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Blooming QCF – Final Report

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Table of Contents

Acknowledgements 4

Executive Summary..... 4

Background 6

Aims and Objectives..... 6

Methodology 7

Implementation 8

Outputs and Results 9

Findings 12

Outcomes 13

Dissemination 14

Conclusions 15

Implications and Recommendations..... 15

Recommendations..... 16

References 17

Appendix A – System Specification..... 18

Appendix B - User Guide..... 19

Appendix C - Curricular areas, SQCF levels, question types used in research and system testing.....20

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The project team is grateful for the contributions and input from college practitioners relating to the value of identifying metadata that supports the effective use of assessment.

Executive Summary

Learning programmes and descriptors are defined at specific SQCF / QCF levels. Assessments are created to address whether learning, at these levels, has been achieved. However, generally assessments are not described using the SQCF / QCF frameworks and as a consequence may not be aligned correctly for the programme of learning with subsequent impact on the learner experience and, potentially, achievement.

If assessments were associated with information identifying their 'learning' characteristics, then practitioners would be supported in the development and selection of suitable assessments to address learning outcomes.

Aims

The project aimed to:

1. Provide practical support for publishers, institutions, practitioners, JISC and its services by developing a specification for a web service based on the use of Bloom's Taxonomy as a language for determining the qualifications level (SQCF / QCF) of assessment questions. The web service aimed to return a list of metadata, utilising a Bloom's query approach, in a standard set format (XML) that can be read by standard searches in applications.
2. The specified web service aimed to provide a platform for potentially populating metadata items for assessment questions and for automatic updating of existing question banks.
3. Investigate the potential for Bloom's taxonomy as a supportive tool in mapping the language used in question stems to identify the SQCF / QCF level.
4. To engage with college practitioners, who have an interest in pedagogy, e-learning and resource development, to ensure dissemination of findings and to encourage embedding of project findings into assessment approaches.

Outcomes

After evaluation of a range of electronic assessments across a number of curricular areas, it was determined that the relationship between the language used in assessment stems and SQCF / QCF levels could not be accurately or consistently identified through a software application. The following reasons were identified –

- There was often a limited amount of text within existing question stems for the software to parse and identify the level.

- The use of language within the question stems did not always reflect the learning domain / level being addressed and, as a consequence, provided no indication of the potential SCQF / QCF level.
- The language used in assessments at different SCQF / QCF levels was often similar / the same therefore providing no discrimination of SCQF / QCF level.

As a consequence, the SCQF / QCF level could only be consistently and accurately identified through reference to programme / unit descriptors.

However, where assessments were well designed for the level, it was possible, though parsing the question stem, to identify the Bloom's Domain and associated Level and the relevant SCQF / QCF generic outcome / indicator. Through discussion in practitioner focus groups and the delivery of workshops in assessment design, it was clear that there was a value to practitioners in identifying these characteristics to support assessment design, alignment with other aspects of the curriculum (such as programme and unit descriptions and learning materials) and to ensure that assessments are deployed to address specific learning objectives.

A web service was designed and implemented to output metadata that could potentially be used to populate metadata items for new assessment questions and for automatic updating of existing question banks. The metadata identified and output included Blooms Domain, the Blooms level within the domain and the relevant SCQF / QCF generic outcome / indicator for the assessment.

To extrapolate this information to determining the SCQF / QCF level was found to be beyond the scope of this project and, in fact, perhaps impossible.

Workshops (details below) have been delivered where the findings from the project, and the web service, have been utilised to enhance practitioner understanding of the pedagogy of learning and of assessment design.

Example:

Question stem: Critically assess George Simmel's account of the characteristic features of modern social relations.

Output from web service as follows -

Verbs in Blooms Taxonomy

Verbs	Level	SCQF Generic Outcome
assess	6 - Evaluation	Evaluation

Highest Blooms Level verb in question stem: 6 - Evaluation
 SCQF Generic Outcome : Generic Cognitive Skills

The web service can be accessed at <http://bloomingcqf.ecomscotland.net/>. The service functions as follows –

Questions can be input as QTI files or as free text.

The service –

- Currently parses all text in the QTI files including responses and feedback.
- Provides feedback on all verbs identified along with Bloom's domain and level and SCQF generic outcome. The service can be easily adapted for other taxonomies and QCF.
- Will be sustained for a short period after the end of the project. Period will be agreed with the JISC project manager.

The code for the web-based tool will be provided to JISC and is also available through [Sourceforge](#) (search for Blooming QCF).

Background

Educational / learning objectives can be described using a variety of taxonomies, including Bloom's and SQCF / QCF (Scottish Credit Qualification Framework / Qualifications Credit Framework). These taxonomies provide opportunities for identifying and tagging resources with information to support effective use in the learning process. This project researched into the value of these taxonomies in supporting practitioner and institutional development in use of effective assessment strategies and approaches in support of learning processes.

Through previous work, each of the partners has contributed significantly to the understanding and implementation of eAssessment into learning environments in Scotland's colleges. This work has included the implementation of systems and procedures (SQA) and development of practitioner skills in developing assessments and delivery (SFEU) and has been had a focus on the pedagogical implications and staff development needs for implementing eAssessment effectively. As a consequence, the project team has viewed this project as not only being supportive of the identification and exchange of metadata associated with assessments but also applying the outcomes from the research and application development to support the professional development of practitioners.

Although assessment has always been a fundamental part of the learner experience it has not always been effectively used as a learning tool. The project has clarified the correlation between Bloom's Taxonomy, the SQCF generic outcomes and the creation of effective assessments.

The project was informed by the outcomes from Assessment is for Learning, a range of JISC and JISCinfonet resources and research and development undertaken by the SQA.

The project was undertaken through a partnership of Scottish Further Education Unit (SFEU), Scottish Qualifications Authority (SQA), the Scottish FE Librarians Community of Practice, eCom Scotland and EDINA.

Aims and Objectives

The project aimed to:

1. Provide practical support for publishers, institutions, practitioners, JISC and its services by developing a specification for a web service based on the use of Bloom's Taxonomy as a language for determining the qualifications level (SQCF / QCF) of assessment questions and an associated business model. The web service returns a list of metadata, utilizing a Bloom's query approach, in a standard set format (XML) that can be read by standard searches in applications.
2. The specified web service provides a platform for potentially populating metadata items for assessment questions and for automatic updating of existing question banks.
3. Investigate the potential for Bloom's taxonomy as a supportive tool in mapping the language used in question stems to identify the SQCF / QCF level.
4. To engage with college practitioners, who have an interest in pedagogy, e-learning and resource development, to ensure dissemination of findings and to encourage embedding of project findings into assessment approaches.

Methodology

All project activities were grounded in a firm understanding of the role of assessment, both formative and summative, in supporting a successful learner experience. A characteristic of the project was engagement with practitioners during the project, in the form of a focus group and workshops that incorporated the lessons and findings as they were developing. This offered an opportunity to evaluate the relevance to practitioners and adapt the research and outcomes to reflect their views.

The workshops, delivered within two SQA managed projects relating to eAssessment, have been delivered in a number of Scotland's colleges (Adam Smith College, Angus College, Cardonald College, Stevenson College and Edinburgh's Telford College to date) and also to teachers from a number of Scotland's secondary schools. This integration of the outcomes and findings from the Blooming QCF project into other national projects has strongly supported the dissemination of the project outcomes.

The research findings and feedback from practitioners have also been incorporated into the web service which has been developed to beta standard and supports the objectives of practitioner understanding and use of Bloom's Taxonomy and SQCF, including SQCF generic outcomes, when developing and using assessments.

Standard qualitative primary and secondary research methods were adopted for this study. The secondary research consisted of desk research that was designed to investigate how additional information / metadata relating to individual and batches of assessments could enhance the potential for more effective use of assessment in both formative and summative contexts. The findings and conclusions drawn from the desk research were then used to design a set of questions that could be explored with a practitioner focus group in the primary research phase and also fed into the design of the practitioner workshops on developing and using formative and summative online assessments.

The practitioner focus group was convened and comprised staff from five colleges: Adam Smith College, Angus College, Cardonald College, Stevenson College and Edinburgh's Telford College¹, who were consulted on how Bloom's Taxonomy in conjunction with

¹ These colleges were chosen as they are partners in a project, supported by the SQA and the SFEU, to develop banks of eAssessments for summative and formative practice in a range of curricular areas.

SQCF/QCF could support practitioner understanding of effective assessment practice. The emerging themes from the focus group were then developed into the design of the workshops for practitioners and in the development of the web-based resource.

As a result of the desk research and discussions within the focus group, it was concluded that determining the SQCF level accurately was beyond the scope of this project (and potentially impossible for the majority of assessments – discussed later in this paper), the following solution was implemented for the web-based service –

Develop and implement a web-based service that would identify the Bloom's domain and level, and the associated SQCF generic outcome, for individual assessments input in QTI format or as free text.

In addition, data collected from the primary and secondary research phases was used to prepare a system specification, which was agreed on and prepared by ecom Scotland. The documents listed below were developed during the design and development phase and are provided in the appendices as undernoted:

- i. Appendix A - System specification including UML diagrams.
- ii. Appendix B - User Guide
- iii. Appendix C - Curricular areas, SQCF levels and question types used in system testing.
- iv. Appendix D - Example QTI files.
- v. Appendix E - Packaged system for distribution under JISC guidelines (Electronic format).

Communication between the project team was achieved through a mixture of face-to-face meetings, email, conference calls and web-conferencing. The project team consulted with a range of college practitioners and colleagues from other sector agencies on the research and investigation.

Some slippage occurred over the summer months of the project due the holiday arrangements of the colleges and staff involved. However, this slippage was addressed throughout the remainder of the project.

Implementation

Standard systems development life cycle procedures were undertaken to develop and implement the web-based application.

Standard project management techniques were employed for the project overall and for the development of the supporting web-based system.

A high level of engagement with practitioners was conducted during the project as two of the project partners, SQA and SFEU, are also working on other projects related to assessment and, in particular, eAssessment. This provided a range of opportunities to discuss with practitioners, from colleges and schools, the project and outcomes and the relevance to supporting practitioners and learners.

The findings from the project, reflecting the feedback from practitioners, influenced the content and delivery of workshops.

The SQCF generic outcomes identified from the assessment stems were limited to 'Knowledge and Understanding', 'Practice: Applied Knowledge and Understanding' and

'Generic Cognitive Skills'. The remaining two generic outcomes, 'Communication, ICT and Numeracy Skills' and 'Autonomy, Accountability and Working with Others', were not included when determining the generic outcome applicable to a particular assessment. Extending the research and web-based tool to encompass these additional generic outcomes could be included in any further developments based on the outcomes from this project.

Throughout the project consideration was given to SQCF with a view that the outcomes from the project would be broadly applicable to QCF. Due to the differences between the two frameworks it was outwith the scope of the project to develop models for both frameworks. However, the project team believe that the project outcomes from consideration of SQCF are likely to have applicability for QCF. The web-based application has been developed for potential adaptation to include the QCF framework.

Outputs and Results

The main research activities focussed on the relationships between existing question stems, Bloom's Taxonomy and SQCF generic outcomes (whilst taking cognisance of QCF and the potential for the findings and web-based application being adapted for the QCF framework).

Initial desk research identified potential relationships between the language used in existing assessments with Bloom's Taxonomy and SQCF generic outcomes. A range of assessments from a variety of curricular areas, SQCF levels and question types were identified (see Appendix C). The assessments were analysed to determine the validity of mapping the language used in the assessment stems to Bloom's taxonomy.

Identifying a clear correlation between the language within question stems and SQCF/QCF levels, through the use of software, was a significant challenge and it was agreed that to achieve this would require development of language parsing and software intelligence beyond the scope of the project. It was also clear that it would be impossible, in some cases, to determine the SQCF level, and in some cases the Bloom's domain and level, due to the minimal use of text in the assessment stem (see examples below).

However, identifying the relationship between the language within question stems and Bloom's taxonomy was possible in many cases as well as identifying the relationship to the SQCF generic outcomes. Whilst deviating slightly from the project goals, the research, supported through discussion with practitioners, identified that, as enhancing the learner experience is the ultimate goal for all JISC activities, identification of this information associated with assessments could support practitioner engagement, understanding and use of assessment as a learning tool.

One of the challenges in identifying SQCF from question stems is due to the language used within many existing questions. For example, the following three questions, at different SQCF levels, come from the area of Business Information Management.

Challenges in Identifying Data Associated with Assessments

This section provides an example of challenges associated with identifying data associated with assessments

SQCF Level 4

According to the Health and Safety (Display Screen Equipment) Regulations 1992, an employer is obliged to provide employees who work with VDUs.

Select the correct response. Choose one answer.

SQCF Level 7

In their 'Situational Leadership' theory Hersey and Blanchard instruct managers to analyse two situation factors prior to deciding which leadership style to adopt. Which option correctly describes these factors?

Select the correct response. Choose one answer.

SQCF Level 8

Which of the Responses shown is the most useful in the decision-making process?

Select the correct response. Choose one answer.

All three questions share a similar language in the stem although the second question uses the word 'analyse' in addition to the word 'select'. 'Select' is within Bloom's taxonomy in the Cognitive Domain at level I (Knowledge) and can be mapped to the SQCF generic outcome 'Knowledge and Understanding'. This 'classification' could be applied to the first and third questions but it would not provide any indication of SQCF level (Level 4 and Level 8).

In the second question, the word 'analyse' indicates Bloom's Cognitive Domain at level 4 (Analysis) and that a higher order of learning is being assessed. However, again this is not an indication of SQCF level as this domain / level can appear at all SQCF levels. However, the academic practitioner does obtain an indication of the kind of learning that the assessment is addressing and can determine the overall learning objective(s) that are being addressed by an individual assessment. The determination of domain / level would be of greater value when considering the learning objectives being addressed by a batch of assessments e.g. is the batch primarily addressing a specific domain / level and not addressing other domains / levels that are part of the programme / unit or is the balance of domains / levels not reflecting the balance within the programme / unit.

Although there is no direct correlation between the language used in the question stem and SQCF level for a particular question, there may be a broad correlation between the proportion of domains / levels contained within a batch of assessments i.e. the lower the SQCF level then the expected proportion of assessments addressing lower learning levels would be higher i.e. containing words such as 'select' and 'describe' from the lower Bloom's levels, and the higher the SQCF level then the proportion of assessments addressing higher levels i.e. containing words such as 'analyse', 'justify' and 'evaluate', of learning would be likely.

As assessments are often delivered in batches, identifying the Bloom's domain and level (with the implication of a broadly associated SQCF level) would be helpful to practitioners to ensure that the appropriate learning objectives / levels were being addressed within the batch.

Caution should be applied as the language within the stem of existing assessments may not accurately reflect the domain / level / generic outcome. This could be due to the language used by developers varying significantly by individual or even by institution.

There may be potential for more extensive framing of assessments utilising a taxonomy such as Bloom's i.e. using the verbs associated with the taxonomy. This could enhance the quality of the assessment, standardise the language of assessment, support student understanding of the language of learning and assessment. It could also ensure that practitioners utilise assessments framed in a common language that used throughout a programme of learning including programme, unit descriptors, learning resources, assessments and feedback.

Findings

This section summarises the findings based upon the discussion above.

The main issue identified was the challenge in accurately identifying the SQCF / QCF level from the question stem of existing assessments. Objective tests frequently do not have a significant amount of text in the question stem to determine the SQCF level and the SQCF level is frequently determined by the topic being assessed and not by the language used in the assessment.

It was possible in the majority of cases to identify a Blooms domain and level, as well as the associated SQCF generic outcome, from information held in the stem of existing assessment instruments.

It was recognised that, where question stems have significant amounts of supporting / background information, there is potential to 'indicate' an SQCF level although further research would be required in this area before this assertion could be verified.

Automatically identifying the SQCF / QCF level from the stem of assessments through the use of software was therefore also challenging with the conclusion that identifying SQCF level was outwith the scope of this project. Factors influencing this conclusion include –

- Many existing assessments are limited in the amount of language used and therefore reviewing the text provides little indication of the SQCF / QCF level. It can be challenging to accurately identify a Bloom's domain / level due to the paucity of language within the stem.
- The SQCF / QCF levels are often identifiable only by the assessment itself. The language in the assessment, even if providing a supportive context, does not provide the SQCF / QCF level but can provide a Blooms domain / level along with an indication of the associated SQCF generic outcome.

Often the language used in assessments is not standardised to any degree and may reflect the preferences of the assessment writer. As a consequence, not all words used in the assessment samples are included in Bloom's taxonomy. Mapping of these words to Bloom's was undertaken for test purposes. For example, matching questions are common in objective testing but the word 'match' does not appear in Bloom's taxonomy (although it may appear in other taxonomies). For the purposes of the project, 'match' was equated with 'arrange' and 'relate' - both at level 1 (Knowledge and Understanding) in the Cognitive domain. It is not intended that these mappings are definitive and further research would be required to determine the veracity of the mappings.

The format of 'multiple choice' and 'multiple response' questions do not reflect a variety of Bloom's levels and domains as often the learner is mainly required to 'select' (level 1, Knowledge, of the Cognitive domain) the appropriate answer. This indicates that it may be appropriate to offer a greater range of assessment types to learners to ensure that the appropriate domains / levels of learning are being assessed.

Complex question stems, such as those where the response is in a free text format, provide greater opportunities for identifying the Bloom's domain and level and the relevant generic outcomes.

A slight correlation between the language within the question stem, Bloom's Taxonomy / SQCF was observed. Verbs associated with higher Bloom's levels frequently had degree of correlation with higher SQCF levels. Further research would be required to identify whether

this was a statistically valid correlation. This would indicate that, if MCQs and MRQs are the primary means of assessment, then higher level learning objectives may not be being assessed to the extent that is expected for the level of programme.

The identification of Bloom's domain and level along with the related SQCF generic outcome for assessments highlights important information for practitioners seeking to address a range of learning objectives. As indicated above, MCQ and MRQ may not address higher level learning objectives (or may not be suitable for addressing higher level learning objectives) as defined in Bloom's Taxonomy, although the question itself may be at an appropriate SQCF level.

Research, focus groups and workshop activities indicated that there was potential for academic practitioners to consider the language used throughout learning programmes to ensure consistency of SQCF level. There is a potential interest in viewing the learning process from beginning to end using Bloom's Taxonomy, SQCF and generic outcomes as a connection between the different elements - programme description, unit descriptors, learning resources including assessments, classroom dialogue and feedback.

Outcomes

<In this section, assess the value of the project work. List project achievements against the aims and objectives set.

Summarise project outcomes and their impact on the teaching, learning, or research communities.

Indicate who will benefit from the work, how, and why. Also comment on what you learned that may be applicable to other projects, e.g. whether the methodology worked.>

As discussed above, the task of identifying SQCF / QCF level from the stems of assessments proved beyond the scope of the project and may in fact not be possible based upon consideration of the format of currently existing assessments. Acknowledging this position, the project has achieved to a significant degree all of the aims and objectives originally set with the only change being that the identification of Blooms domain / level and SQCF generic outcome associated with assessments was achieved rather than the actual SQCF level.

However, the identification of this information associated with assessments has proved to be of significant interest to practitioners in supporting good practice in the development and utilisation of effective assessment strategies.

Batch input of assessments through the web-based tool could provide feedback on the constituent elements of Bloom's taxonomy. This would provide opportunities for practitioners to determine what levels of learning were being addressed within a particular batch of assessments to ensure the desired learning outcomes (domain / level) were addressed.

With course programmes and units levelled at SQCF level, and by implication, addressing particular Bloom's domains and levels, in combination with assessments categorised at Bloom's domains / levels and generic outcomes, it could potentially be of value to the academic community to ensure that the learning materials and classroom dialogue are aligned at similar levels.

With metadata on Bloom's domain / level and generic outcomes addressed by a particular assessment, or batch of assessments, practitioners have the information and tools to identify

suitable assessments to support students. The association of Bloom's taxonomy and SQCF generic outcomes support the alignment of thinking and practice of assessment with learning objectives and provides practitioners with a learning framework that can be applied from programme / unit development through to assessment (and potentially through to the feedback on the assessments).

Learning programmes consist of a number of resources:

- programme description
- unit descriptions
- learning materials
- assessments
- feedback on assessments.

If the alignment of programme and unit descriptors with learning materials, assessment instruments and associated feedback can support consistency of level (SQCF / QCF), then there is potential for impact on the learner engagement, retention and achievement. There are many reasons for students leaving their course of study and perceived inconsistency of levels in the resources and learning experiences within the programme could be one of these influencing factors. To ensure consistency of level in an academic programme the language used within the classroom should also be at an appropriate level. Further research on the value and structure of effective communication i.e. the dialogue within the classroom, at the correct level, could be of value to practitioners. Clear understanding of Bloom's Taxonomy, SQCF/QCF, generic outcomes and general use of language in assessment development enhances practitioner understanding of the learning process. This could potentially have a positive impact on the learner as there would be a significant degree of consistency throughout all communications within a learning programme.

In summary, the findings from the project are supportive of academic practitioners in developing an understanding of assessment in the learning process. It provides a framework for considering the alignment of all programme resources based upon Blooms domains / levels in the context of SQCF / QCF (though identification of the generic outcomes).

The web-based tool –

- Supports practitioners to identify individual, or batches of, assessments that assess particular learning objectives in line with programme and unit descriptions.
- Supports technical and learning resources staff to populate metadata associated with assessments (to achieve this aim it would be likely that some additional development of the beta software implementation would be required).

Dissemination

The research outcomes from the project have been included in a number of workshops delivered to the college community in Scotland through TranSETT (Transforming Scottish Education Through Technology²) programme. Over 60 delegates from a range of Scotland's

² TranSETT - the motivation behind this project partnership of the SQA, SFEU and COLEG is the delivery of modernised National Certificates and National Progression Awards (Scotland) to learners in a more innovative way.

The initial stages will see the development of e-assessments and web-based teaching and learning resources for the modernised awards. The development of e-assessments will be supported by SQA and the SFEU with delivery of workshops on the pedagogy of assessment planning and delivery provided by the SFEU.

colleges will be attending these workshops. These workshops were delivered in October and November 2008.

In addition, workshops incorporating the outcomes have been delivered as part of the 'Open Access to Assessments' programme managed by the SQA and funded through the Scottish Government. Over 80 delegates from a range of Scotland's schools and colleges will be attending these workshops. These workshops are being delivered through November 2008 to February 2009.

In these workshops, practitioners enhance their skills and understanding for the creation of effective eAssessments. Practitioners have found it helpful to consider the language of Bloom's taxonomy, including domains and levels, to ensure that assessments are addressing a range of levels and generic outcomes based on the SQCF framework.

The SFEU supports a number of Communities of Practice. The outcomes of the project will be disseminated through an event held by the Librarians CoP at the beginning of 2009.

Conclusions

The initial research phase identified significant challenges in accurately and consistently identifying the SQCF level from the question stem of assessments. This was particularly the case with questions with short stems including MCQ and MRQ where minimal information / text is available to make judgements. These challenges were beyond the scope of this project.

The research identified significant value in identifying characteristics relating to assessments such as the Bloom's domain / level and related SQCF generic outcomes. Identification of these characteristics, for new and existing assessments, supports practitioners in using assessments to clearly address particular learning outcomes.

This identification of the Bloom's domain / level and related SQCF generic outcomes in relation to batches of assessments would provide feedback to both the learner and practitioner on areas of learning / skills where there are challenges e.g. in the cognitive domain at the analysis level, thus indicating areas to be addressed through the provision of targeted learning opportunities. In essence, the information provided in relation to individual learners would be supportive of individualised / personalised learning.

Implications and Recommendations

The research into the language used within the stems of assessments has provided an indication that a framework for assessment design, based on Bloom's Taxonomy and SQCF generic outcomes would be beneficial in the development of assessments. Engagement of practitioners with this framework could be implemented within existing professional development programmes or through specific activities related to assessment development.

The alignment of the language used in programme and unit descriptions with the language of associated assessments and feedback –

- Could have potential positive impact on learner engagement, retention and achievement.
- Is of value to the practitioner when reflecting upon the purpose of a particular assessment.

This research suggests that the alignment of learning materials, classroom dialogue / exposition and electronic assessment feedback could be an area for further investigation. This alignment of language may have a positive impact on retention and achievement. There are many reasons for learners discontinuing their studies. One of these is a feeling of lack of achievement or understanding of the programme of learning. If course materials, classroom dialogue, assessment tools and feedback do not reflect a consistent SQCF level and / or are not effectively addressing the required learning domains / levels there is potential for the learner to disengage potentially having an impact on learner achievement. Comments from practitioners in workshops supported this view.

The web-based application reflects the findings of the research and could be further developed to support the findings from any subsequent research e.g. parse of learning materials and feedback from electronic assessment, to identify characteristics of the language and ensure that they are suitable for the learning programme.

Many of the practitioners attending workshops delivered while the project was underway and integrating the findings commented that they found it helpful to revisit the language of learning and assessment, in the context of Bloom's taxonomy. Some commented that it was 'several decades' since they had fully considered learning taxonomies!

Recommendations

As the development and use of electronic assessments continues to progress in all educational institutions, there are opportunities for the engagement of practitioners both in the development of electronic assessments (and associated language characteristics), and as a consequence, fundamental aspects of the learning process relating to domains and levels of learning.

With learning programme and unit descriptions levelled, there is a requirement to ensure that all aspects of the learner experience are aligned within the learning framework (Bloom's taxonomy and SQCF for the purposes of this project). This includes learning resources, classroom dialogue and exposition and feedback from assessments (particularly for electronic assessments due to the impersonal nature of this feedback). Further research to support this alignment could be of value to all learners and practitioners.

When developing assessments, practitioners should consider the content of the stem and ensure that the language is supportive of the learner undertaking the assessment by ensuring that the language used addresses the appropriate learning objectives and is consistent with the language used in associated resources such as unit descriptors and learning resources / activities.

Automated systems, such as the web-based tool developed as part of this project, can support the engagement of the practitioner in the process of learning and has been developed with a view to further enhancements to support future research activity.

References

[SQCF Handbook Volume 1 2007](#)

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<http://d.scribd.com/docs/2ng6cdyuti73lhjeu4yf.pdf>

SOLAR – Development of Summative and Formative Assessments
<http://www.sgasolar.org.uk/mini/27322.html>

Assessment is for Learning
<http://www.ltscotland.org.uk/assess/index.asp>

Appendix A – System Specification

[QCF-QMT Specification v2.doc](#) - on project webpage on JISC website

Appendix B - User Guide

[Blooming CQF – User Guide](#) – on project webpage on JISC website

Appendix C - Curricular areas, SQCF levels, question types used in research and system testing

This appendix indicates the range of curricular areas and assessment types, in QTI format, used in system testing. IPR for the assessments lies with a number of organisations and as a consequence the actual assessments are not available.

*Business Information Management SQCF Level 4
MCQ and MRQ*

*Business Information Management SQCF Level 7
MCQ and MRQ*

*Business Information Management SQCF Level 8
MCQ and MRQ*

*Environmental Biology & Genetics SQCF Level 6
MCQ and MRQ*

*Computing and IT SQCF Level 4
MCQ and MRQ*

*Computing and IT SQCF Level 7
MCQ and MRQ*

*Travel and Tourism SQCF Level 4
MCQ and MRQ*

*Travel and Tourism SQCF Level 7
MCQ and MRQ*

Appendix D - Example QTI Files

This appendix provides examples of assessments in QTI format that were used in system testing.

```
<?xml version="1.0" encoding="UTF-8" ?>
- <assessmentItem xmlns="http://www.imslobal.org/xsd/imsqti_v2p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imslobal.org/xsd/imsqti_v2p0
  imsqti_v2p0.xsd" identifier="match" title="Characters and Plays" adaptive="false"
  timeDependent="false">
- <responseDeclaration identifier="RESPONSE" cardinality="multiple"
  baseType="directedPair">
- <correctResponse>
  <value>C R</value>
  <value>D M</value>
  <value>L M</value>
  <value>P T</value>
  </correctResponse>
- <mapping defaultValue="0">
  <mapEntry mapKey="C R" mappedValue="1" />
  <mapEntry mapKey="D M" mappedValue="0.5" />
  <mapEntry mapKey="L M" mappedValue="0.5" />
  <mapEntry mapKey="P T" mappedValue="1" />
  </mapping>
  </responseDeclaration>
  <outcomeDeclaration identifier="SCORE" cardinality="single" baseType="float" />
- <itemBody>
- <matchInteraction responseIdentifier="RESPONSE" shuffle="true" maxAssociations="4">
  <prompt>Match the following characters to the Shakespeare play they appeared
  in:</prompt>
- <simpleMatchSet>
  <simpleAssociableChoice identifier="C"
    matchMax="1">Capulet</simpleAssociableChoice>
  <simpleAssociableChoice identifier="D"
    matchMax="1">Demetrius</simpleAssociableChoice>
  <simpleAssociableChoice identifier="L"
    matchMax="1">Lysander</simpleAssociableChoice>
  <simpleAssociableChoice identifier="P"
    matchMax="1">Prospero</simpleAssociableChoice>
  </simpleMatchSet>
- <simpleMatchSet>
  <simpleAssociableChoice identifier="M" matchMax="4">A Midsummer-Night's
  Dream</simpleAssociableChoice>
  <simpleAssociableChoice identifier="R" matchMax="4">Romeo and
  Juliet</simpleAssociableChoice>
  <simpleAssociableChoice identifier="T" matchMax="4">The
  Tempest</simpleAssociableChoice>
  </simpleMatchSet>
  </matchInteraction>
</itemBody>
```

```

<responseProcessing
  template="http://www.imsglobal.org/question/qti_v2p0/rptemplates/map_res
  ponse" />
</assessmentItem>

= <assessmentItem xmlns="http://www.imsglobal.org/xsd/imsqti_v2p1"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imsglobal.org/xsd/imsqti_v2p1
  http://www.imsglobal.org/xsd/imsqti_v2p1.xsd"
  identifier="COLEGOD8AB4486F114A8287A9741207C7A14B"
  title="OD8AB4486F114A8287A9741207C7A14B Matching on Parameters"
  adaptive="false" timeDependent="false">
<responseDeclaration
  identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BA"
  cardinality="single" baseType="identifier" />
<responseDeclaration
  identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BB"
  cardinality="single" baseType="identifier" />
<responseDeclaration
  identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BC"
  cardinality="single" baseType="identifier" />
<responseDeclaration
  identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BD"
  cardinality="single" baseType="identifier" />
<responseDeclaration
  identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BE"
  cardinality="single" baseType="identifier" />
<outcomeDeclaration identifier="FEEDBACK" cardinality="multiple"
  baseType="identifier" />
<outcomeDeclaration identifier="SCORE" cardinality="single" baseType="integer" />
= <itemBody>
= <p>
  Scenario: A Visual Basic program has set up the following variables:
<br />

<br />
  These variables will be sent to a subroutine that requires five parameters. The
  five variables above will be sent as arguments for the parameters. It is
  important that the values in A and D WILL NOT be changed by the subroutine.
  The values of B and C WILL be changed by the subroutine and the value of E
  may or may not be changed by the subroutine.
<br />
  Match each of the arguments shown with an appropriate parameter from the
  parameters shown.
</p>
<p />
= <choiceInteraction
  responseIdentifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BA"
  shuffle="true" maxChoices="1">
<prompt>ByRef V as Integer</prompt>
= <simpleChoice identifier="A" fixed="false">
<p>B</p>
</simpleChoice>

```

```

- <simpleChoice identifier="B" fixed="false">
  <p>A</p>
  </simpleChoice>
- <simpleChoice identifier="C" fixed="false">
  <p>E</p>
  </simpleChoice>
- <simpleChoice identifier="D" fixed="false">
  <p>D</p>
  </simpleChoice>
- <simpleChoice identifier="E" fixed="false">
  <p>C</p>
  </simpleChoice>
</choiceInteraction>
- <choiceInteraction
  responseIdentifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BB"
  shuffle="true" maxChoices="1">
  <prompt>ByVal W As Integer</prompt>
- <simpleChoice identifier="A" fixed="false">
  <p>B</p>
  </simpleChoice>
- <simpleChoice identifier="B" fixed="false">
  <p>A</p>
  </simpleChoice>
- <simpleChoice identifier="C" fixed="false">
  <p>E</p>
  </simpleChoice>
- <simpleChoice identifier="D" fixed="false">
  <p>D</p>
  </simpleChoice>
- <simpleChoice identifier="E" fixed="false">
  <p>C</p>
  </simpleChoice>
</choiceInteraction>
- <choiceInteraction
  responseIdentifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BC"
  shuffle="true" maxChoices="1">
  <prompt>ByRef X As String</prompt>
- <simpleChoice identifier="A" fixed="false">
  <p>B</p>
  </simpleChoice>
- <simpleChoice identifier="B" fixed="false">
  <p>A</p>
  </simpleChoice>
- <simpleChoice identifier="C" fixed="false">
  <p>E</p>
  </simpleChoice>
- <simpleChoice identifier="D" fixed="false">
  <p>D</p>
  </simpleChoice>
- <simpleChoice identifier="E" fixed="false">
  <p>C</p>
  </simpleChoice>
</choiceInteraction>

```

```

- <choiceInteraction
  responseIdentifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BD"
  shuffle="true" maxChoices="1">
  <prompt>ByVal Y As Currency</prompt>
- <simpleChoice identifier="A" fixed="false">
  <p>B</p>
  </simpleChoice>
- <simpleChoice identifier="B" fixed="false">
  <p>A</p>
  </simpleChoice>
- <simpleChoice identifier="C" fixed="false">
  <p>E</p>
  </simpleChoice>
- <simpleChoice identifier="D" fixed="false">
  <p>D</p>
  </simpleChoice>
- <simpleChoice identifier="E" fixed="false">
  <p>C</p>
  </simpleChoice>
</choiceInteraction>
- <choiceInteraction
  responseIdentifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BE"
  shuffle="true" maxChoices="1">
  <prompt>ByRef Z As Currency</prompt>
- <simpleChoice identifier="A" fixed="false">
  <p>B</p>
  </simpleChoice>
- <simpleChoice identifier="B" fixed="false">
  <p>A</p>
  </simpleChoice>
- <simpleChoice identifier="C" fixed="false">
  <p>E</p>
  </simpleChoice>
- <simpleChoice identifier="D" fixed="false">
  <p>D</p>
  </simpleChoice>
- <simpleChoice identifier="E" fixed="false">
  <p>C</p>
  </simpleChoice>
</choiceInteraction>
</itemBody>
- <responseProcessing>
- <responseCondition>
- <responseIf>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BA" />
  <baseValue baseType="identifier">A</baseValue>
  </match>
- <setOutcomeValue identifier="SCORE">
- <sum>
  <variable identifier="SCORE" />
  <baseValue baseType="integer">1</baseValue>
  </sum>

```

```

    </setOutcomeValue>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">CorrectA</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BB" />
  <baseValue baseType="identifier">B</baseValue>
  </match>
- <setOutcomeValue identifier="SCORE">
- <sum>
  <variable identifier="SCORE" />
  <baseValue baseType="integer">1</baseValue>
  </sum>
  </setOutcomeValue>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">CorrectB</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BC" />
  <baseValue baseType="identifier">C</baseValue>
  </match>
- <setOutcomeValue identifier="SCORE">
- <sum>
  <variable identifier="SCORE" />
  <baseValue baseType="integer">1</baseValue>
  </sum>
  </setOutcomeValue>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">CorrectC</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BD" />

```

```

    <baseValue baseType="identifier">D</baseValue>
  </match>
=> <setOutcomeValue identifier="SCORE">
=> <sum>
=> <variable identifier="SCORE" />
=> <baseValue baseType="integer">1</baseValue>
=> </sum>
=> </setOutcomeValue>
=> <setOutcomeValue identifier="FEEDBACK">
=> <multiple>
=> <variable identifier="FEEDBACK" />
=> <baseValue baseType="identifier">CorrectD</baseValue>
=> </multiple>
=> </setOutcomeValue>
=> </responseIf>
=> </responseCondition>
=> <responseCondition>
=> <responseIf>
=> <match>
=> <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BE" />
=> <baseValue baseType="identifier">E</baseValue>
=> </match>
=> </setOutcomeValue identifier="SCORE">
=> <sum>
=> <variable identifier="SCORE" />
=> <baseValue baseType="integer">1</baseValue>
=> </sum>
=> </setOutcomeValue>
=> <setOutcomeValue identifier="FEEDBACK">
=> <multiple>
=> <variable identifier="FEEDBACK" />
=> <baseValue baseType="identifier">CorrectE</baseValue>
=> </multiple>
=> </setOutcomeValue>
=> </responseIf>
=> </responseCondition>
=> <responseCondition>
=> <responseIf>
=> <not>
=> <match>
=> <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BA" />
=> <baseValue baseType="identifier">A</baseValue>
=> </match>
=> </not>
=> </setOutcomeValue identifier="FEEDBACK">
=> <multiple>
=> <variable identifier="FEEDBACK" />
=> <baseValue baseType="identifier">IncorrectA</baseValue>
=> </multiple>
=> </setOutcomeValue>
=> </responseIf>
=> </responseCondition>
=> <responseCondition>

```

```

- <responseIf>
- <not>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BB" />
  <baseValue baseType="identifier">B</baseValue>
  </match>
  </not>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">IncorrectB</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <not>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BC" />
  <baseValue baseType="identifier">C</baseValue>
  </match>
  </not>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">IncorrectC</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <not>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BD" />
  <baseValue baseType="identifier">D</baseValue>
  </match>
  </not>
- <setOutcomeValue identifier="FEEDBACK">
- <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">IncorrectD</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
- <responseCondition>
- <responseIf>
- <not>
- <match>
  <variable identifier="RESPONSE_OD8AB4486F114A8287A9741207C7A14BE" />
  <baseValue baseType="identifier">E</baseValue>

```

```

    </match>
  </not>
= <setOutcomeValue identifier="FEEDBACK">
= <multiple>
  <variable identifier="FEEDBACK" />
  <baseValue baseType="identifier">IncorrectE</baseValue>
  </multiple>
  </setOutcomeValue>
  </responseIf>
  </responseCondition>
  </responseProcessing>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="CorrectA">
  <p>Yes, this is correct. The value in B will be changed by any changes made to V
  inside the subroutine.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="IncorrectA">
  <p>No, this is incorrect. The data types of argument and parameter must match
  and the passing type of parameter should allow the value of B to be changed if
  V is changed inside the subroutine.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="CorrectB">
  <p>Yes, this is correct. The value in A will NOT be changed if any changes are
  made to W inside the subroutine.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="IncorrectB">
  <p>No, this is incorrect. The types of argument and parameter must match and
  the passing type of the parameter must not allow changes made to W inside the
  subroutine to be passed back to A.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="CorrectC">
  <p>Yes, this is correct. It is the only string so must be correct.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="IncorrectC">
  <p>No, this is incorrect. Look carefully at both the type of variable and the passing
  type of the parameter.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="CorrectD">
  <p>Yes, this is correct. The type is correct and the passing type will not allow any
  changes made to Y in the subroutine to be passed back to D.</p>
  </modalFeedback>
= <modalFeedback outcomelIdentifier="FEEDBACK" showHide="show"
  identifier="IncorrectD">
  <p>No, this is incorrect. Look carefully at the type of variable and the passing
  type, which must stop any changes made to Y in the subroutine from being
  passed back to the variable D.</p>
  </modalFeedback>

```

```

- <modalFeedback outcomeIdentifier="FEEDBACK" showHide="show"
  identifier="CorrectE">
  <p>Yes, this is correct. Any changes made to Z inside the subroutine will be
  passed back to C.</p>
</modalFeedback>
- <modalFeedback outcomeIdentifier="FEEDBACK" showHide="show"
  identifier="IncorrectE">
  <p>No, this is incorrect. Look carefully at the type of variable and the passing
  type, which must allow any changes made to Z in the subroutine to be passed
  back to the variable C.</p>
</modalFeedback>
</assessmentItem>

<?xml version="1.0" encoding="UTF-8" ?>
- <assessmentItem xmlns="http://www.imsglobal.org/xsd/imsqti_v2p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imsglobal.org/xsd/imsqti_v2p0
  imsqti_v2p0.xsd" identifier="match" title="Characters and Plays" adaptive="false"
  timeDependent="false">
- <responseDeclaration identifier="RESPONSE" cardinality="multiple"
  baseType="directedPair">
- <correctResponse>
  <value>C R</value>
  <value>D M</value>
  <value>L M</value>
  <value>P T</value>
</correctResponse>
- <mapping defaultValue="0">
  <mapEntry mapKey="C R" mappedValue="1" />
  <mapEntry mapKey="D M" mappedValue="0.5" />
  <mapEntry mapKey="L M" mappedValue="0.5" />
  <mapEntry mapKey="P T" mappedValue="1" />
</mapping>
</responseDeclaration>
  <outcomeDeclaration identifier="SCORE" cardinality="single" baseType="float" />
- <itemBody>
- <matchInteraction responseIdentifier="RESPONSE" shuffle="true" maxAssociations="4">
  <prompt>Match the following characters to the Shakespeare play they appeared
  in:</prompt>
- <simpleMatchSet>
  <simpleAssociableChoice identifier="C"
    matchMax="1">Capulet</simpleAssociableChoice>
  <simpleAssociableChoice identifier="D"
    matchMax="1">Demetrius</simpleAssociableChoice>
  <simpleAssociableChoice identifier="L"
    matchMax="1">Lysander</simpleAssociableChoice>
  <simpleAssociableChoice identifier="P"
    matchMax="1">Prospero</simpleAssociableChoice>
</simpleMatchSet>
- <simpleMatchSet>
  <simpleAssociableChoice identifier="M" matchMax="4">A Midsummer-Night's
  Dream</simpleAssociableChoice>

```

```
<simpleAssociableChoice identifier="R" matchMax="4">Romeo and
  Juliet</simpleAssociableChoice>
<simpleAssociableChoice identifier="T" matchMax="4">The
  Tempest</simpleAssociableChoice>
</simpleMatchSet>
</matchInteraction>
</itemBody>
<responseProcessing
  template="http://www.imslobal.org/question/qti_v2p0/rptemplates/map_res
  ponse" />
</assessmentItem>
```

Appendix E - Packaged system for distribution under JISC guidelines

The web-based service can be accessed at –

<http://bloomingQCF.ecomscotland.net/index.php>

This service will be maintained until 1 February 2009 (will discuss with JISC alternatives for support after this period).

The code for the web-based tool will be provided to JISC and is also available through [Sourceforge](#) (search for Blooming QCF).