
Assessment of Learning Outcomes: The EASIMAP solution

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Programme leaders are expected to be able to demonstrate that students are offered the opportunity of achieving the learning outcomes specified by the professional institution accrediting their programmes. These learning outcomes should in turn map onto the UK-SPEC Output Standards. In addition, programme leaders are also expected to provide evidence that students have attained these learning outcomes.

The Higher Education Academy Engineering Subject Centre's EASIMAP (Engineering Assessment Student Information Mapping And Planning) Project (2007-2008) seeks to assist programme leaders in these tasks by providing a coherent approach to the mapping, recording, and assessment of learning outcomes. This project, under the guidance of the Assessment of Learning Outcomes Working Group involving the Engineering Subject Centre, The Engineering Professors' Council, and the Engineering Council UK, has developed an electronic tool (the EASIMAP Tool) that enables programme and module leaders to map and record student attainment of learning outcomes. In addition, the tool provides the opportunity for tutors to record assessment outcomes, and for assessment feedback to be made available to each student. Students can then use this data (marks/grades and feedback) to help populate their e-portfolios and PDP (Personal Development Planning) records, detailing their progression in meeting the learning outcomes for their programme of study, as well as initiating reflection on progress.

This paper explores some of the key issues regarding assessment practice, details the rationale for and purpose of the project, identifies stakeholder needs, and describes the work undertaken to design and develop an electronic tool to support academics in the assessment of learning outcomes. In addition, the paper reports upon the early stages of the piloting of the EASIMAP Tool in a number of Engineering degree programmes across different higher education institutions.

Assessing Learning Outcomes: Key Issues

A 1998 study of engineering departments conducted by the QAA (Quality Assurance Agency) concluded that there was little evidence of a systematic, programme-wide approach to assessment, and that there was considerable variety of practice between departments (Jackson, 1998). Further study conducted in May 2001 by the EPC (Engineering Professors' Council) Assessment Working Group concluded that while elements of appropriate assessment practice are in place in the engineering community, considerable help should be offered to those trying to devise coherent and valid programme-level assessment practices appropriate to the outcome statements (EPC, 2001).

On the basis of the EPC's work, and the publication of its Engineering Graduate Output Standard in 2000, the EC^{UK} (Engineering Council UK) published the *UK Standard for Professional Engineering Competence: The Accreditation of Higher Education Programmes* in 2004, commonly known as UK-SPEC. This document sets out the expected learning outcomes that students on accredited engineering degree programmes within the UK should attain. In 2006 the UK-SPEC was adopted as the revised QAA Subject Benchmark Statement for Engineering. (The Subject Benchmark Statements provides a means for the academic community to describe the nature and characteristics of a particular discipline or subject area).

With the introduction of the UK-SPEC, and its adoption as the Subject Benchmark Statement for Engineering, a single set of clearly defined learning outcomes for engineering degree programmes was established. The challenge for engineering departments is now to demonstrate that their accredited programmes offer students the opportunity to demonstrate these learning outcomes, and to provide evidence of student attainment of the learning outcomes. This implies that assessment practice needs to be targeted to demonstrate student achievement of learning outcomes. For most departments this involves demonstrating that assessment activity at module level can be clearly linked backed to the UK-SPEC Learning Outcomes.

The publication of the Engineering Subject Centre Guide: Assessment of Learning Outcomes (July 2005) was a major step in supporting engineering departments in meeting this challenge, through providing advice and guidance on the design of the curriculum to enable effective assessment of student attainment of learning outcomes. This publication encourages a coherent approach to the assessment of learning outcomes through the mapping of intended learning outcomes at programme, module and assignment level using a top down approach to programme design. For many within the engineering academic community this requires a re-alignment of existing practice where programmes are often constructed by grouping appropriate modules that are already in existence. In such cases, a mapping exercise would be of great assistance in revealing where learning outcomes may be over-assessed and where they may not be assessed at all.

The Assessment of Learning Outcomes Working Group (ALOE) – involving representatives from the Engineering Council UK, the Engineering Professors' Council, and the Engineering Subject Centre - through the Engineering Subject Centre have run a number of events throughout 2006-2007 to help support the engineering academic community to meet this challenge. These events have sought to facilitate the sharing of practice between programme leaders, and to capture and disseminate examples of good assessment practice. In addition, the Engineering Subject Centre is currently engaged in an 18 month JISC (Joint Information Systems Committee) funded (JISC, 2008) project (EASIMAP) that has developed an online tool to enable the engineering academic community to respond more effectively to this challenge.

The EASIMAP Project

The EASIMAP (Engineering Assessment Student Information Mapping And Planning) Project (January 2007 to August 2008) seeks to enable engineering academics to take a more coherent approach to the assessment of learning outcomes by developing an online tool that enables academics to map and record student attainment of learning outcomes. In addition, the tool can capture tutor's assessment feedback and transfer this data to students' personal development planning (PDP) records and e-portfolios.

The rationale for this project is based upon four key drivers: the need to improve formative assessment and feedback; the need to provide support for academics in response to the new Engineering QAA Benchmark Statement for Engineering; the need to provide evidence for accreditation requirements; and the need to find a PDP/e-portfolio solution that both staff and students can embrace.

The primary objective of this project has been to define, design and develop an electronic tool that enables academics to map programme, module, and assignment intended learning outcomes to the QAA Benchmark Statement for Engineering and the UK-SPEC. This provides programme designers and leaders with an assessment matrix that will demonstrate coverage of intended learning outcomes across a programme for purposes of internal review, external accreditation, and institutional quality assurance. This matrix reveals both where learning outcomes are being over-assessed and where there are gaps in terms of learning outcomes assessment opportunities, allowing programme designers/leaders to rationalise their assessment procedures.

The EASIMAP Tool also captures, records, evidences and demonstrates the attainment of learning outcomes at programme, module, and assignment level for each student. In turn, students are able to access this information to record and evidence the attainment of learning outcomes and assessment feedback within their PDP records or e-portfolios, to aid the processes of evidencing competence, reflecting upon progress, and planning personal and academic development.

Analysing Stakeholder Needs

To help define and design the tool the project set out to identify the stakeholder needs. The project team identified the following stakeholder groups: engineering academics; engineering students; engineering professional institutions; the EPC; and EC^{UK}. Each stakeholder group was approached for their views, either by interview or as in the case of engineering students by means of conducting a focus group. Each group was asked to articulate the outcomes that they desired from the project. The responses received were recorded and compared, and a significant level of agreement was noted (Maddocks, 2007, unpublished report, available from the authors).

In short, the desired outcomes expressed by the key stakeholders in the project can be classed under each of the following key processes: Programme Design; Accreditation / Quality Assurance; Assessment / Feedback; and Personal Development Planning. For each of these processes, key desired outcomes were expressed.

For Programme Design, it was noted that the EASIMAP Tool should assist engineering academics to be able to use UK-SPEC to conduct curriculum design in a more holistic fashion, by the mapping of programme, module, and assignment outcomes to the UK-SPEC for both new and existing programmes. In particular, the need for greater alignment in the assessment of learning outcomes at module level to both the programme level and UK-SPEC was emphasised.

For accreditation and quality assurance, it was noted that the EASIMAP Tool should assist engineering academics to simplify preparation for accreditation visits, by helping to prepare effective documentation to demonstrate how programmes and modules offered students the opportunity to attain the UK-SPEC learning outcomes.

Additionally, the stakeholders expected that the tool would provide evidence/data of student/cohort progress and attainment of learning outcomes at module and programme level. It was also noted that the tool should provide Professional Institution accreditation teams with a means of easily interpreting evidence of student attainment of UK-SPEC learning outcomes.

For assessment and feedback, it was noted that the EASIMAP Tool should assist engineering academics to capture and record the attainment of learning outcomes more efficiently. The need to identify where learning outcomes are being over/under assessed, and where gaps in assessment occur was highlighted. In addition, stakeholders stressed the importance of providing students with more timely, detailed and structured feedback.

It was noted that the EASIMAP Tool should provide students with assessment feedback and data that would enable them to more effectively maintain a record of attainment and progress, develop personal learning plans, and create a portfolio of skills and competencies. It was emphasised that students should as a result be able to relate their skills, competencies, and learning attainment to the UK-SPEC learning outcomes and Professional Institution professional requirements, and to reflect upon their academic, personal, and professional development. Stakeholders noted that the EASIMAP Tool should be both intuitive and easy to use and manage, and that the use of the tool should not impose any long-term additional time or effort burden upon engineering academics. Stakeholders also felt that the project had the potential to: raise awareness of UK-SPEC amongst engineering academics; establish a common terminology to assist the exchange of experience; and to encourage engineering academics to consider the nature of assessment more deeply.

The EASIMAP Tool: Development

The EASIMAP Tool (see Figure 1) is intended to assist academics to engage in three key processes: mapping of programme, module, and assignment intended learning outcomes to UK-SPEC; recording student attainment of programme, module, and assignment learning outcomes; and providing assessment data for students PDP records and e-portfolios.

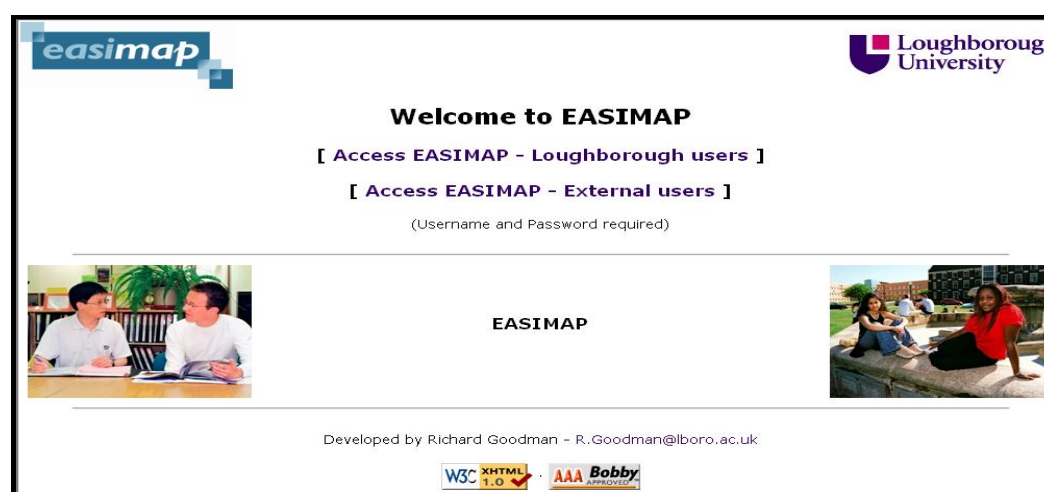


Figure 1: the EASIMAP Tool Home Page

Mapping the Assessment of Learning Outcomes

A key recommendation of the Subject Benchmark Statement for Engineering is that “there should be a holistic approach to the design of the curriculum. The methods of teaching, learning and assessment should be constructed so that the learning activities and assessment tasks are aligned with the learning outcomes that are intended in the programme” (QAA, 2006). Later in the same publication the authors state that “there should be a programme level approach to assessment that ensures output standards are met.”

These ideals reflect the desired outcomes for the project identified by the project’s key stakeholders (see previously), and imply in effect the need for an effective matrix (or series of matrices) that demonstrates the attainment of learning outcomes, and a programme-led, top-down approach to course design. At the same time, there needs to be a realistic appreciation that for many, if not most, current engineering degree programmes may not have been designed in this way.

The EASIMAP Tool has been designed to encourage a top-down approach to programme design but will also accommodate existing programmes where – from our experience - it is often at the module level that the learning outcomes are mapped to UK-SPEC. In developing a design spec for the tool, the project team reflected this top-down approach by developing a series of cascading matrices from the interface between the UK-SPEC and Programme Learning Outcomes to the interface recording assessment feedback at assignment level.

UK-SPEC General and Specific Learning Outcome Statement	Programme Learning Outcomes					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
UK-SPEC Statement 1						x
UK-SPEC Statement 2	x			x		
UK-SPEC Statement 3					x	x
UK-SPEC Statement 4		x				
UK-SPEC Statement 5		x	x			
UK-SPEC Statement 6			x			
UK-SPEC Statement 7	x					
UK-SPEC Statement 8					x	

KEY:

PLO1 = Programme Learning Outcome 1

PLO2 = Programme Learning Outcome 2

(x marks where a Programme Learning Outcome maps onto a UK-SPEC General or Specific Learning Outcome)

Table 1: Mapping Programme Learning Outcomes to the UK-SPEC

Programme Learning Outcome	Module Learning Outcomes					
	MLO1	MLO2	MLO3	MLO4	MLO5	MLO6
Programme learning outcome 1	x					
Programme learning outcome 2				x		
Programme learning outcome 3		x	x			x
Programme learning outcome 4					x	
Programme learning outcome 5	x					
Programme learning outcome 6			x			x
Programme learning outcome 7		x				
Programme learning outcome 8				x		

KEY:

MLO1 = Module Learning Outcome 1

MLO2 = Module Learning Outcome 2

(x marks where a Module Learning Outcome maps onto a Programme Learning Outcome)

Table 2: Mapping Module Learning Outcomes to Programme Learning Outcomes

Tables 1 and 2 (above) demonstrate the mapping of intended learning outcomes at the programme and module level. Most programme leaders will probably have done an exercise similar to this as part of their preparation for programme accreditation.

They may not, however, have taken the next step in making explicit links between individually assessed assignments and the module learning outcomes, as illustrated in Table 3 (below).

Module Learning Outcome	Assignment Assessment Criteria					
	AC1	AC2	AC3	AC4	AC5	AC6
Module learning outcome 1				x		
Module learning outcome 2			x			
Module learning outcome 3	x					
Module learning outcome 4			x		x	x
Module learning outcome 5		x				
Module learning outcome 6					x	
Module learning outcome 7	x					
Module learning outcome 8				x		x

KEY:

AC1 = Assignment Assessment Criteria 1

ALO2 = Assignment Assessment Criteria 2

(x marks where an Assignment Assessment Criteria maps onto a Module Learning Outcome)

Table 3: Mapping Assignment Learning Outcomes to Module Learning Outcomes

The EASIMAP Tool thus enables academics to map the learning outcomes to be assessed for each assignment back up to the UK-SPEC. This mapping process (see Figures 2 & 3) when completed, provides a matrix that demonstrates the relationship between each assignment and the learning outcomes at module and programme levels, and the UK-SPEC. Initial piloting studies at Loughborough University have shown that the Programme and Module learning outcomes can be loaded directly from data already held on the University's database.

Please select a degree programme

BEng Civil Engineering	Manage programme outcomes	Manage module outcomes for Year 1	Manage module outcomes for Year 2	Manage module outcomes for Year 3	
		Manage assessments for Year 1	Manage assessments for Year 2	Manage assessments for Year 3	
MEng Civil Engineering	Manage programme outcomes	Manage module outcomes for Year 1	Manage module outcomes for Year 2	Manage module outcomes for Year 3	Manage module outcomes for Year 4
		Manage assessments for Year 1	Manage assessments for Year 2	Manage assessments for Year 3	Manage assessments for Year 4

Figure 2: Example of a Mapping Interface

EASIMAP UK SPEC mapping

BEng Civil Engineering

This programme has the following programme level outcomes and modules

	07CVA001 Communication	07CVA002 Fluid Mechanics	07CVA005 Structural Analysis & Mechanics 1 & 2	07CVA007 Engineering Design	07CVA009 Surveying 1	07CVA014 Construction Technology and Management 1	07CVA027 Graphical Communication	07MAA102 Mathematics 1	07MAA202 Mathematics 2
Number of module outcomes	1	4	2	1	1	5	3	0	0
Number of programme outcomes linked to	2	7	2	1	0	5	0	0	0

[List of programmes]

Figure 3: Interface for mapping module outcomes to programme outcomes

Furthermore, these matrices can be used to highlight those learning outcomes which may be over-assessed, and those for which there may be insufficient assessment opportunities. This knowledge could then be used to help ensure a comprehensive coverage of learning outcomes, and to rationalise assessment across a programme. Potentially this could have a significant impact upon reducing the assessment burden on both tutors and students.

Recording Student Attainment of Learning Outcomes

Once the mapping process has been completed (and the tool has been populated with details of programme, module, and assignment learning outcomes), the tool can then be used to record the attainment of learning outcomes for each student.

Assignment Assessment Criteria	Student Assessment Data		
	Student 1	Student 2	Student 3
Assessment Criteria 1	Mark/feedback	Mark/feedback	Mark/feedback
Assessment Criteria 2	Mark/feedback	Mark/feedback	Mark/feedback
Assessment Criteria 3	Mark/feedback	Mark/feedback	Mark/feedback
Assessment Criteria 4	Mark/feedback	Mark/feedback	Mark/feedback
Assessment Criteria 5	Mark/feedback	Mark/feedback	Mark/feedback
Assessment Criteria 6	Mark/feedback	Mark/feedback	Mark/feedback

Table 4: Recording Assessment for each Assessed Assignment

The assessment interface (Table 4) enables tutors to input within the tool assessment data (marks and feedback) for each student. (At this point in time this is a manual process).

As assessment data is recorded, the tool automatically updates the attainment of learning outcomes by the student at assignment, module, and programme level. Over time a picture of the student’s overall attainment of learning outcomes emerges, along with documented evidence of how and where each student is demonstrating the attainment of UK-SPEC learning outcomes. This data is available to the tutor at any time as a snapshot of each student’s progress.

The tool provides complete and comprehensive evidence of a student’s attainment of the UK-SPEC learning outcomes. Moreover, those pieces of assessed work that have contributed to this attainment can be easily identified. Programme leaders can demonstrate not only where students attain their learning outcomes, but how and when they have done so.

Providing Students with Assessment Data

The final part of the jigsaw will be the ability of the tool to transfer assessment data to the student in a form and format that can easily be accommodated within their individual PDP (personal development planning) tool or e-portfolio to help aid reflection and planning (see Table 5).

Student Assessment Data				
Student 1	Student 2	Student 3	Student 4	Student 5
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback	Mark/feedback
v	v	v	v	v
Students’ PDP Records / e-Portfolios				
Student 1	Student 2	Student 3	Student 4	Student 5
Transcript of criteria, mark/grade and feedback with relevant module/programme learning outcome attained is transferred to the each student’s PDP records / e-portfolios				

Table 5: The Data Transfer Interface

The EASIMAP Project is currently working on testing the transfer of data from the EASIMAP Tool to three Personal Development Planning (PDP) Tools / e-Portfolios identified in a survey conducted by the project team as being used by students at more than one UK Higher Education Institutions. (Maddocks, 2007, unpublished report, available from the authors)

The three PDP Tools / e-Portfolios being tested are:

- LUSID (<https://lusida.liv.ac.uk>) (developed at the University of Liverpool)
- PebblePad (<http://www.pebblepad.co.uk/>) (developed at the University of Wolverhampton)
- RAPID (<http://rapid.lboro.ac.uk/>) (developed at Loughborough University)

QAA Subject Reviews has consistently identified assessment feedback as one of the least effective and consistent learning and teaching practices. Our discussions with students indicate that for a variety of reasons students do not (or are not able to) make significant use of the assessment feedback that they receive (Maddocks, 2007, unpublished report, available from the authors). By providing more timely, detailed and structured feedback through the EASIMAP Tool, students should now be more willing and able to respond more effectively to the feedback received.

Moreover, by means of a traffic light system (red, amber, green) the Tool can provide a clear signal to the student whether they are progressing on course in terms of meeting intended learning outcomes. Failure to do so is highlighted both clearly and quickly allowing for the student to address the issues at hand.

The EASIMAP Tool: Piloting

At the time of writing the EASIMAP Tool is being piloted in four UK Higher Education Institution Engineering Departments. This involves: mapping programme and module learning outcomes to the UK-SPEC; mapping assignment criteria to module learning outcomes; and recording assessment and feedback for student cohorts.

Interim reports from those involved in the piloting have offered feedback that will be used to further enhance the functionality and performance of the tool. Furthermore this feedback has highlighted a number of key issues. These include: the diversity of mapping practices across different Institutions; the complexity of assessment procedures; the different way that terminology is used in different Institutions; and the level of online support required to explain how the tool should be used.

The diverse practice that exists in terms of mapping programme and module learning outcomes has been highlighted. For some academics their practice differs substantially from that encouraged through the use of the tool, making engagement problematic. For others, however, the tool has offered a means of structuring more effectively what they already do in another medium (e.g. paper-based systems). Another issue that has come to the fore is the complexity of assessment procedures. Some felt that the EASIMAP Tool did not cater fully for the subtle methods used within their Institution to assess the achievement of learning outcomes. Moreover, some felt that the tool did not reveal clearly enough where under and over assessment of learning outcomes was taking place. Another issue arising from the initial piloting undertaken was the possibility of making the tool more customisable e.g. by having the option to rename existing fields to accommodate the terminology used at local level. For some, the level of help and guidance on using the tool was considered to be inadequate.

These issues are to be explored further, and revisions to the tool to capture the full range of mapping and assessment practice, to signal under and over assessment, and to enable greater customisation, will be made following more comprehensive testing by those involved in the piloting. A review of the help and guidance offered to support engagement will also be made.

Conclusion

The assessment of learning outcomes is a problematic issue for programme leaders/designers. Established assessment practices may well need to be reviewed and, where necessary, revised. All indications to date are that the EASIMAP Tool has the potential to enable programme leaders/designers to more effectively map and record their programme/module learning outcomes to the UK-SPEC, and to begin to identify how current assessment practice meets the goals of assessing each student's attainment of these learning outcomes.

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