

How do you use technology to improve flexibility in assessment and maintain high standards of validity?

The Association of Chartered Certified Accountants (ACCA) and RM Results

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Introduction

The issue of how to maintain high levels of test validity whilst moving to computer-based exams (CBE) is a constant challenge to assessment experts across the world. It is a challenge that is facing ACCA as it migrates its paper-based Fundamental level exams to a computer based format, offering students more exam opportunities throughout the year. A relatively common approach in migrating to computer based assessment is to adopt a format in which exams are objectively marked, using the range of different objective items (e.g. multiple choice questions (MCQs)) offered by the test delivery partner. This approach has the advantage of being able to move to on-demand assessment once a large enough bank of objective items has been established and also enables instant or near-instant results to be issued to the test taker. Conversely, objectively-marked items are poor at assessing higher order analytic skills (Paul and Nosich, 1993) and can be a challenge to write. In addition, test users and bodies that recognise and regulate exams generally wish to see that the exam is as authentic as possible and represents the skills that the person being tested will be expected to perform in their ‘real-life’; this is not always possible with objectively marked exams.

ACCA, therefore, wished to design a set of new format exams which would be recognised for their rigour, validity and authenticity of testing experience, whilst also offering the flexibility that students and employers require in today’s fast-moving world. This paper describes the journey that ACCA took in conjunction with its technology partners, including RM Results, in re-designing the format of its exams. It details some of the key design decisions that were taken and outlines the inherent challenges faced along the way.

About ACCA

ACCA is a global body for professional accountants. It was founded in 1904 and aims to bring long-term value to economies in which it develops and supports professional accounting accountants. It works with global bodies such as the International Federation of Accountants (IFAC) and has 71 accountancy partnerships across the world. It currently has in the region of half a million candidates per year, sitting exams in 170 different countries.

About RM Results

[RM Results](#) is a UK-based company that specialises in providing e-marking software to awarding organisations globally. The company also has expertise in processing and analysis of high volumes of educational data, project management for international education surveys (e.g. PISA and TIMMS), and the implementation of end-to-end e-assessment systems in conjunction with partners. Its e-marking solution, [RM Assessor](#), was used to mark 160 million exam pages in 2014, making it the most widely-used high stakes examination marking software in the world, trusted by some of the most prestigious names in assessment.

RM Results currently supplies e-marking software to clients administering high stakes examinations in countries including India, Poland, Slovenia, the UK and the Caribbean; as well as international bodies such as ACCA, the International Baccalaureate and Cambridge International Examinations.

The ACCA Qualification

The ACCA qualification is recognised for its rigour and is valued by accounting professionals across the world for the way in which it prepares students to enter into the world of professional accountancy. The qualification is divided into two levels: Fundamental and Professional.

FUNDAMENTALS
Knowledge
F1 Accountant in Business (AB)
F2 Management Accounting (MA)
F3 Financial Accounting (FA)
Skills
F4 Corporate and Business Law (CL)
F5 Performance Management (PM)
F6 Taxation (TX)
F7 Financial Reporting (FR)
F8 Audit and Assurance (AA)
F9 Financial Management (FM)
PROFESSIONAL
Essentials
P1 Governance, Risks and Ethics
P2 Corporate Reporting (CR)
P3 Business Analysis (BA)
Options (two to be completed)
P4 Advanced Financial Management (AFM)
P5 Advanced Performance Management (APM)
P6 Advanced Taxation (ATX)
P7 Advanced Audit and Assurance (AAA)

Fig 1. The structure of the ACCA Qualification.

Exams at the lowest level (F1-F4) are offered via computer on-demand objective tests, whilst F5-P7 exams are still offered via a paper-based delivery mode. Until September 2015 the F5-P7 exams were offered twice a year in June and December. A major feature of the F5-P7 exams is that they contain Constructed Response (CR) items which are e-marked by a team of external, expert markers.

ACCA courses are taught by independent Learning Providers across the world and exams are taken in exam centres approved and quality assured directly by ACCA.

Changes to the ACCA Qualification

Research undertaken in 2012 indicated that students and employers wanted more flexibility in being able to take their exams more frequently than twice a year and also indicated an expectation to move to a computer-based delivery format – but without losing any of the rigour that ACCA exams are recognised for.

In September 2015, ACCA F5-P7 exams moved from being offered twice a year to being offered four times a year in March, June, September and December. Further, F5-F9 will be migrated to a computer-based delivery mode from September 2016, with changes to the Professional Level exams following sometime after that. The rest of this paper describes:

- A. the challenges involved in introducing two additional exam sessions
- B. the changes being made to F5-F9 exams to enable their migration to a computer-based format and the challenges involved in making this change.

A Moving from 2 to 4 Exam Sessions per year

Perhaps the two biggest areas of challenge that ACCA experienced in moving to 4 exam sessions were IT systems development and business process change.

Changing IT systems

ACCA previously had an old technology stack which had grown over a number of years in response to specific customer and business requirements. The exams processing architecture was based on an Oracle package with each component part of the architecture being tightly integrated. This approach was deemed not to be scalable to enable exams to be processed 4 times a year and, instead, it was decided that a new Service Oriented Architecture should be implemented. This is a major, strategic change for any organisation and, for ACCA, meant bringing additional skills and experience into the organisation.

It also meant splitting ACCA's technology components into specific capabilities and linking them through an integration layer. Since ACCA's strategy is to ensure that its exams retain their rigour and validity by continuing to assess candidates using Constructed Response items marked by expert human markers, the ability to scan paper scripts and to mark them using on-screen marking technology is an essential part of the overall Service Oriented Architecture. RM Assessor, RM Results' e-marking solution, has been used successfully by ACCA for seven years. It enables ACCA to employ a robust quality model, with the flexibility to support marking anywhere in the world; it was therefore a natural choice as ACCA's chosen on-screen marking component in the overall IT architecture.

RM Results has worked with ACCA since 2009 to provide a complete on-screen marking solution, from script scanning, to the return of marks. The on-screen marking technology integrates with ACCA's own IT systems via industry standard web services that are fast, scalable and secure. This approach to sharing data requires no manual intervention and provides ACCA with the ability to make changes and updates mid-session should they require to do so.

Business process change

ACCA's previous business process was geared around two 26 week exam cycles, with candidates able to enter for an exam up to a year before the exam session date and receiving their results 9 weeks after the exam. Since candidates very often want to know their result from a previous exam session before entering for the next (e.g. if they wish to re-sit a failed exam) it was necessary to reduce the cycle from 26 to 13 weeks. This meant a root and branch review of ACCA's business processes and an analysis of where technology could be used to increase efficiency and reduce timeframes.

A major part of the end-to-end process involves script scanning and marking, and previously 7 weeks had been allowed in the administration cycle. Working with RM Results, ACCA was able to reduce this to 5 weeks, with the resulting overall process timeframe changes as shown in the diagram below.

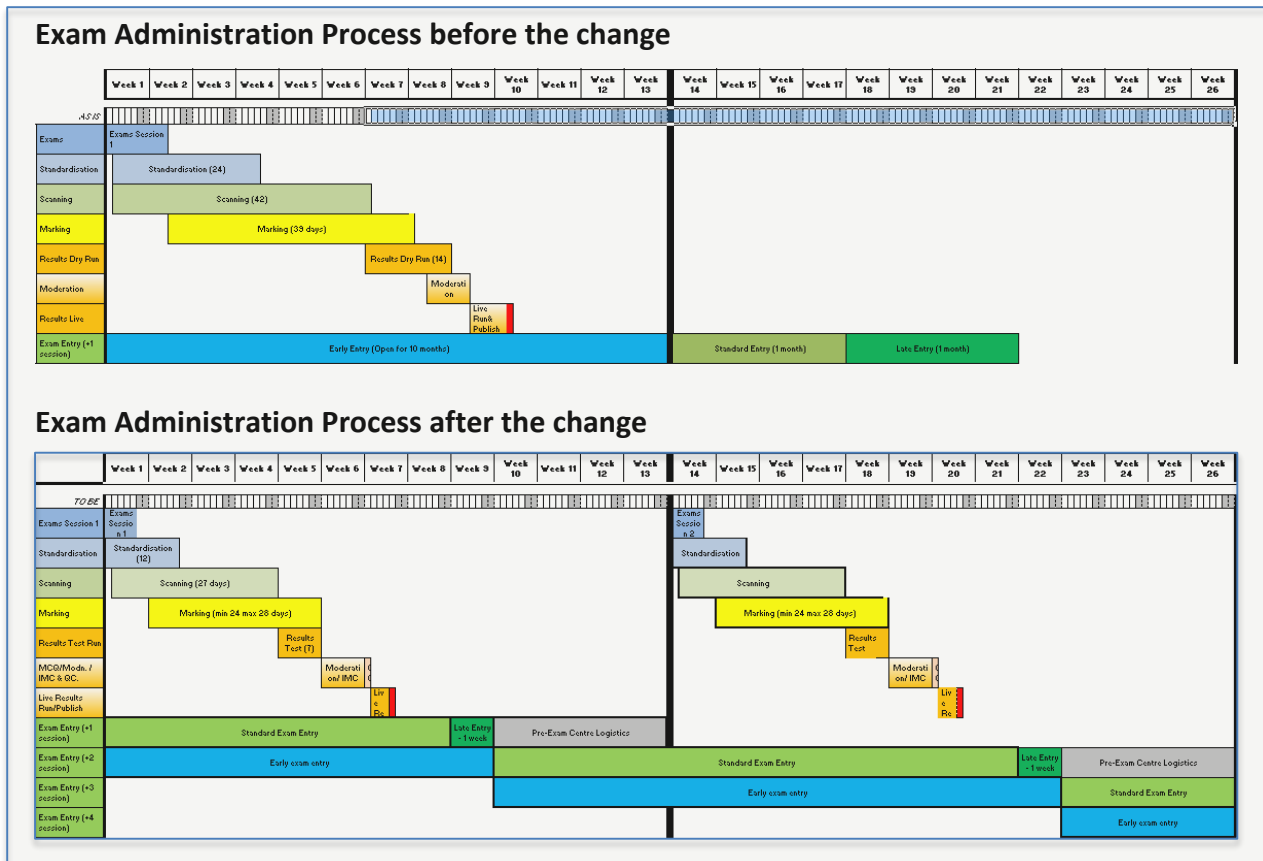


Fig. 2. Diagram to show marking process and timescales before and after the business process change.

As ACCA sets and marks exams globally, this reduction in timeframe would not have been possible without on-screen marking being embedded within the assessment life cycle.

B. Migrating the F5-F9 papers to a computer-based delivery mode

The F5-F9 paper-based exams were, until recently, typically written by a single examiner and consisted of a series of Constructed Response Questions; these could take any form and candidates were required to answer in a paper answer booklet. In December 2014, a short section containing Objective Items was introduced into each exam, paving the way for the future migration from a paper-based to a computer-based delivery format.

In 2013/14 a new CBE format was proposed and developed after lengthy stakeholder consultation, and this is being trialled throughout 2015. This new format comprises three sections:

- Section A containing Objectively Marked (OT) items;
- Section B containing Case items - a collection of items all relating to a single scenario stem; and
- Section C containing Constructed Response (CR) items.

Since the number of test taker seats (exam capacity) will be limited by comparison to paper-based exams¹, each exam will be offered more than once in each of the four exam sessions.

ACCA placed enormous emphasis on ensuring that, as the F5-F9 exams are migrated to a computer-based format, they retain the rigour and validity for which they are recognised today and, as a result, needed to address the following challenges:

- the need to define an appropriate model to ensure that test items remain adequately secure² over an exam session and between sessions where re-used - the ‘Test Security Model’;
- the need to develop new item types which reflect the real life experience of an accountant, ensuring that ACCA’s exams continue to be valid and perceived as rigorous; and
- the need to develop an appropriate psychometric model which takes into account the fact that both dichotomous and polytomous items are used to form part of the new exam design.

Test Security Model

ACCA exams are taken by candidates across the world in different time-zones. A security model was, therefore, developed which enabled a tight control on item exposure so that candidates in one part of the world cannot be advantaged by item leaks from candidates in another part who have completed the same exam earlier in the day. Different exposure rates were agreed for different item types, with the exposure rate for Constructed Response items being only a number of hours (a ‘content period’) within any one 24 hour period. This means, for example, that two candidates taking the same exam in 2 different content periods within the same day would receive items drawn from a different bank of Constructed Response items.

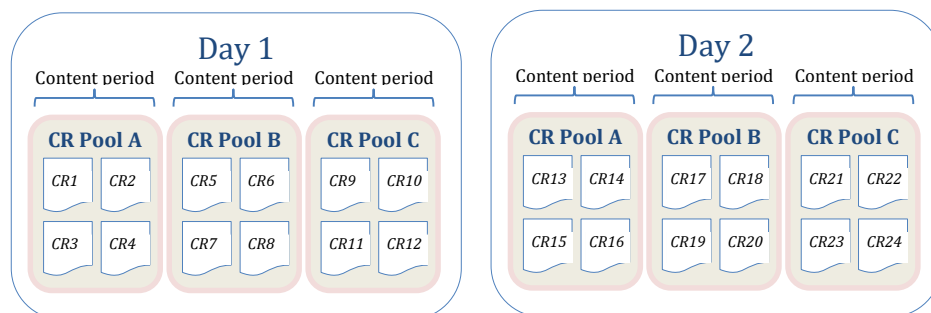


Fig. 3. Diagram to show the Test Security Model as applied to Constructed Response items.

¹ Currently, paper-based exams are sat by candidates in venues up to 5000 seats in size. Such venues sizes are not typically available for computer-based exams.

² To limit visibility so as to ensure that candidates cannot gain an unfair advantage through having seen items before.

New Valid Item Types

ACCA strives to be innovative and to ensure that a candidate's experience in the exam reflects their real life experience as an accounting professional. In other words, a key objective of ACCA's exam design decisions was to ensure the continued validity of the exams as they were migrated to CB format. In order to achieve this, it was necessary to develop some new item types not currently available from ACCA's test delivery partner. Two new item types were developed ('Spreadsheet' and 'Word with Tables') which enabled candidates to manipulate numbers and formulae within a spreadsheet environment or within tables in a word processing tool. These items are complex to the extent that they are not automatically marked but are marked on-screen by human markers using RM Assessor. This, in turn, meant developing the required integration to ensure a candidate's test responses could pass from ACCA's test delivery solution, via ACCA, and into RM Assessor, in accordance with ACCA's Service Oriented Architecture to enable the required marker standardisation and human rating exercise to apply to the new item types.

A Candidate's CBE responses, which are in both HTML and Spreadsheet format, will be viewable directly within RM Assessor, with markers able to enter marks and add comments at question item level, or against the whole question, if required to support evaluation. With the spreadsheet format answers, markers will be able to view any formatting used by the candidate, as well as being able to view calculation formula used and the calculated answer.

ACCA's global security model has also been supported. RM Assessor will be modified such that each question within an exam will be allocated to different markers with each marker only having visibility of their specific allocated questions for that session. This reduces the risk of security breaches across question types and time zones and also increases the reliability of marking, since each marker can focus on applying the mark scheme for a smaller number of items. As ACCA moves to adopt CBE and the utilisation of an item bank, this also means that marking instructions will need to be uploaded at question level and not whole paper level; again this increases both candidate and marker security.

SampleAssessment-RR - Candidate Name Time Remaining 35:58
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[Flag for Review](#)

	A	B	C	D	E
		Main Pool	Motor Car	Special Rate Pool	Allowances
		£	£	£	£
1					
2					
3	Written down value (WDV) brought forward	12,400		13,600	
4	Additions				
5	Machinery	42,300			
6	Motor car [1]	13,800			
7	Motor car [2]		14,000		
8		68,500			
9	Annual investment allowance (AIA)	-68,500			68,500
10	Disposal proceeds			-9,300	
11				4,300	

Ready

(1) Motor car [1] has a CO2 emission rate of 110 grams per kilometre.
 (2) Motor car [2] has a CO2 emission rate of 155 grams per kilometre. This motor car is used by the sales manager and 50% of the mileage is for private journeys.
 (3) All of the items included in the special rate pool at 1 April 2014 were sold for £9,300 during the year ended 31 March 2015. The original cost of these items was £16,200.

Other information
 From your files, you note that Naive Ltd has one associated company (the 100% UK subsidiary company mentioned in working 3).

Prepare a corrected version of Naive Ltd's corporation tax computation for the year ended 31 March 2015.
 Note: You should indicate by the use of zero any items in the computation of the trading profit for which no adjustment is required.

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Fig. 4 New Spreadsheet Constructed Response item type

The Psychometric Model

A common approach in adopting computer-based assessment is to ensure that all candidates receive tests of more or less equivalent difficulty and receive a fair result through the introduction of a psychometric model –typically based on either Classical Test Theory or Item Response Theory. Both of these approaches work for objectively marked, dichotomously scored items. ACCA, however, wished to ensure a continued high focus on the validity of its exams through the inclusion of Constructed Response items. These items were to be polytomously scored, which meant the need to develop a psychometric approach which would in addition, accommodate the scoring of such item types. The approach selected was to apply the Rasch model of Item Response Theory for Sections A and B (Objectively marked items) in the new F5-F9 exams and to adopt Equipercentile Equating for Section C (Constructed Response items). Overall scores are calculated by scaling each set of scores and combining onto a 100 point scale to give a final exam score.

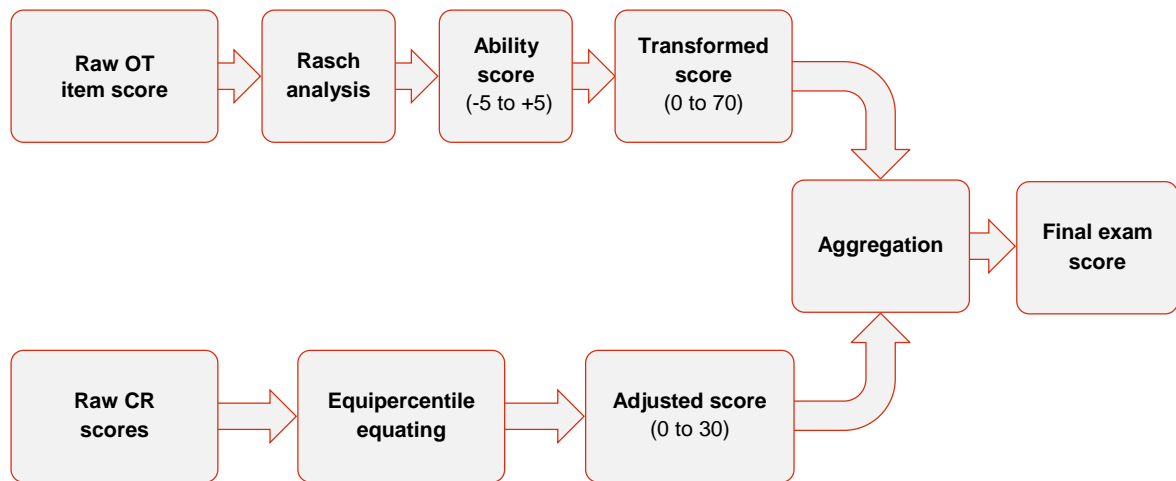


Fig. 5 Diagram summarising the approach to combining dichotomously and polytomously scored items

Summary

This paper has described the changes which ACCA is implementing in its global accounting qualification as it moves to offer more exam sessions per year and implements a computer-based approach to assessment. It has summarised the challenges ACCA has faced along the way and has described how it has worked specifically with one of its technology partners, RM Results, to overcome some of the challenges to ensure a successful implementation of the new exams and new exam delivery model. These changes will transform candidates' assessment experience whilst retaining the needs of students and employers for valid, rigorous and yet flexible accountancy examinations, fit for the 21st Century.

References

Paul, R and Nosich, G (1993) A Model for the National Assessment of Higher Order Thinking, in Paul, R (1993). *Critical Thinking: What Every Student Needs to Survive in A Rapidly Changing World*, Dillon Beach, CA: Foundation For Critical Thinking.