning purposes in that unit during the semester. The questionnaire was administered at the commencement of the final lecture in the unit. One of the authors was available throughout the process. The total number of students in attendance on the day of survey administration was 485. All those present completed the questionnaire, and all questionnaires were useable. Completed surveys were placed in large envelopes provided and sealed by student volunteers. One of the authors then collected the envelopes and subsequently reconciled the number of questionnaires issued with those collected. This procedure provided an acceptable sample size, ensured participant anonymity, and eliminated concerns relating to non-response bias.

Demographic data for age, gender, and self-assessed level of information technology (IT) competence were also gathered in the questionnaire. The data revealed a slight majority of female (53%) to male (47%) students. As to be expected in an undergraduate unit, the vast majority of the students (93%) were in the age bracket of 18-24 years. In terms of self-assessed competence level with respect to general use of IT, 14% of the students rated their IT

competence as 'less than average,' 45% as 'average,' and 41% as 'better than average.'

The short form of the Moore and Benbasat (1991) instrument, with minor modifications, was used to obtain multi-item measures of student perceptions for each of the four attributes of WEBLEARN expected to explain intentions for future use. This instrument has been used extensively in past research studies, demonstrating reliability and validity in a range of contexts (Bradley, 1997). However, following pilot surveys and discussions with students, minor changes were made to the instrument. The *ease of use* and *result demonstrability* scales were reduced from 4 to 3 items and from 4 to 2 items respectively to reduce repetitiveness and improve their relevance to Web use in the teaching and learning context. The redundancy of some of these items became apparent during the pilot testing of this study, and the change was also based upon student feedback. No modifications were made to the short form items measuring *relative advantage* (5 items) and *compatibility* (3 items). All 13 items (shown in Appendix A) were measured on a seven-point Likert scale with polar anchors 'strongly agree' and 'strongly disagree.' The 13 items were then factor analysed (Comry, 1973) using Principal Components Analysis with Varimax Rotation to test for unidimensionality of the variables. All items loaded onto the four expected factors.

These 13 questions were followed by three open-ended questions (shown in Appendix B) seeking more detailed feedback about various elements of WEBLEARN. Consistent with prior research using the Moore and Benbasat (1991) instrument, a single-item scale was used to measure *intention to use WEBLEARN if offered in (extended to) other topics in this accounting unit* (WEBEXTEND), the dependent variable in this study. This questionnaire item was measured on a seven-point Likert scale with polar anchors 'strongly agree' and 'strongly disagree.'

Descriptive statistics for the five variables are provided in Table 1.

Table 1  
Descriptive Statistics

Variable	Min	Max*	Mean	SD
Intention to use WEBLEARN	1.00	7.00	4.74	1.53
Relative advantage	1.00	7.00	4.68	1.23
Compatibility	1.00	7.00	4.55	1.20
Ease of use	1.00	7.00	5.06	1.20
Result demonstrability	1.00	7.00	4.52	1.46

N = 485

\* Both minima and maxima are equal to the theoretical range

Cronbach’s (1951) alpha was used to assess the internal consistency reliability of each of the scales. These are summarised in Table 2, which also contains the alpha values obtained by Moore and Benbasat (1991). Table 2 shows that all alpha coefficient values are acceptable and are similar to those obtained by Moore and Benbasat (1991). These results indicate that although modifications were made, all scales displayed similarly acceptable results for internal consistency reliability to the original form of the instrument.

Table 2  
Internal Consistency Reliability of the Scales

Scale	M & B 1991		This Study	
	Items	Alpha	Items	Alpha
Relative advantage	5	.90	5	.92
Compatability	3	.86	3	.83
Ease of use	4	.84	3	.83
Result demonstrability	4	.79	2	.84

\* Moore & Benbasat (1991)

### Analysis and Results

#### Quantitative Findings

To test our research proposition, a multiple regression model was developed, regressing the four ICT adoption attributes as independent variables on the dependent variable *intention to use WEBLEARN if offered (extended) for other topics (WEBEXTEND)*. Various tests were conducted to check the regression assumptions of normality, linearity, and homoscedasticity of residuals (Tabachnick & Fidell, 2001). The tests revealed no serious violations of the regression assumptions. The results of the regression analyses are summarised in Table 3. Our interpretation of these results follows thereafter.

The full (four-attribute) model regression equation was statistically significant ( $p = .000$ ) and explained approximately 37% of the variation in WEBEXTEND (Adjusted  $R^2 = .367$ ). The relative advantage, compatibility, ease of use, and results demonstrability attributes were all positively related to WEBEXTEND and statistically significant with  $p$ -values of .000, .008, .002, and .027 respectively.

Overall, these results demonstrate that the relative advantage, compatibility, ease of use, and results demonstrability attributes were all important in explaining students’ intention to extend their use of WEBLEARN for learning purposes if the module was extended to other topics in their program of study. Since all four variables are measured in the same units (i.e., seven-point response scale), the relative advantage variable had the most influence and the results demonstrability variable the least influence when controlled for other variables in the model. The

variables in the model can explain 36.7% variance relating to students’ intention to extend their use of WEBLEARN for learning purposes if the module was extended to other topics in their program of study.

Table 3  
Results of regression of ICT adoption variables on intention to use WEBLEARN if offered (extended) for other topics (WEBEXTEND)

Variables	Four- attribute model			
	Beta	SE	t	p-value
Constant	.244	0.287	.85	.394
Relative advantage	.500	0.073	6.85	.000
Compatibility	.184	0.069	2.68	.008
Ease of use	.183	0.059	3.10	.002
Result demonstrability	.088	0.040	2.22	.027

$R^2 = 37.2\%$ , Adjusted  $R^2 = 36.7\%$ ,  $F_4 = 71.02$ ,  $p = 0.000$

#### Qualitative Findings

The qualitative responses to the questionnaire were analysed by the four independent variables examined in the quantitative analysis. This allows us to provide cohesive evidence relating to each variable and gain insights into the relative importance of qualitative attributes surveyed in the questionnaire. They are outlined as follows.

#### Relative Advantage

The qualitative data indicate mixed feelings regarding the feedback component of WEBLEARN for cash flows. Although most students appreciated the feedback, it seems there was great potential for improvement in this aspect of the software. Many student comments relating to the relative advantage factor were about effectiveness in learning (Item 4 in the survey questionnaire). The majority of student responses were highly positive, as shown by comments such as:

Student comment	Item #
The feedback is very detailed and easy to understand.	2
I always check it even when I got it right.	4
The feedback is quite helpful and I did check the feedback even when right.	4
I always checked feedback. Feedback was excellent, never made the same mistake twice.	4
Very useful feedback.	4

However, other students were more critical about the usefulness of the feedback function, as illustrated by the following comments:

Student comment	Item #
Some features were good, some not so good. If right I don't check, some simply state 'you are wrong', not why you are wrong, which can get frustrating.	4
I didn't check the feedback.	4
It's quite good but could be better if you add more explanation.	4
Please give reasons for correct answers as well.	4

The students identified WEBLEARN as having certain features which surpassed those of the required text, as represented by the following excerpts:

Student comment	Item #
Provides better method of learning than the problems in the textbook. Those problems come without feedback, unlike WEBLEARN!	4
There are not enough questions and answers in the book.	4
There are solutions provided in the Web, which tell me where my mistakes are.	4

The feelings of frustration observed with the feedback function in the second category of responses indicate negative perceptions about the relative advantage of the feedback function when using WEBLEARN. To cater for the different learning requirements of our students, it seems at this stage that the feedback function needs to be improved. As suggested earlier, the aim of this module is to allow students to practise many different types of question without the assistance of our already overstretched teaching staff. As such, to improve the relative advantage of the feedback function, we will need to expand it further by providing detailed feedback for all the questions rather than for particular aspects of the questions. This process will assist in addressing the concerns of students in the second set of responses above, particularly in addressing the issue of where their mistakes originated. However, the positive observations by the majority of the students indicate that they perceived WEBLEARN as possessing certain aspects that are better than the traditional mode of independent learning, that being primarily the completion of assigned problems from the set textbook.

### Compatibility

The computer-assisted learning format was thought to be compatible with the cash flows topic because it required a highly quantitative, procedural, and

systematic style of learning. The topic requires much practice on the part of students, but it also requires a great deal of detailed and targeted feedback because the thought processes are not necessarily linear. These features of the cash flows topic are not unique to cash flows in our course. Several other topics display similar characteristics and would thus be compatible with the WEBLEARN format. Due to our limited resources, however, the preparation of cash flow statements was targeted in the pilot phase due to its relative difficulty and importance.

Students' comments indicated that DOI relating to the compatibility factor were made up of several attributes surveyed in the questionnaire comprising the compatibility factor. One category of student responses indicated that WEBLEARN was compatible with cash flows and other 'practical' or quantitative topics with similar characteristics, as shown by the following comments:

Student comment	Item #
It may help overall understanding. Due to the high level of practical work in cash flows, very good for this topic. Not as good for other theoretical topics.	6
I think it should be useful if you introduce the program for perpetual and periodic inventory exercises.	7
It is quite useful for practising the steps of cash flows. It helps develop the knowledge for beginners of cash flows.	8
I think the topic of accounts receivable should be on the Web as well.	7
Other topics that could be given on the Web are non-current assets and inventory.	7
More topics, including depreciation and inventories.	7
Other topics such as inventory which are practical rather than theory-based should be introduced.	7
It shows constant progress and tutorials can be used to assist students in understanding topics more.	6

The responses above indicate that WEBLEARN is compatible with the way these students like to learn practical topics. The other topics that the students suggested by name include accounts receivable, depreciation of non-current assets, and perpetual and periodic inventory. All these topics have significant 'practical' components similar to those of cash flows. Another interesting finding that emerged from this analysis is that the WEBLEARN format appears to offer better compatibility with the tutorial component of these topics than the set textbook. The last

comment suggested that WEBLEARN exercises would facilitate greater independent study by students and hence allow tutorial time to be utilized in a more productive manner. This could encourage deep learning of the topics and their underlying concepts. Notwithstanding the positive responses from the majority of students, the following student response also questions the compatibility of the WEBLEARN format for our more advanced students:

Student comment	Item #
Random generator seemed to create numbers in the same ratio. It gets boring! Please vary also between profit and loss.	8

This student seemed to have found patterns in the generation of numbers for additional questions. The process of random number generation occurs after a student has completed every question once. This student obviously required a greater challenge than the one provided by WEBLEARN, which is an issue that will affect several of our advanced students, rendering the current format incompatible with their learning needs.

In summary, the responses in this section suggest that WEBLEARN, when used for practically oriented topics such as cash flows, is compatible with the learning requirements for the majority of the students in our sample. The findings in this section suggest that we should focus on providing additional modules for the other practical topics. However, while advanced students will generally adopt learning innovations, we need to ensure that the module provides challenging and stimulating extensions in order to maintain their interest.

**Ease of use**

Although one student suggested that manoeuvrability around the program could be improved, the majority found WEBLEARN easy to use. Success of the program with regard to the ease of use characteristic can mainly be attributed to the effective communication between the content experts and the instructional designers and programmers.

**Result Demonstrability**

Students' comments indicated that students favoured the results demonstrability factor mainly due to the apparent benefit WEBLEARN provided for their learning (Item 13 in the survey questionnaire). The students indicated that WEBLEARN assisted them in problem solving and pointed them in the direction of where they were making their mistakes. Thus they understood the advantages of having this particular

learning tool and were capable of articulating these benefits to others, as the following comments illustrate:

Student comment	Item #
Explanations enhanced my understanding of cash flows. Very helpful.	13
It explains where I went wrong.	13
The Web exercises allow me to see mistakes, and then repeat the problem, so I get better at understanding cash flows each time I do the question.	13

**Future Use**

The analysis and discussion of our findings, notwithstanding areas identified for further improvement, portray positive student perceptions regarding the attributes of relative advantage, compatibility, and ease of using WEBLEARN as a learning resource for cash flows and other practical topics. Student responses regarding their intended future use of the module support the plausibility of the DOI framework as a valid form of evaluating the potential spread of e-learning innovations. Furthermore, the findings indicate that positive student perceptions regarding the attributes of innovations translated into positive intentions regarding future use of WEBLEARN. When asked whether they intended to use the program in the future, all but one of the students indicated that they: *will use WEBLEARN for revision purposes; would use it in other accounting subjects; would have used it in other topics in the introductory accounting course; and, overall were satisfied with using WEBLEARN.* These responses suggest that the spread of WEBLEARN would more than likely occur fairly rapidly and that our early efforts in addressing the factors of relative advantage, compatibility, result demonstrability, and ease of use were successful in this sample of initial users.

**Conclusions and Future Research**

In evaluating the effectiveness of WEBLEARN as a learning tool for the topic of cash flows, we utilized the theoretical framework developed by Rogers (1995). The DOI theory was applied to determine whether the students would be willing to adopt this ICT innovation in the future to supplement traditional teaching methods. The evaluation focused on student perceptions relating to the attributes of WEBLEARN as an innovation in their learning environment. As hypothesised, our empirical results show that DOI theory, as operationalised in this study, was successful in predicting the students' intention to use WEBLEARN for learning purposes.

We found that students who used WEBLEARN formed favourable perceptions regarding its relative



advantage over other learning resources such as the prescribed text exercises, in particular as an effective platform to learn. Students attributed the compatibility of the resource in the context of the cash flows topic to a multitude of reasons such as: being how they like to learn, and being compatible with their learning style and with all aspects of their learning. Students also commented favourably on the ease of using the program independently. There was positive result demonstrability, as students clearly identified the benefits that they gained from using the WEBLEARN tool. Consistent with the DOI theoretical framework, these adopter students also provided encouraging responses regarding their intended future use of WEBLEARN and their overall level of satisfaction with the program. The findings of this study are consistent with those of Pugalee and Robinson (1998) and Leidner and Jarvenpaa (1995), who commented that interaction with the Web, and in this study with WEBLEARN, results in greater student control over their pace and content of learning, and is the way students like to learn.

The qualitative results have provided us with greater insight into each of these attributes pertinent to the use of WEBLEARN from the students' perspectives. The issues identified when evaluating the responses from the student sample include: the need to expand the level of detail and scope of the feedback function; the opportunity to expand the number of topics offered in WEBLEARN format, while limiting the use of WEBLEARN to topics with a high focus on practical skills development; the need to integrate more challenging components for advanced students; and the need to form a focus group committee which will include student representatives to formally evaluate the format and layout of the various components in WEBLEARN.

The findings of this study indicate that unit conveners seeking to introduce e-learning modules can apply DOI theory and specifically consider students' perceptions regarding certain attributes associated with these modules. Unit conveners could also utilise the Moore and Benbasat (1991) instrument to assess and monitor students' perceptions of already introduced exercises, with a view to fine-tuning the learning module to ensure that it is compatible with student needs. Understanding what students perceive as important characteristics of a new learning tool is important in order to ensure that it will actually be adopted by them in a manner that supplements or perhaps even replaces traditional modes of teaching, such as practical exercises in set textbooks. Also, it is important to ensure that its introduction leads to more independent learning, which would facilitate better discussion during class time rather than focusing on reiterating the basic technical aspects of the topic.

This study investigated the spread of a Web-based learning tool from the perspective of students. Future research employing the same methodology could also investigate other applications of technology in educational settings, such as the perceptions of teachers regarding the use of a particular e-learning tool. As the model in this study explains the 36.7% of the variance to extend the use of WEBLEARN to other topics, the same model can be examined with additional variables that can increase the model predictability. There could be further investigation into the flow-on effects in tutorials of utilizing an ICT learning tool such as WEBLEARN. For instance, does the use of such a tool encourage students then to focus on achieving more in-depth understanding of the underlying concepts related to the topic during class time, instead of spending most of the time focusing on the basic technical aspects? Finally, studies incorporating a longitudinal design may provide deeper insight into the complex underlying interactions involved during the e-learning spread process.

In summary, the theoretical framework utilised in this study provides a rich and potentially fruitful area for further research and has practical implications for teachers, educational administrators, and vendors concerned with the spread of e-learning in traditional educational institutions.

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Appendix A  
Moore and Benbasat (1991) Instrument

*Relative Advantage*

1. Using the Online Electronic Program enabled me to accomplish tasks more efficiently.
2. Using the Online Electronic Program improved the quality of my learning.
3. Using the Online Electronic Program made it easier to learn.
4. Using the Online Electronic Program enhanced the effectiveness of my learning.
5. Using the Online Electronic Program gave me greater control over my learning.

*Compatibility*

6. Using the Online Electronic Program was compatible with all aspects of my learning.
7. I think that using the Online Electronic Program fits well with the way I like to learn.
8. Using the Online Electronic Program fits well with my learning style.

*Ease of Use*

9. My interaction with the Online Electronic Program was clear and understandable.
10. I believe that it is easy to get the program to do what I wanted it to do.
11. Overall, I believe that the Online Electronic Program was easy to use.

*Result Demonstrability*

12. I would have no difficulty telling others about the results of using the electronic program.
13. The results of using the Online Electronic Program are apparent to me.

**Appendix B – Additional questions**

Q1. Do you think that an online assessment task is a good means of adding to your assessment criteria? Why or why not?

Q2. When you used the online exercises, how useful was the feedback when you got the wrong answer? Did you want feedback when you got the question right?

Q3. Any other comments?