

Investigation into the marking of CCEA A level Chemistry Summer 2010

Stage 1 Report



September 2010

Ofqual

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Executive Summary

The Office of Qualifications and Examinations Regulation (Ofqual) was asked by the Department of Education (DE) in Northern Ireland to conduct an external investigation into the marking of A level Chemistry by the Council for the Curriculum, Examinations and Assessment (CCEA) in summer 2010 following the discovery that incorrect marks had been awarded to 935 candidates in the multiple choice section of the A2 unit 1 paper.

The terms of reference for the investigation (annex A) set out two stages for the investigation. The first stage is to: identify what went wrong, how the failure occurred, how it was discovered, how many candidates were affected and how it was communicated to relevant bodies. The second stage is a more detailed review of the processes and practices within CCEA Awarding Body. This report details Ofqual's findings in relation to stage one of the investigation.

CCEA was established on 1 April 1994 and is a non-departmental public body reporting to the Department of Education in Northern Ireland. CCEA is a unique educational body in the UK, bringing together the three areas of curriculum, examinations and assessment. As such; they advise government, monitor standards and award qualifications.

In summary, 151 students from 42¹ centres received lower grades than they should have in their A level Chemistry examinations in summer 2010. This was due to incorrect marks being issued for the A2 unit - AC212. This was caused by a processing failure in the marking of the multiple choice component (AC211) of unit AC212. The Optical Mark Reader (OMR) system used to mark the multiple choice component incorrectly held the mark scheme for the January 2010 examination series, rather than the mark scheme for the summer 2010 examination series. This meant that correct answers on candidates' OMR answer sheets were not awarded marks. Secondly, a manual check of processed OMR answer sheets was not carried out in accordance with CCEA's standard procedures. This check would have identified that the incorrect mark scheme had been used.

CCEA's response to the error once it had been discovered was swift, and the remedial measures implemented were effective. CCEA was proactive in

¹ The news release issued by CCEA on 23 August 2010 indicated that students from 41 centres had received lower grades. Manual checks conducted by CCEA after 23 August showed that actually 42 centres were affected.

communicating with the university admissions authorities in the UK and Republic of Ireland as well as centres and candidates. The commitment and professionalism demonstrated by CCEA staff in response to the error ensured that no candidates were disadvantaged.

Ofqual has identified a number of deficiencies in CCEA's existing systems and procedures as well as a range of other factors which combined to create the circumstances in which an error of this nature could occur. Ofqual has particular concerns in relation to the:

- a) fitness for purpose of the current OMR software and the high potential for operator error
- b) security of the OMR database and the lack of any audit trail function
- c) adequacy of the existing control and assurance arrangements. In particular, the arrangements and level of sign-off required for business critical processes
- d) structure and allocation of responsibilities within the part of the organisation that is responsible for processing OMR answer sheets
- e) how multiple choice components are considered during the awarding process.

This report contains recommendations which are intended to address these concerns and prevent a similar error occurring again. To ensure the public can continue to have confidence in the examinations system, Ofqual has identified a number of areas that require attention before the start of the January 2011 examination series.

Background

On 20 August 2010 the Council for the Curriculum, Examinations and Assessment (CCEA) became aware following the receipt of enquiry about results (EAR) requests that incorrect marks had been awarded in the multiple choice section of an A2 Chemistry paper. There were 1024 entries for the examination and of this, a total of 935 candidates received incorrect marks. 151 candidates from 42 centres received lower grades than they should have. A summary of the grade changes is given in the table below

Grade change	Number of Candidates
A to A*	65
B to A	58
C to B	20
D to C	4
E to D	4

On 23 August 2010 the Education Minister, Caitríona Ruane, announced that a full external investigation would be carried out to determine how the failure occurred. On 31 August 2010, the Department of Education (DE), CCEA's sponsor department, announced that it had asked the Office of Qualifications and Examinations Regulation (Ofqual) to conduct an external investigation into the failure of the CCEA marking process in relation to the 2010 summer A level Chemistry paper. Ofqual is the independent regulator of qualifications, assessments and examinations in England and of vocational qualifications in Northern Ireland.

Terms of Reference

The terms of reference set by the Department of Education require the investigation to be conducted in two stages:

- **Stage 1** – an immediate investigation to identify and record what went wrong, how the failure occurred, how it was discovered, how it was communicated to all relevant bodies and how many candidates were affected.
- **Stage 2** – informed by the findings of Stage 1, the completion of a more detailed review of processes and practices within CCEA Awarding Body

focussing on systems and processes as well as management, control, quality assurance and compliance.

The full terms of reference can be found at Annex A.

This report details Ofqual's findings in relation to stage one of the investigation.

Overview of CCEA A level Chemistry

The table below summarises the structure and assessment format for CCEA's A level Chemistry specification.

Unit	Assessment Format	Duration	Weightings	Availability
AS 1(AC111): Basic Concepts in Physical and Inorganic Chemistry	A written paper consisting of Section A, containing 10 multiple choice questions (20 marks), and Section B, containing a number of structured questions (80 marks). Externally assessed.	1 hour 30 minutes	35% of AS 17.5% of A Level	January and Summer
AS 2(AC121): Further Physical and Inorganic Chemistry and Introduction to Organic Chemistry	A written paper consisting of Section A, containing 10 multiple choice questions (20 marks), and Section B, containing a number of structured questions (80 marks). Externally assessed.	1 hour 30 minutes	35% of AS 17.5% of A Level	January and Summer
AS 3(AC131&132): Internal Assessment	This unit is timetabled and taken by candidates under controlled conditions. The papers will be marked by the centres to a CCEA supplied mark scheme. Section A consists of two practical tasks (each worth 25 and 29 marks respectively). Section B has a planning exercise (20 marks) and a number of other questions testing knowledge of practical techniques, observations and calculations (16 marks). Internally assessed.	2 hours 30 minutes	30% of AS 15% of A Level	Summer only

A2 1(AC212): Periodic Trends and Further Organic, Physical and Inorganic Chemistry	A written paper consisting of Section A, containing 10 multiple choice questions (20 marks), and Section B, which has a number of structured questions (100 marks). Externally assessed.	2 hours	40% of A2 20% of A Level	January and Summer
A2 2(AC222): Analytical, Transition Metals, Electrochemistry and Further Organic Chemistry	A written paper consisting of Section A, containing 10 multiple choice questions (20 marks), and Section B, which has a number of structured questions (100 marks). Externally assessed.	2 hours	40% of A2 20% of A Level	Summer only
A2 3 (AC231&232): Internal Assessment	This is a practical examination consisting of a planning exercise (20 marks) and practical exercises (50 marks). Internally assessed.	2 hours 30 minutes	20% of A2 10% of A Level	Summer only

Format of the Investigation

The Ofqual investigation team visited CCEA's offices between 6 and 8 September and on 13 September 2010. The purpose of the visits was to:

- understand the processes and quality assurance mechanisms in relation to the marking and awarding of CCEA's summer 2010 A level Chemistry examination; with a specific focus on the marking of the multiple choice component of unit AC212
- identify the roles and responsibilities of relevant staff
- form an account of the events which led to the failure
- identify the cause of the error and the scale of impact in terms of numbers of candidates and centres affected

- identify the remedial measures CCEA implemented once the error was discovered.

The approach adopted by the investigation team included:

- a tour of CCEA's offices, including where multiple choice answer sheets are processed
- a briefing on CCEA's organisational structure and its different business units
- Interviews with 20 key members of CCEA staff
- a review of CCEA'S procedures and other relevant documentation
- a demonstration of CCEA's OMR reader and database
- consideration of CCEA's internal investigation report. This report was received at the end of Ofqual's investigation, and after Ofqual had formulated its initial conclusions.

Two further telephone interviews were conducted with CCEA staff on 21 September 2010.

A summary of the documentation reviewed by the investigation team can be found at Annex B.

Overview of the marking process

The assessment format for CCEA A level Chemistry includes 4 units (2 AS units and 2 A2 units) which have a multiple choice sub-component. Candidates are required to answer 10 questions and record their answers by marking the appropriate letter on a separate answer sheet. An Optical Mark Reader (OMR) is used to optically read the answer sheets.

The procedure for the processing of optically read answer sheets is documented in CCEA's standard procedure *Processing of Optical Mark Reader Sheets* (Ref:EDS/TP0145/08). Responsibility for the processing of OMR read answer sheets rests with the Entries, Results and Certification (ERC) section. The information contained on the candidates' answer sheets is processed using an Optical Mark Reader which is connected to an MS Access database that is held on a dedicated PC. The PC is connected to the CCEA internal network. The OMR database contains the mark schemes for each of the multiple choice components of all CCEA examinations. The database is manually updated with new mark schemes for each examination series as required.

The final version of the mark scheme to be used by the OMR is approved by senior examiners at the appropriate standardisation meeting. Once approved, the Question Paper Production section (QPP) deliver a copy of the approved mark scheme to the ERC section for keying onto the OMR database. The OMR operator first has to select the correct component code on the database. This brings up the mark scheme from the previous examination series which then has to be manually overwritten with the mark scheme for the current examination series. The mark scheme is then keyed onto the OMR database. Once the mark scheme has been keyed-in the operator exits the database and then re-opens it. Another member of the ERC section reads back the mark scheme to the operator and both members of staff verify that the mark scheme has been inputted correctly onto the OMR database by signing and dating the hard copy of the mark scheme. Once the mark scheme has been keyed and verified, the corresponding answer sheet batches are put through the OMR to be read. ERC staff state that answer sheets are normally read by the OMR immediately after the mark scheme has been keyed in. However, the standard procedure does not state that this is a requirement therefore the reading of answer sheets can take place several days after the mark scheme has been keyed onto the OMR database.

CCEA's procedure for the processing of optical mark reader sheets requires that the first batch of any answer sheet to be read should contain 10 sheets. After the batch has been read through the OMR the sheets are manually marked and checked against the mark awarded by the OMR to confirm that the OMR system is awarding the correct marks. This check is verified and recorded by a second member of ERC staff. Once this check has been done, the rest of the answer sheets are read through the OMR in batches, with each being given a unique batch number. The completed batches are then imported into CCEA's AS400 examinations processing IT system. Answer sheets that are rejected when read through the OMR are marked twice manually and then keyed directly into the AS400 system. Answer sheets are sometimes rejected due to anomalies with the candidates details contained on the OMR answer sheet.

How the marking error occurred

Ofqual has identified two key processing errors which caused incorrect marks to be issued for multiple choice - component AC211 of unit AC212.

Firstly, the OMR database system used to mark the multiple choice component incorrectly held the January 2010 rather than the summer 2010 mark scheme. This is confirmed by the analysis of IT system back up tapes conducted by CCEA's internal investigation team. Therefore, when the answer sheets for component AC211 were read by the OMR on 29 June correct answers on candidates' OMR answer sheets were not awarded marks.

Secondly, the first batch of 10 answer sheets was not checked manually after being put through the OMR as required by CCEA's standard procedure. CCEA acknowledge that as a result of human error this check was not carried out in relation to AC211. Consequently, the ERC section was unaware that the OMR was reading the answer sheets against the incorrect mark scheme.

Factors which contributed to the marking error

The OMR database

The database which holds the mark schemes for optically read multiple choice examination components is separate to CCEA's main AS400 examinations processing database. It is an MS Access database and has been in use for over 10 years. A member of the ICT section stated that the need to update the OMR database software was recognised but was not viewed as a priority as there had not previously been significant problems with its operation.

The OMR database requires the manual keying in of the mark scheme for the multiple choice component. This involves over-writing the mark scheme from the previous examination series which is held on the database. When inputting a new mark scheme against an existing component code the database automatically retains changes made to it, regardless of how the user exits.

The OMR database is not user friendly and its full functionality is not properly understood by users. For example, the user interface on the OMR database contains two menus – drop down and scroll across – for selecting the component code to be processed. The OMR operator uses the scroll across menu for selecting the component code. When staff from the ERC section demonstrated the database to Ofqual, the purpose of the drop down menu and how it is used to select a component code could not be explained.

ERC state that three mark schemes – components AC211 (the component where the error occurred), AC221 and G6801 - were keyed onto the OMR database on 23 June 2010. The procedural check and audit trail that a mark scheme has been correctly inputted onto the OMR database is the signed copy of the mark scheme. CCEA's records show that the mark schemes for these components were signed and dated by two members of the ERC section as being added to the OMR database on 23 June 2010.

The answer sheets for AC211 (the component where the error occurred) were not read by the OMR until 29 June. ERC state that when they initially tried to run the answer sheets through the OMR, the sheets were rejected because the length of the answer sheet was not recognised by the OMR. This was due to change in stationery supplier. CCEA's IT helpdesk records show that a call was made by the ERC section

on 24 June requesting that the OMR be reprogrammed to accommodate the new sheet length, and that the problem was satisfactorily resolved.

Component AC221 was being marked for the first time in summer 2010. The component was not on the OMR database when ERC staff came to key-in the mark scheme. ERC state that they contacted the ICT section on 23 June 2010 to have the new component code, AC221, put on the OMR database. They state that it was usual for ERC to contact the ICT team to get new component codes added to the database. However, CCEA's IT helpdesk log does not show any record of the call and there is no email to confirm the component code had been added. The ICT staff interviewed by Ofqual do not recall a request being made by ERC for a new component code to be added to the database. There are variations in the accounts of those interviewed by Ofqual as to whether the mark scheme for AC221 was keyed in by the ICT section, and then subsequently checked by the ERC section, or whether the mark scheme was keyed in by ERC after the component code for unit AC221 had been added by ICT.

CCEA's internal investigation team carried out a detailed analysis of the IT back-up tapes to establish, as far as possible, what changes had been made to the OMR database and when these took place. The earliest available back-up tape is for 25 June 2010 – two days after the mark scheme for AC211 (the component where the error occurred) was keyed in. This tape shows the OMR database holding the January 2010 version of the AC211 mark scheme rather than the summer 2010 version. Further analysis of this tape shows that the component AC221, which needed to be created on the database on 23 June, originally had the correct mark scheme against a wrong, existing component code, A2C11.

The back-up tape for 2 July shows that the information on the database had been changed after 25 June and the correct component code for AC221 had been added with the correct mark scheme information. This analysis also shows that the database contains redundant component codes and mark schemes, and that changes were made to those mark schemes on 2 July 2010 even though the components were not in use.

Due to the lack of an audit trail function being built into the OMR database and the absence of back-up tapes for 23 & 24 June, it is not possible to conclude with any certainty whether the mark scheme for component AC211 was actually keyed in on 23 June 2010, or what happened to the database to cause the mark scheme not to be saved. It is also not possible to identify who was responsible for adding the new code for component AC221 onto the database, or who was responsible for correcting the database between 25 June and 2 July. However, the back-up tapes do clearly show changes being made to the database after the date in which mark schemes had originally been keyed in. It is therefore possible that changes made to the OMR database on and after 23 June caused the data held to become corrupted.

CCEA has a procedure which documents the processing of optical mark reader sheets. However, this document does not include a procedure for adding new components to the OMR database. Also the respective roles and responsibilities of the ERC and ICT sections in relation to the maintenance of the database are not documented. It appears from the interviews conducted by Ofqual that there is a recognised OMR database expert within the ICT section which the ERC section usually rely on to resolve technical issues regarding the OMR database. ERC state that on 23 June the OMR expert in the ICT section was not available so another member of the ICT came to fix the problem. However, this cannot be verified for the reasons outlined above.

The absence of a clear understanding of the respective roles and responsibilities of the ERC and ICT teams in relation to the OMR database is illustrated by the fact that the changes that needed to be made to the OMR database in light of new specifications and component codes had not been planned and implemented before the mark scheme for AC221 needed to be keyed in. The absence of planning resulted in changes to business critical systems being made in the middle of a busy processing period.

Component codes

The multiple choice sections of the Chemistry units are sub components of the overall unit. The mark schemes which are provided to ERC by the QPP section for inputting onto the OMR database state only the code for the overall unit eg Chemistry A2 Unit 1 mark scheme carries the code AC212. Whereas in order to mark the multiple choice element the ERC section need to refer to the sub-component code; in the case of A2 unit 1 code AC211. The copies of the mark schemes viewed by Ofqual indicate that the code for the multiple-choice sub component is hand-written on the mark scheme. The OMR database also contains redundant component codes and the difference between the codes for legacy and new specifications is minimal. This creates an environment in which errors can occur.

Quality control arrangements

Ofqual has identified a number of weaknesses in CCEA's existing quality control arrangements, particularly in relation to the level of sign-off required for certain business critical processes and audit trail requirements.

Keying of the mark scheme

Responsibility for checking and verifying that a mark scheme has been correctly keyed in to the OMR database rests with the two members of staff who undertake the keying in. Verification that the process has been completed correctly is a copy of the mark scheme which has been signed and dated by the two members of staff involved

that undertook the keying in. There is no requirement for the ERC Team Leader to verify that the mark scheme has been entered correctly.

The OMR database does not have any audit functionality. Therefore it is not possible to establish when a new mark scheme was keyed in and who entered it. The existing controls therefore provide insufficient assurance that a mark scheme has been correctly entered and saved onto the OMR database. ERC staff feel that the current controls provide them with little protection and that responsibility for verifying that a business critical process has been completed correctly rests with junior members of staff.

Access to the OMR database

Only a small number of ERC and ICT staff need access to the OMR database. However, CCEA's records show that there is approximately 100 staff who can gain access to the OMR database, this includes temporary members of staff. The risk of accidental or deliberate changes being made to the database by unauthorised or untrained staff is high.

Manual batch checking

CCEA acknowledge that the manual batch check on the first batch of ten answer sheets was not carried out, as required by CCEA's operating procedures. However, responsibility for verifying that the batch check has been carried out resides with the individual carrying out the check. There is also no requirement to record the details of the answer sheets that have been checked, or any mechanism to provide assurance to the Team Leader that the appropriate checks have been completed.

Other contributory factors

Organisational

There has been a high turnover of Team Leaders in the ERC section. There have been four post holders over the past two years. The current Team Leader joined CCEA in June 2010. To ensure business continuity, and to provide support to the new team leader, CCEA has relied on an experienced Team Leader from another section to cover the ERC section. A concern about staffing within the ERC section, and in particular the impact of the ERC Team Leader vacancy, is flagged in CCEA's Qualifications Directorate risk highlight report for the June 2010 examination series. CCEA Regulator also raised concerns about contingency staffing arrangements within the ERC section when it conducted a review of CCEA Awarding Body GCE/GCSE examinations systems and processes in spring 2010. The ERC Team Leader's role focuses on ensuring that operational timetables are established, implemented and reviewed. CCEA's procedures indicate that the Team Leader has

limited responsibility in signing off OMR answer sheets that have been marked correctly.

In the 2009 examination series responsibility for OMR processing rested primarily with the Senior Clerical Officer (SCO) within the ERC section. The SCO post holder was promoted to the post of Senior Executive Officer (Section Leader) within the same section in February 2010 but retained responsibility for processing OMRs as the vacated SCO post was not filled. Paragraph 4, page 3, of the procedure for the processing of optical mark reader sheets states that it is the Senior Executive Officer's responsibility *"to supervise and assist temporary members of staff in the processing of OMRs"*, and that it is the Clerical Officer's role *"to undertake the processing of mark sheets, answer sheets and the processing of batches"*. The SEO was new in the post for the summer 2010 examination series and appears to have been performing both processing and supervisory responsibilities. The ERC section also relies on temporary staff to carry out what are business critical functions.

At the time when OMR answer sheets were being processed there was a serious ongoing staffing issue within the ERC section which required the attention of the ERC Team Leader and the Section Leader. This resulted in the Team Leader and Section Leader being involved in numerous unplanned meetings at the time that the OMR answer sheets were being processed. Ofqual also observed that the processing of OMR answer sheets takes place in a busy open plan office, and the potential for staff operating the OMR system to be distracted is high. These factors may explain why the manual batch check was not completed.

Knowledge and technical expertise in relation to the programming and operation of the OMR database is held by a relatively small number of staff within CCEA's ICT section. This, combined with the absence of documented procedures detailing how changes are made to the OMR database, presents a risk to business continuity and for staff that are not fully knowledgeable of the system to unintentionally corrupt data.

Awarding

The investigation team looked closely at CCEA's Review of Marking and Awards (RMA) process to establish whether it was possible for the problem with the marking of the multiple choice component of the A2 Chemistry unit 1 to have been identified at this stage. Ofqual reviewed the awarding documentation for A level Chemistry, which included the Accountable Officer's report, and interviewed staff from CCEA's examinations technical support team.

Unit AC212, which includes the multiple choice sub-component AC211, is graded as one unit at the RMA meeting. 20 marks are available for the multiple choice sub-component of AC221. Consequently, its weighting as part of the overall A level examination is relatively small.

A review of the statistical information considered at the RMA meeting indicates that the mean mark for unit AC212 (which includes the multiple choice component AC211) was 74.1, compared with a mean mark of 75.5² in the comparable summer 2009 unit. Similarly, the standard deviation for unit AC212 in summer 2010 was 16.6 compared to 16.8 in summer 2009. These variances are within acceptable tolerances and therefore would not be a cause for concern for the awarding committee and the examinations technical team. The mean mark and standard deviation for the multiple choice component were available at the RMA meeting but were not used.

The record of the RMA meeting indicates that the examiners were asked to comment on the demand of the multiple choice sub-component in comparison with the summer 2009 examination. They judged that the multiple-choice questions were of similar demand to that of the previous examination series. However, this judgement was not informed by any reference to data on how candidates had actually performed on the multiple choice questions. Furthermore, when reviewing candidates' scripts to inform the grade boundary decisions for the written theory element of unit AC212, examiners were not able to see how many marks candidates' had achieved on the multiple choice element because candidates answers are recorded on a separate answer sheet which is optically read.

CCEA state that the focus of the awarding process in summer 2010 was on establishing acceptable qualification level outcomes for the revised A level specifications rather than carrying forward standards at the unit level which is usually the case when a specification is established.

The combination of these factors meant that the problem with the marking of the multiple choice element was not visible to the awarding meeting or the CCEA staff that were responsible for carrying out the post-award checks. Had the mean mark for the multiple choice component been considered during awarding, it is likely it would have prompted CCEA to investigate the marking of AC211 before final marks were processed.

CCEA's response to the error

CCEA was first alerted to a potential problem with the marking of A level Chemistry on Friday 20 August when the Enquiries about Results (EAR) section received an EAR request. The EAR section checked the candidate's OMR answer sheet using a template which is overlaid on the OMR sheet. This immediately showed that there was an error. The EAR section checked another answer sheet and manually marked

² This is the mean mark after scaling to reflect the changes in weightings between the revised and legacy specifications.

them using the hard copy of the mark scheme to confirm the error. On discovering the error EAR staff immediately escalated the issue within CCEA.

CCEA immediately put in place arrangements to establish the scope of the problem and organised for staff to come in over the weekend to fix the problem. This included checking the marking of all other OMR marked components. The correct mark scheme for component AC211 was then applied and candidates re-graded.

CCEA's CEO was informed of the problem at 5.10pm on Friday 20 August. He informed the Chairman of CCEA at 6pm and contacted the Permanent Secretary at the Department of Education at 7pm.

On Saturday 21 August CCEA had confirmed the scope of the problem and processed the new marks for the candidates affected. Manual checks were carried out on all 151 candidates who had a grade change and new statements of results were printed for those candidates.

CCEA's CEO spoke directly to the Chief Executive of the Universities Central Admissions Service (UCAS) to explain the problem and concerns about ensuring candidates did not miss out on university places as a result of the error; and contact was established with senior UCAS staff. CCEA also contacted the Central Applications Office (CAO) in the Republic of Ireland to inform them of the grade changes. CCEA staff state that they experienced difficulties in establishing contact with CAO. This was in part caused by problems experienced by CAO regarding its IT systems but a contact point within CAO was eventually established.

Amended EDI files containing the grade changes were sent to UCAS and CAO in the afternoon of Saturday 21 August. UCAS confirmed that they were able to process the new grades immediately and initiate contact with those universities where candidates' places were affected. UCAS confirmed that 80% of the candidates affected had applied for courses at Queens University Belfast. Regular contact was maintained with UCAS to identify candidates at risk.

On Sunday 22 August, CCEA put in place arrangements for contacting centres on Monday 23 August as well as setting up a dedicated helpline for centres, parents and candidates who had queries regarding the error and its impact.

On Monday 23 August CCEA staff contacted those centres that had candidates with grade changes informing them to contact students that had been affected. The Head of Admissions at Queens University Belfast was contacted and she was able to confirm that students would be entitled to a place if they were able to secure the grades in their offer.

New correct statements of results were sent to centres on Tuesday 24 August. Between 24 and 28 August it is evident that CCEA continued to take proactive steps

to ensure that centres had informed the candidates that had been affected, and the progress being made to ensure that candidates were able to take up their university places.

For those candidates where the mark changes meant their new UMS mark was closer to the grade and consequently wanted to access the Enquiries about Results service, CCEA arranged for the re-marking to be completed within 24-48 hours. Where the re-marking process resulted in a grade change CCEA liaised with the universities to ensure they had the correct results for those candidates wishing to take up university places.

CCEA confirmed that by 31 August 2010 all affected candidates had been accepted on their chosen university course.

Ofqual reviewed the log of telephone calls received by the dedicated helpline set up by CCEA. 39 calls were received on 23 August and 4 calls were received on 24 August. No further calls were received after this date. In view of the total number of candidates and centres affected and the volume and nature of the calls received by the helpline suggests that CCEA's strategy for handling the problem was effective.

Communication with relevant bodies

CCEA's communications team was first alerted to the problem on 21 August and in response immediately implemented CCEA's standard procedure for Handling a Media Crisis (Ref:CEO/TP/0008/06). This included the setting up of a crisis communication management team which included: the CEO, Director of Qualifications, Examinations & Administration Manager, Marketing & Communications and Communications Executive.

The crisis communications management team met at regular intervals between 21 and 24 August to agree a communication strategy in terms of how to inform candidates, provide additional help for candidates and handle contact from the media. It is evident that CCEA decided to adopt a proactive communication strategy in response to the error. This included issuing a statement on Monday 23 August which detailed the facts relating to the error and the actions CCEA had taken to remedy the situation. The communications team also contacted key media contacts in advance of the issuing of the statement to brief them on the nature of the issue. CCEA's statement was issued to the media on Monday 23 August and distributed at the same time to CCEA's stakeholders which included universities, the Joint Council for Qualifications and the other UK qualifications regulators. CCEA's communication team also maintained close contact with the Department of Education communications team to ensure the appropriate coordination and factual accuracy of the statements made by both organisations.

Communication with the regulators

CCEA is a unique education body in the UK as it awards qualifications and is also responsible for the regulation of all qualifications, except vocational qualifications, in Northern Ireland. The regulation of qualifications is carried out collaboratively with the regulatory authorities in England (Ofqual) and Wales (DCELLS).

The error with the marking of A level Chemistry was discovered on the afternoon of Friday 20 August 2010. CCEA Awarding Body informed CCEA Regulator of the error on the morning of Monday 23 August. CCEA Regulator was contacted at the same time by Ofqual which had been informally informed over the weekend by UCAS that there had been a problem. On being informed of the problem, CCEA Regulator checked whether any English or Welsh candidates were affected. CCEA Regulator states that confirmation that only candidates in Northern Ireland were affected was sent by email to their counterparts at Ofqual and DCELLS on the morning of Monday 23 August.

CCEA Awarding Body state that it did not immediately inform CCEA Regulator when the error was discovered on 20 August because the scope of the error was still being established. However, this does not explain why CCEA waited a further two days before informing the regulator. By not informing the regulator as soon as possible the ability of the regulators in England, Wales and Northern Ireland to discharge their regulatory responsibilities, and the efficacy of their response, was potentially compromised.

Conclusions and recommendations

The error which led to incorrect marks being issued for the multiple choice component of unit AC212 of CCEA's A level Chemistry examination in summer 2010 occurred due to a combination of deficiencies in CCEA's processing systems, quality control arrangements, human error and a range of other contributory factors detailed in this report

The absence of any audit function on the OMR database and IT system back up tapes for 23 and 24 June means Ofqual cannot report with certainty as to why the January 2010 rather than summer 2010 mark scheme was used to mark the multiple choice component AC211 and who accessed the OMR database between 23 June and 2 July. Based on the evidence available, the most likely scenario which caused the incorrect mark scheme to be used is that the data held on the database was unintentionally corrupted. It is likely that the mark scheme for AC211 was keyed into the OMR database on 23 June against the wrong component but this was overwritten when the mark scheme for AC221 was keyed on to the same wrong component code also on 23 June. Although changes were made at a later date to ensure component AC221 and its mark scheme had been correctly added, no

changes were made to component AC211. Therefore, when the answer sheets for AC211 were eventually read by the OMR on 29 June they were marked against the incorrect mark scheme.

Ofqual makes the following recommendations which are intended to help prevent a similar error occurring again.

OMR database

1. CCEA should review the suitability of the current OMR database with a view to replacing it with a more up-to-date and robust system.
2. The following interim measures should be implemented by CCEA in advance of the January 2011 series:
 - a. Conduct an audit of the existing data held on the database and remove previous versions of mark schemes and redundant component codes
 - b. Review the existing functionality of the software to reduce the potential for operator error caused by the 'drop down' menu and the absence of any prompts or alerts when users make changes to the database
 - c. Review the user access and security arrangements for the OMR database
 - d. Incorporate an audit function as part of the OMR processing system which records all user activity
 - e. Review the location of the OMR reader and database to avoid the potential for users to be distracted.

Control and Assurance arrangements

3. Prior to the start of the January 2011 examination series the ISO procedure (EDS/TP/0145/08) for the processing of OMRs should be reviewed and updated to include the:
 - a. roles and responsibilities of all staff involved in the process, including the ICT section
 - b. procedure for adding new component codes and selecting component codes on the OMR database
 - c. sign off arrangements for each element of the process.
4. Sample batches of processed OMR answer sheets should be checked at the beginning, middle and end of the processing run. Details of the answer sheets

manually checked as part of the batch checking process should be recorded and retained.

5. Where manual keying in of mark schemes onto the OMR database continues, users should take and retain a dated and timed screen capture of the information inputted in addition to the signed and data copy of the mark scheme.
6. The awarding process for multiple choice components should be reviewed. Statistical information, in particular in relation to mean marks, for multiple choice components and sub components should be considered at awarding meetings.
7. CCEA, in liaison with the regulators, should address the technical issues caused by incorrect marks being used in the summer 2010 A level Chemistry award to ensure that the correct standard is maintained in 2011.
8. The role of the ERC Team Leader in assuring that mark schemes have been keyed in correctly and that batch checks have been completed should be reviewed.
9. CCEA should review its data back-up policy, in particular in relation to busy examination periods.

Organisational issues

10. CCEA should review the structure, work load and allocation of responsibilities of the ERC section to ensure it is best equipped to meet the business critical demands placed on it.

Communications

11. A protocol should be established detailing how CCEA Awarding Body informs CCEA Regulator when operational issues arise.
12. The regulators in England, Wales and Northern Ireland should review the arrangements for informing each other to risks and operational issues.

Issues for further investigation in Stage 2

The following issues require further scrutiny as part of the second stage of the external investigation:

The fitness for purpose of key operational systems and procedures and the extent to which they reflect current roles and responsibilities

- The level of checks required at key stages of the examination process
- Audit trail requirements – both electronic and hard copy

- Business continuity, in particular the arrangements for knowledge capture and transfer
- Planning
- Risk assessment and risk management.

Annexes

Annex A

Terms of reference for the external investigation set by the Department of Education

On 20 August 2010 the Council for the Curriculum, Examinations and Assessment (CCEA) became aware that incorrect marks had been awarded in the multiple choice section of an A2 Chemistry paper. This resulted in 151 students from the north of Ireland receiving lower grades than they should have.

The Department of Education, CCEA's sponsor department, has therefore asked the Office of Qualifications and Examinations Regulation (Ofqual) to conduct an external investigation into the failure of the CCEA marking process in relation to the 2010 summer A level Chemistry papers.

The investigation should comprise two stages:

(a) Stage 1

An immediate investigation to identify and record what went wrong, how the failure occurred, how it was discovered, how it was communicated to all relevant bodies, how many candidates were affected, with a report and recommendations for immediate action to the Department by the end of September at the latest.

(b) Stage 2

Informed by the findings of Stage 1, a more detailed review of processes and practices within CCEA Awarding Body focusing on systems and processes as well as management, control, quality assurance and compliance will be conducted. The review will identify any weaknesses and make recommendations on measures to be taken to ensure that similar failures do not recur. The review will report to the Department by the end of October 2010, in order to allow any necessary actions to be taken in time for the forthcoming winter examinations series.

Ofqual will be provided with access to evidence from CCEA and may seek evidence from third parties as appropriate.

The stage 1 and 2 reports should be provided to the Department of Education and should not be shared outside Ofqual or the Department without the Department's explicit agreement. The reports will be made available to the Minister of Education

and subsequently published, along with details of actions to be taken in response to the reports.

Annex B

Summary of documentation reviewed

- I. CCEA Organisational Chart.
- II. Corporate Risk Register.
- III. Business unit and team risk registers.
- IV. Business Continuity Management Policy Document.
- V. Quality Assurance documents – Operational schedules.
- VI. ISO Procedure: EDS/TP/0145/08 – Processing of Optical Mark Reader Sheets.
- VII. AS400 disaster recovery plan.
- VIII. Print outs of all UMS changes up/down and grade changes for unit AC212.
- IX. Awarding file for A level Chemistry and Accountable Officer's report.
- X. Awards data for A level Chemistry.
- XI. Copies of keyed in mark schemes for all CCEA multiple choice components.
- XII. Details of the CCEA staff that have access to CCEA's IT exams processing systems.
- XIII. IT helpdesk log sheets.
- XIV. Confirmatory evidence of when update EDI files were sent to UCAS and CAO on 21 August.
- XV. ISO procedure CEO/TP/0008/06 – Handling a media crisis.
- XVI. CCEA and DE press releases.
- XVII. A2 Chemistry helpline log sheets.
- XVIII. Log sheets of contact with centres that had candidates who were at risk of losing university places. (Enquiries about results).
- XIX. Copies of winter and summer series question papers and mark schemes.

- XX. CCEA report to the Department of Education – Review of GCE/GCSE Examinations Systems and Processes – June 2010.
- XXI. Question and Answer record of Ofqual interviews with CCEA staff in relation to CCEA/Ofqual review in June 2010.
- XXII. CCEA's internal investigation report into the awarding of incorrect grades for CCEA A2 Chemistry Summer 2010.
- XXIII. Written statement from Gavin Boyd, CCEA Chief Executive.

Glossary

Awarding - the process through which candidates' grades are determined on the basis of the available evidence

Centre - An organisation (such as a school or college) accountable to an awarding organisation for the assessment arrangements leading to an award.

Enquiries about results - A process through which an awarding organisation may be asked to check one or more of the steps leading to a reported result.

Component - A discrete assessable element within a qualification that is not itself formally reported.

Mark scheme - A scheme detailing how credit is to be awarded in relation to a particular assessment unit or component. A mark scheme normally characterises acceptable answers to questions/tasks or parts of questions/tasks and identifies the amount of credit each attracts.

Standardisation - A scheme detailing how credit is to be awarded in relation to a particular assessment unit or component. A mark scheme normally characterises acceptable answers to questions/tasks or parts of questions/tasks and identifies the amount of credit each attracts.

Abbreviations

CAO	Central Applications Office
CCEA	Council for the Curriculum, Examinations and Assessment
CEO	Chief Executive Officer
DE	Department of Education
EAR	Enquiries about results
ERC	Entries, Results and Certification team
ICT	Information and Communications Technology Team
Ofqual	Office of Qualifications and Examinations Regulation
OMR	Optical Mark Reader
QPP	Question Paper Production team
UCAS	Universities Central Admissions Service

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