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Exploring the Use of Computer Based Exams for Undergraduate Accounting

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Abstract

This paper explores the use of computer-based exams (CBEs) for undergraduate accounting. The primary objective of writing this paper was to establish whether CBEs should be integrated with paper-based exams as a summative assessment in undergraduate accounting modules. Professional accounting organisations and universities and colleges in Ireland were contacted to establish whether CBEs had been adopted and, if so, to take relevant lessons from their experience. The literature reviewed the experiences of students, academics, institutions and professional accounting organisations using CBEs worldwide. Findings from this desk-based research indicated an overall positive experience with CBEs. The professional accounting organisations are continuing to adopt CBEs as a method of assessment, with one professional accounting organisation adopting CBEs for examinations across their entire syllabus. In contrast, four of nine third level institutions in Ireland use CBEs. CBEs are not unique to professional accounting organisations. The adoption of CBEs in undergraduate accounting is an area that needs further exploration. This will help determine best practice to facilitate students who wish to pursue a career in accountancy, and support completion of the professional accounting exams. An area for further research is to interview academics to hear their reasons for not adopting CBEs, and to survey the student experience of CBEs for post-undergraduate and post-professional accounting.

Keywords: accounting, assessment, computer-based exams (CBE), exams, higher education, undergraduate

Introduction

Today the accounting profession and the world of business are dynamic and changing environments (Specht & Sandlin, 2006) and the way the world does business is changing too (Chartered Institute of Management Accountants, 2016).

In 1997, the Institute of Management Accountants (IMA) Certified Management Accountant examination programme became computerised after being offered for 25 years as a traditional paper-and-pencil exam. Since then, the use of computer based exams is an increasingly prominent strategic objective for many accountancy organisations: they promise the possibility of an efficient and effective method of assessment. This paper considers research from a range of international professional accounting organisations, mainly the American Institute of Certified Public Accountants (AICPA), the Association of Chartered Certified Accountants (ACCA), as well as university and college publications and feedback from third level institutions in Ireland.

The adoption of CBEs in undergraduate accounting is an area that needs further exploration in order to determine what is best practice to facilitate students who wish to pursue a career in accountancy and intend to complete the professional accounting exams. The CBEs desk-based research commenced with a review of the professional accounting organisations. This was followed by contacting colleagues in my school and college and other third level institutions in Ireland, with a view to establishing whether CBEs have been adopted and, if so, to take on board relevant lessons from

their experience. Integral to this research was the need to establish if CBEs are unique to the professional accounting organisation. The primary objective of the study was to establish whether a decision should be taken to integrate CBEs with paper-based exams as a summative assessment in my own accounting modules. We are living in a fast-paced digital era. With the launch of CBEs in the field of accounting I wanted to explore the use of CBEs further in higher education and also within the professional accounting organisations. I am an accounting and business lecturer in higher education for four years and this research is my first in the accounting field. The literature review procedure for this paper involved examining existing evidence from the literature, identifying keywords relevant to CBEs for identifying and prioritising journals and other published sources relevant to CBEs, a review of the research and findings, and in turn identifying gaps in the knowledge available.

I present first the literature review on CBEs from the point of view of students, academics, third-level institutions, and professional accounting organisations. This review explored primary and secondary sources on the use of CBEs in the discipline.

Context and Rationale

Moving to academia from a career as an accountant in industry four years ago, I saw several changes since completion of my own professional accounting exams. Among the changes I found were the use of technology for lecture notes and assessment, however, the paper-based exam was still commonplace, which is no longer the case for some professional accounting exams. After completing a Postgraduate Diploma in Third Level Learning and Teaching, I became more aware of the use of technology in teaching and learning, which links with the use of efficient systems/technology in

industry to aid process improvement. My interest in researching CBEs developed after reading an article by Hatfield (2015). This article primarily focused on the flexible exam timetable available nowadays for professional accounting exams offered by the ACCA and explained that CBEs are currently offered for three introductory modules of the professional ACCA exams. However, looking forward, the ACCA plans to move five more modules to CBEs. This sparked the research question for this paper: Are computer based exams and/or assessments being used in undergraduate accounting? The first phase of research examined the literature to address this question.

Research Methodology

This study included both primary and secondary research. Secondary research involved a review of relevant literature and consideration of various reports on CBEs and computer-based tests (CBTs) in Ireland and elsewhere.

The literature review procedure for this paper involved a number of steps: developing a framework of criteria based on existing evidence for deciding which literature should be used; identifying a common set of keywords relevant to CBEs across the different types of published evidence; identifying and prioritising the range of journals and other published sources to be reviewed; conducting a review of research and findings on issues relating to CBEs and undergraduate education; identifying the gaps in current knowledge about CBEs in accountancy education.

The literature and various reports on CBEs and CBTs was researched using an institutional library database. Relevant information was obtained from various

academic journals in relation to keywords like exams, computer based exams (CBEs), assessment, test, undergraduate, higher education and accounting. Two journals which provided considerable sources of information on CBEs were the *Journal of Accounting Education* and *The CPA Journal*. Other journals reviewed included the *Academy of Educational Leadership Journal*, *Accounting and Business Magazine*, *Australasian Journal of Educational Technology*, *Computers & Education*, *Journal of Computer Assisted Learning*, *Journal of Correctional Education*, *Journal of Higher Education Theory and Practice* and *Journal of Technology, Learning, and Assessment*.

CBE formats used by the ACCA are objective test questions, objective test case questions and constructed response questions using spreadsheets and word processing tools (Figures 1 and 2).

Figure 1: Objective test questions

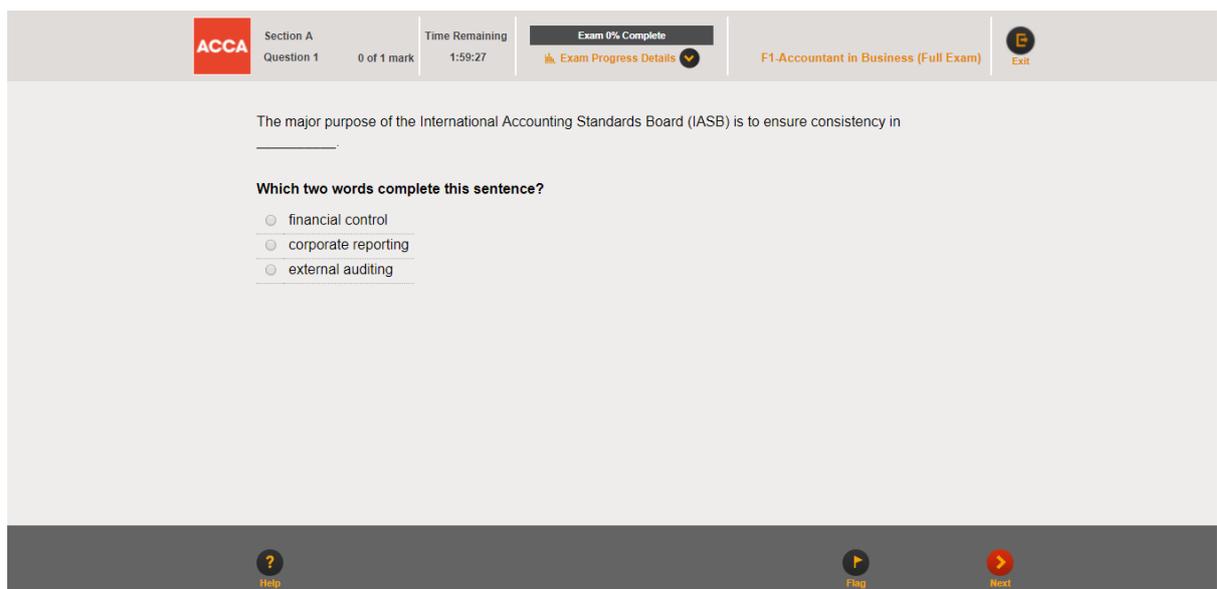


Figure 2: Objective test case questions

Section A
Question 7
0 of 2 marks
Time Remaining
1:59:09
Exam 0% Complete
Exam Progress Details
F3-Financial Accounting (Full Exam)
Exit

A company's statement of profit or loss for the year ended 31 December 20X5 showed a net profit of \$83,600. It was later found that \$18,000 paid for the purchase of a motor van had been debited to the motor expenses account. It is the company's policy to depreciate motor vans at 25% per year on the straight-line basis, with a full year's charge in the year of acquisition.

What would the net profit be after adjusting for this error?

\$

Help Flag Previous Next

The literature examined was not solely in accountancy, but across other disciplines, for example, Psychology and Medicine. The literature explored the use of CBEs from a practical point of view, specifically looking at digital literacy, such as internet and computer skills.

The primary research involved contacting (by email) the accounting lecturers in the School of Hospitality Management and Tourism in the College of Arts and Tourism, the School of Management and the School of Accounting and Finance in the College of Business, Dublin Institute of Technology (DIT), as well as eight other higher education institutions (HEIs) in Ireland, namely Cork Institute of Technology (CIT), Dublin City University (DCU), Maynooth University, National University of Ireland, Galway (NUI Galway), Trinity College Dublin (TCD), University College Cork (UCC), University College Dublin (UCD) and University of Limerick (UL). The survey instrument used was an email questionnaire. The question content included asking if the lecturers undertake accounting modules assessments/exams via CBEs and if their students intended to pursue a career in accounting. The questions were

formed from reading the literature on CBEs and from reflections on my professional practice. The responses received could be broken down into two categories - 'I use' or 'I do not use' CBEs as a method of assessment. In regard to the former category, further information on the type of assessment the CBEs are used was received i.e. continuous assessment or end of semester exams. The responses also included information on the students' intentions of pursuing a career in accounting. The accounting lecturers' response to this question was based on the undergraduate programme's name for example, Accounting or Accounting and Finance are undergraduate programmes aimed at students who wish to pursue a career in accountancy and intend to complete the professional accounting exams. In regard to undergraduate business programmes offered by some institutions, accounting is taught at some stage of the course, but the programme is not primarily an accounting undergraduate qualification. Consent was provided by the institutions that responded, which provided valuable primary data on the topic. It provided empirical data on how computer based exams and/or assessments are being used in undergraduate accounting in a selection of HEIs in Ireland (Table 1).

Table 1: Contacts with colleagues in Irish HEIs

Higher Education Institution	Number of Accounting Lecturers Contacted	Number of Accounting Lecturers Responses
College of Arts and Tourism, DIT	3	3
College of Business, DIT	10	6
CIT	1	1
DCU	11	11
Maynooth University	12	4
NUI Galway	13	2
TCD	3	3
UCC	15	3
UCD	7	5
UL	8	2

Findings: Literature Review

This review is structured into three areas: (i) the use of CBEs in the professional accounting organisations, (ii) the student and staff experience of CBEs and (iii) the professional accounting organisations research post the launch of CBEs.

How CBEs are used in professional accounting organisations

There are four professional accounting organisations in Ireland and the UK: the Association of Chartered Certified Accountants (ACCA), Chartered Institute of Management Accountants (CIMA), the Institute of Certified Public Accountants (CPA) and the Institute of Chartered Accountants (ACA). All four organisations have adopted the use of CBEs; all CIMA exams are CBEs; nine ACCA exams are CBEs; three CPA exams are CBEs; and one ACA exam is a CBE. Many of the organisations' research work is reported in the literature found.

A study of web-based assessment on student performance considers the practical element of adopting CBEs. The participants in a study by Cassady and Gridley (2005) were involved in courses that required the use of the Internet to access course information and material. Also in 2005, a CPA article by Churyk and Mantzke (2005) discussed the technology behind CBTs a year on from the launch of CBTs. An important difference between the old paper and pencil-based exam and the new CBT is the presumption that students possess basic computer skills for completion of CBTs. Deutsch, Herrmann, Frese, and Sandholzer (2012) found that early practical experience such as formative assessment, would be a helpful component of a successful implementation for computer-based assessment (CBA) in higher education. It is commonly agreed that the ability of students to understand the requirements of an

assessment is vital and is mainly influenced by the guidance provided by the tutor or lecturer (Marriott & Lau, 2008).

Computerised exams have been shown to be extremely expensive (Peterson & Reider, 2002). However, it is important to weigh up if cost is the only downside of CBEs. Churyk and Mantzke (2005) state that “as with any computer-based system, backup concerns exist with the CBT” (p. 61). The technological quirks in CBTs can be confusing unless students are aware of them in advance of the exam. Students must not only master the technical content of the exam, they must also master the exam technology (Churyk & Mantzke, 2005). Lockwood, Nally, Dowdell, McGlone and Steurer (2013) found that institutions are training staff on how to incorporate computer literacy into their curricula so students can master the necessary skills to access and take the CBEs. The strong reservations about the existence of technical problems could influence test performance and the student results in a summative assessment (Deutsch *et al.* 2012). The availability of testing resources, for example, computer labs, become stressed to meet the need for testing (Cassady & Gridley, 2005).

The type of assessment impacts on the flexibility of an exam. For example, if it is an open book exam, the assessment could be completed in the evenings and/or weekends, allowing greater flexibility for the student. As a result, the instructor would have increased instructional time (Cassady & Gridley, 2005). The majority of CBEs are scored efficiently, however, this depends on the method of delivery chosen by the instructor (Cassady & Gridley, 2005). Efficient assessment and grading

technology means that some computer-aided assessments (CAA) can provide students with immediate automated feedback (Marriott & Lau, 2008).

The student and staff experience of CBEs

Cassady and Gridley's (2005) study of *The Effects of Online Formative and Summative Assessment on Test Anxiety and Performance* does not support the contention that online assessment will induce anxiety or impact student performance levels. This survey was conducted with students on a psychology course. How students perceived CBEs was examined through an introduction to management accounting module in the US. The results showed both positive and negative perceptions for computerised testing, however, overall the results were more negative than positive (Apostolou, Blue & Daigle, 2009). A similar study conducted by Peterson and Reider (2002) examined the module *Certification in Financial Management* (CFM) issued by the Institute of Management Accountants (IMI), a US professional accountancy body. However, this study found that students perceived CBE experience as positive (2002).

A more recent study by Hewson (2012) provides evidence to support the validity of online assessment by showing that the performance of students taking an online or offline assessment does not differ depending on whether they are required to use their preferred or non-preferred mode. A comparison of computer-based and paper and pencil assessment was conducted for a supervised intermediate accounting exam, with the outcome showing that CBT provided an accurate assessment of a student's abilities (Maguire, Smith, Brallier, & Palm, 2010).

Marriott and Lau (2008) state that "the use of phased summative assessment is recognised as an important and powerful assessment practice that supports high-

quality learning and teaching” (p. 79). The study was completed with students in a financial accounting module and the focus group interview held after the assessments found that the use of computer-based, phased assessment was something that students had not experienced before. The majority of students were open to such an innovative method (Marriott & Lau, 2008).

Birch and Burnett (2009) conducted a study on encouraging institution-wide diffusion of e-learning environments for a distance learning programme moving more online. They reported on the adoption and integration of educational technologies by academics in third level as being slow. Marriott and Lau (2008) also commented on technological advancements having a dramatic impact on the delivery and assessment of higher education courses, with virtual learning environments (VLE) and computer-aided assessment (CAA) being commonplace.

A CPA article on a preliminary response to the computer-based CPA exam highlighted areas for schools to develop in order to prepare students for the professional accounting exams and for their professional careers. These areas included online research, analysis of case studies and development of written communication skills. The results of this study of deans and chairs by Specht and Sandlin (2006) revealed that some accounting programmes did change their curricula as they prepared for the first computer-based CPA exam and that public universities increased the use of case studies for the purpose of research and analysis. A similar study to the same respondents was conducted by Lopez and Specht (2009) to determine whether additional changes had been made to the curricula since the CBT. The results of the study found that schools had increased in-class use of computers across the following

areas: student research and writing assignments; the use of individual assignments that require students to perform research; the use of authoritative pronouncements, cases, and simulations; the preparation of professional writing assignments; and the use of spreadsheets and timed in-class assignments.

Peterson and Reider's (2002) survey found students who successfully completed the IMA's *Certification in Financial Management* (CFM) exam believe that computerised testing weakens the perception of the certification. This finding is perhaps explained by respondents indicating that writing skills and free-form problem solving should be included on certification exams. Bunker and Flesher (2013) conducted a study on the computer-based CPA exam, which was issued to accounting practitioners, accounting educators, graduate accounting students, and business professionals. They concluded that the switch from the paper-and-pencil exam to the computer-based CPA exam has not had a negative impact on the perceptions about the prestige of the CPA certification.

Findings from the literature review showed that a student's ability to use the internet and to possess basic computer skills was taken for granted. The literature review also found that the costs and problems incurred in set up, back up and technical issues can be considerable and that these need to be weighed up in relation to the reported benefits, which include flexibility, feedback and increased instructor time. The review also explored the affect that adoption of CBEs can have on students, particularly in relation to anxiety, performance and ability, and also on academics and the professional accounting organisation.

Professional accounting organisations research

Apostolou *et al.* (2009) reported that the adoption of CBEs by one school in the US was influenced by the professional accounting bodies. The aim was to give students some insight into the environment of computerised professional accounting exams. Prior to this, Peterson and Reider (2002) found that many students expected the faculty to prepare them for professional certification exams, and the more the faculty knew about computerised exams, the better informed students were likely to be. It is important to ask if this is the basis for integrating CBEs in undergraduate courses. Churyk and Mantzke (2005) found that CBTs assess a student's knowledge base by using multiple-choice questions. To further test a student's integrated accounting knowledge, the CBT used case-based simulations to replicate tasks students will see or have seen in practice. The simulations require students to research the relevant authoritative literature, apply appropriate analytical skills, and communicate the solution in a coherent manner.

The use of formative assessment is an essential component prior to adopting CBEs as a summative assessment (Deutsch *et al.* 2012). It is, however, important to ask whether it is practical to set up CBEs using the software and labs provided by the third level institutions or should this be outsourced to the experts to set up and use their centres to carry out the CBEs. Based on this review of the literature, it appears that the traditional pen and paper-based exams will continue to be used for end of semester exams in third level. The widespread adoption of CBEs for continuous assessment would be a major move for third level institutions. Some professional accounting organisations are early adopters of CBEs for all modules, while others are moving slowly in a staged approach towards CBEs adopting one or three modules.

Recently one professional accounting organisation adopted an additional six CBEs modules from three initially, bringing it to nine CBEs modules.

The professional accounting organisations are leaning towards the adoption of CBEs. The practical aspects of CBEs, for example, digital literacy, such as Internet familiarity and basic computer skills, are imperative if CBEs are to be adopted successfully. The costs of CBEs are significant and other factors in relation to the technical issues that arise have to be considered also. CBEs increase flexibility, instructor time and provide timely feedback, which is welcomed by all. The literature on the student experience in relation to test anxiety and performance shows no support for the view that online assessment will induce anxiety or impact performance levels (Cassady & Gridley, 2005). The student perception of CBEs was examined in two separate papers showing two different results, one showing overall negative perceptions for computerised testing (Apostolou et al. 2009) and the second study conducted by Peterson and Reider (2002) found that students perceive CBE experience as positive (2002). However, a similar study by Marriott and Lau (2008) comments that “seventy-four percent of students agreed/strongly agreed that they prefer to be assessed on-line rather than by traditional methods” (p. 83). A comparison of computer-based and paper-and-pencil assessment was conducted, the outcome showed that CBT provides an accurate assessment of a student's abilities (Maguire et al. 2010). Overall it appears the use of CBEs on students is positive and is an option that should be considered as an assessment method at third level for any module or discipline.

The literature review showed that academics' adoption of CBEs or of the integration of educational technologies in third level is slow (Birch & Burnett, 2009). Marriott and Lau (2008) comment on technological advancements having a dramatic impact on the delivery and assessment of higher education courses with virtual learning environments (VLE) and computer-aided assessment (CAA) being commonplace.

The literature from the professional accounting organisation, CPA, highlighted areas for schools to develop to prepare students for the professional accounting exams and for their professional careers. The areas included online research, analysing case studies and developing written communication skills. Some universities and accounting programmes changed their curricula as they prepared for the first computer-based CPA exam and public universities increased the use of case studies for the purpose of research and analysis (Specht & Sandlin, 2006). The adoption of CBEs by one school in the US was influenced by the professional accounting bodies. The aim was to give students some insight into the environment of computerised professional accounting exams (Apostolou et al. 2009). The negative reporting of CBEs was mainly experienced at the initial stages. Eleven years on, a survey of accounting practitioners, accounting educators, graduate accounting students, and business professionals was carried out (Bunker & Flesher, 2013). This study informed the CPA that the switch from the paper-and-pencil exam to the computer-based CPA exam has not had a negative impact on the perceptions about the prestige of the CPA certification (ibid).

The candidates who will take the assessments fall within Generation Y. This demographic group value flexibility, are IT-savvy and seek to take control of their own learning activities. In assessment terms they will value more frequent and modularised assessment which uses the

technology features to which they are used. The behaviour patterns of candidates for CIMA's Certificate in Business Accounting exams support this view. They usually take three subjects sit examinations once a month (frequency) as close to their homes or places of work as possible (convenience). (Tagoe, 2014, p.21).

Findings: Primary Research

The results from the primary research in relation to the use of CBEs in undergraduate accounting in third level institutions in Ireland were analysed using Excel and the results from the secondary research were examined from three perspectives: student, academic and professional accounting organisations.

The question posed in the email to the academics in DIT and the eight higher education institutions was in relation to the undertaking of accounting modules assessments/exams via CBEs. The speed of the responses was encouraging.

Eight third level institutions responded that they do not use CBEs for the end of semester accounting undergraduate exam, however, one accounting lecturer in CIT, two accounting lecturers in Maynooth University, one accounting lecturer in NUI Galway, one accounting lecturer in UCC and two accounting lecturers in UCD have adopted CBEs for an accounting continuous assessment in an undergraduate accounting programme. The undergraduate programme prepares students for careers in accountancy. Dublin Institute of Technology (DIT), College of Business responded that they also do not use CBEs for the end of semester accounting undergraduate exam, however, one accounting lecturer has adopted CBEs for an accounting continuous assessment in an undergraduate management programme. The undergraduate programme does not prepare students for careers in accountancy. In the College of Arts and Tourism in DIT, one accounting lecturer has adopted CBEs for an accounting continuous assessment in an undergraduate Hospitality and Tourism

programme using the software and labs in the School. The undergraduate programme is not preparing students for careers in accountancy.

This was a preliminary study to validate the findings of the literature review and establish whether they were applicable to the context of Irish higher education or not. A further study based on what has been established here is being planned.

Discussion

The findings of this study highlighted three groups on which CBEs can have an impact. The three groups are: students, academics in third level institutions, and the professional accounting organisations. The primary research findings on exploring the use of CBEs in undergraduate accounting in nine third level institutions in Ireland are informative as they show that these institutions do not use CBEs for assessing the end of semester accounting undergraduate exam.

From the secondary research on the literature in relation to students' perspective on CBEs, the outcome was positive. According to Birch and Burnett (2009), this is a useful starting point for any new or amended process in third level, however, they argue that direction on how to use e-learning environments is required. These results related not just to accounting students, but to other modules and disciplines.

The literature in relation to the academic perspective and the adoption of CBEs showed that uptake was slow and this also applies to other e-learning environments. The reasons for this slow adoption vary. One study found that there are two inhibitors, institution and individual, with some academics saying it is due to lack of leadership, lack of specialised training and the cost involved in relation to the institution inhibitors (Birch & Burnett, 2009). The individual inhibitors to the development of e-

learning formats were lack of time, increased academic workloads and no time relief provided by the institution (ibid). The findings of the primary research links closely with the literature. This finding of a slow pace of academic adoption is comparable with four of the nine third level institutions in Ireland, in relation to the adoption of CBEs for undergraduate accounting. Across the nine third level institutions in Ireland examined by this study, the vast majority of academics are not using CBEs for continuous assessment, nine academics out of forty responses are using CBEs for continuous assessment.

An area for further research is to interview some of the academics to hear their reasons for not adopting CBEs and to survey the student experience on CBEs exams for post undergraduate and post professional accounting. The barriers or obstacles shown in the literature highlighted rooms, including a situation where the demand for computer rooms may well exceed the supply or availability of testing resources. Another major barrier was rooted in back-up problems, a full backup occurs on completion of a certain amount of questions or after a period of time and this is followed by an incremental back up, saving only the changes since the full back up and technical issues encountered when using CBEs. A method to overcome such obstacles is the use of specialised software and exam centres provided by Pearson VUE, the market leader in delivering CBEs (Hatfield, 2015). In their study, Marriot and Lau (2008) reported that one academic prior to the test had hard copies of the test papers as a backup in case of technical issues arising which would prevent on-line testing.

The professional accounting organisations are continuing to move towards the use of CBEs. The ACCA intended to move five more exams to CBEs in 2016, bringing the number of CBEs offered by the ACCA to eight (Hatfield, 2015). CIMA is the first

global accountancy body to use a combination of computerised assessments to examine their syllabus. CIMA found that it reflects the wider use of technology in education and industry (Chartered Institute of Management Accountants, 2016).

Conclusions and Implications for Practice

Based on the primary research in this study, it can be concluded that CBEs for assessing the end of semester accounting undergraduate exam are not being used at third level in the surveyed colleges and universities in Ireland for preparing students for careers in accounting. Seven lecturers in five third level institution have adopted CBEs for an accounting continuous assessment in an undergraduate accounting programme. This undergraduate programme prepares students for careers in accountancy. CBEs are not unique to professional accounting organisations when one compares them to the third level institutions sampled in this study. Based on the secondary research in this study, there are three groups on which CBEs can have an impact. Of these, the students' perspective was positive, the academics' perspective indicated slow adoption and the professional accounting organisations are continuing to move towards the use of CBEs. One professional accounting organisation is the first global accountancy body to use a combination of computerised assessments to examine their syllabus. They see the move as meeting the needs of Generation Y, who value flexibility, are IT-savvy and seek to take control of their learning activities. An area for further research is to interview some of the academics to hear their reasons for not adopting CBEs and to survey the student experience on CBEs exams for post undergraduate and post professional accounting. The implications for practice are evident in particular in relation to how to implement CBEs in undergraduate

accountancy effectively at third level. The completion of a cost/benefit analysis may shed some light on any implementation concerns by seeking information from experts in the CBEs field.

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