Improve MCQ-Creation Skills To Support Corporate Learning

Robert Michael Foster

University of Wolverhampton,
Wulfruna Street, Wolverhampton, WV1 1LY,
Research Institute in Information and Language Processing
R.M.Foster@wlv.ac.uk

Abstract

This paper presents a survey of the application of Multiple Choice Questions (MCQs) within a UK company. The survey begins with a trend analysis of 5 consecutive annual totals of KACEs (Knowledge Acquisition Confirmation Events) arising from the company's use of MCQs. This is followed by a comparison of the proportions of KACEs that occurred in formative, summative and refresher assessment contexts. An alternative method for categorizing KACEs is then applied to the data from selected years to show how MCQ use has expanded into new content sub-domains. The conclusion is that MCQ-Creation and delivery are becoming increasingly important in the effective communication of corporate knowledge, rules and procedures. The recommendation is that investment is required in the development of staff skills in MCQ-Creation and the associated task of writing effective approved documents from which MCQs are derived.

1. Introduction

UK Companies are required by legislation such as Health and Safety at Work, etc Act 1974 [1] to provide information, instruction, training and supervision to ensure the health and safety at work of their employees. Some UK companies have introduced systems of training and authorisation that use Multiple Choice Questions (MCQs) as part of their response to these requirements. This paper presents the results from a survey of the application of Multiple Choice Questions (MCQs) within a UK company which illustrates how the quantity and scope of MCQ usage in addressing this requirement are increasing.

The survey begins with a trend analysis of MCQ usage over 5 consecutive years. There follows an analysis of the proportions of MCQ usage in 2012 in each of three assessment categories: formative, summative and refresher assessments. Then there is an alternative presentation of the totals for selected years which show how this company is using MCQs to address assessment needs in an increasingly diverse range of content sub-domains. The conclusion is that MCQ-Creation and delivery are becoming increasingly important in the effective communication of corporate knowledge, rules and procedures.

2. Background

The UK Health and Safety at work, etc Act 1974 [2] specifies that every employee has a duty of care for the health and safety of themselves and their colleagues.

Health and Safety at Work, etc Act 1974 – Section 2

"2. (1) It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.

(2) Without prejudice to the generality of an employer's duty under the preceding subsection, the matters to which that duty extends include in particular:

(A)... (B) ... (C) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees; (D)... (E)...."

An increasingly significant method for providing the instruction, training and supervision required by the Health and Safety at Work, etc. Act 1974 is to carry out formative, summative and refresher knowledge check assessments so that knowledge gaps can be identified and then addressed.

Formative assessments [2] can be carried out during training to allow trainees to build new knowledge into their world view at a pace that suits them. Summative assessments [3] can be used immediately after training to confirm that trainees have retained the important knowledge from their training in short term memory, and Refresher assessments [4] can be used to confirm that trainees have retained the knowledge from their training in long term memory. In this way a coordinated system of formative, summative and refresher assessments can be very effective in supporting the activity of managing corporate knowledge.

In recent years the method for delivering assessments that provide the instruction, training and supervision required by the Health and Safety at Work, etc Act 1974 has changed. In place of paper based questionnaires, managers now use Computer Based Tests (CBTs) consisting of Multiple Choice Questions (MCQs). An assessment context in which this change has been specified in the company's approved document library is illustrated below:

ST:OS7D – Relating to Audit Procedures for Operational Authorisations – Paragraph 3.1

"All Senior Authorised and Authorised Persons who hold an authorisation for HV Operational Work (11SW, 33SW, 66SW, 132SW and restricted variations) shall complete an annual CBT test to the satisfaction of an Examining Officer qualified to examine for that authorisation."

An important motivation for moving towards systems that include automatic marking has been the significant increases in staff numbers in recent years (in 2011 the existing staff numbers of 2,200 were increased to over 6,000). However the change to MCQs within CBTs is also supported by the case study quoted in a recent experiment [4] which in addition to demonstrating how MCQs used in

refresher contexts can be evaluated, also described how careful application of a new MCQ-Creation methodology in response to a specifically identified learning need, provided a cost effective method for filling a significant knowledge mis-match between two categories of staff. It has also been noted that if staff who are seeking to gain increased levels of authorization know that they will need to pass a CBT as part of the authorization interview then they will revise their learning materials more vigorously than if the CBT had not been included in the authorization process.

3. Survey Method and Results

The survey presented in this paper makes use of the 'KACE' as a measure of MCQ usage. A 'KACE' has been defined [4] as a Knowledge Acquisition Confirmation Event. A 'KACE' is considered to have occurred each time a user of a CBT clicks the correct response button within a MCQ. The first table in this survey shows a count of all KACEs that occurred within the company within the specified years.

Table 1 does not include KACE counts from 1990 – 2007 even though CBTs consisting of MCQs have been used in the company since 1990. The reason for this omission is that annual KACE totals between 1990 and 2007 did not change significantly. The interesting changes are seen to have occurred since 2008.

Table 1. KACE totals between 2008 and 2012

Year	KACE total
	Note: 1 x KACE = 1 x correct response to a MCQ test item by a staff member
2008	**32,890**
2009	**53.655**
2010	**162,680**
2011	**164.031**
2012	**511,602**

In Table 2 the KACEs for 2012 are categorised according to the assessment type for which the MCQ was created. This table only includes KACE counts for 2012 since only very low KACE counts for formative and summative assessment CBTs were found in years prior to 2012.

Table 2. 2012 KACE counts categorized by assessment type

Assessment Type	2012 KACEs Note: 1 x KACE = 1 x correct response to a MCQ test item by a staff member
Formative	7,800
Summative	22,149
Refresher	481,653

In Table 3 the KACEs for 2008, 2010 and 2012 are categorised according to the content sub-domain which is covered by the MCQ in which the KACE occurred:

Table 3. KACE counts in 2008, 2010 and 2012 by Content Sub-domain

Content sub-domain	2008 KACEs	2010 KACEs	2012 KACEs
Chainsaws	0	0	28,840
Heavy Plant	7,620	25,380	31,380
Operational Safety	0	47,480	271,685
Safety Health and Environment	25,270	55,920	104,160
Specific Risk	0	31,500	45.588
Apprentice Training	0	2,400	29,949

MCQ response data that includes counts of KACEs continues to be gathered, but the results presented in this report are those collected before 31st December 2012.

4. Discussion

Perhaps the most surprising table among the three presented in this survey is Table 2 which indicates a very low level of MCQ usage for the widely researched assessment contexts of Formative[2] and Summative[3] assessment. The text accompanying the table states that "only very low KACE counts for formative and summative assessment CBTs were found in years prior to 2012". It is also interesting to note that the number of sub-domains for which Computer Based Tests have been produced has increased during the surveyed period as indicated by Table 3.

The most obvious message from this survey is provided by the general trend in Table 1. Usage of MCQs in the featured company is clearly increasing. That table also shows that there have been step changes in MCQ usage within the featured company between 2009 and 2010 and again between 2011 and 2012. The rise in MCQ usage in 2010 is likely to have been caused by the introduction of CBT assessments covering many more content sub-domains, as is shown in Table 3. The same explanation cannot be given for the 2012 rise since Table 3 shows that nearly all content areas that existed in 2012 had already been introduced in 2010. Closer examination of Table 3 shows that the increases apply in all content areas, with the most significant proportional increases appearing in the areas of Apprentice Training assessments and Operational Safety Training assessments.

Table 2 indicates that the vast majority of KACEs occurring in years prior to 2012 have been in the context of a Refresher assessments. If we combine this observation with the observed step change in KACE counts in 2012 and the observation in the Background section that there were significant staff number increases in 2011 then the fact that the step change in KACE counts occurred a year after the new staff arrived is consistent with the observation that most KACEs occur during refresher assessments.

5. Conclusions

The results from this survey indicate that MCQ-Creation and delivery are becoming increasingly important in the effective communication of corporate knowledge, rules and procedures in this

company. KACE counts are increasing in all categories of MCQ assessments, although increasing the use of MCQs in Formative and Summative assessment contexts might lead to further benefits. This recommendation is supported further by recent research [5], which has shown that when compared to traditional assessment methods, CBTs consisting of MCQs in the MAC (Multiple Alternate Choice) format deliver more comprehensive feedback within formative assessments and more targeted identification of knowledge gaps during summative assessments. Other research [6] has shown how the process of MCQ-Creation can be more closely linked to the approved documents upon which training materials are based and can therefore provide an effective method for delivering formative and summative assessments of staff knowledge following training in current corporate knowledge.

6. Recommendations

The survey presented in this paper shows how the number of KACEs made possible by the delivery of corporate knowledge using MCQs has risen significantly each year since 2008. This annual rise provides supporting evidence for the assertion that if MCQs are to be used to deliver, reinforce and refresh corporate learning as part of a system for managing corporate knowledge, then greater investment is needed in the development of staff skills in MCQ-Creation and the associated task of writing effective approved documents from which MCQs are derived.

In addition to the general rise in MCQ usage, some usage patterns have also been identified which suggest that greater application of MCQs to formative and summative assessment contexts might prove beneficial. Perhaps some kind of 'conversion' of MCQ test items that have proved useful in refresher assessments might be possible to make them suitable for use in formative and summative assessment contexts.

7. References

[1] UK Government (1974) 'Health and Safety at Work, etc Act' (http://www.hse.gov.uk/legislation/hswa.htm) (Access date: 15 May 2012)

[2] Crooks, T.(2001). "The Validity of Formative Assessments". British Educational Research Association Annual Conference, University of Leeds, September 13-15 2001

[3] Glickman, C.D., Gordon, S.P. & Ross-Gordon, J.M. (2009) – Summative Assessment

[4] Foster, R.M., (2012) – 'Evaluating an application of the CAREGen MCQ Creation Methodology' – London International Conference on Education 2012

[5] Foster, R.M., (2010) – 'Multiple Alternative Choice test items (MACs) deliver more comprehensive assessment information than traditional 4-option MC test items ' – London International Conference on Education 2010

[6] Foster, R.M., (2011) 'Creating a High Voltage Cable-Jointing knowledge check using the CARE generation methodology ' – London International Conference on Education 2011