Curriculum Design for e-Education: Make effective use of course data

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***Abstract*-This paper provides an overview of how an XML-based information model is used for managing course data in e-education. The work presented in this paper has been funded by JISC as part of a number of projects under the e-learning programme and more specifically the course data coordination activities. The projects' outputs included toolkits for generating, comparing, matching and using course data with the use of the XCRI-CAP information model that is known as eXchanging Course Related Information – Course Advertising Profiles. The initial stage of the project work focused on transforming course data descriptions in text format to XML files based on the XCRI-CAP model, allowing course providers to compare and contrast their provision according to the XCRI-CAP fields (e.g. duration, learning outcomes, description). The second stage of the project was concerned with the visualization of course data in a way that would allow course stakeholders (e.g. applicants, students, providers) to assess the extent to which, certain user-defined keywords exist in course definitions. Finally, the third project stage was focused on developing tools to match courses to potential job profiles in an attempt to align specific courses to available job opportunities. The paper provides a brief background on the project work and summarises the main outputs as walkthroughs of the developed toolkits.**

I. INTRODUCTION

The Middlesex University Skills and Education Planning Tools (MUSKET) projects provided the means for enhancing the creation and manipulation of course data. More specifically, the project aimed at (i) producing tools transforming information for academic courses that may be in the form of structured documents into the XCRI-CAP information model, (ii) generating XCRI-CAP feeds from course data that reside in the institution's existing systems, and (iii) providing training courses and supporting resources for the dissemination of the role of XCRI-CAP in the management of course data. A range of stakeholders, including marketing of new and existing courses, registrar functions, career service and open day events as well as curriculum design, development and delivery procedures, could use the project's outputs.

The first stage of the course data programme helped the institution to form a strategic alliance between the School of Science & Technology and in particular the Computer Science Department and the Centre of Learning & Teaching Enhancement. This allowed the existing skills and knowledge gained from the first two projects under the MUSKET group of projects to be applied to a new set of problems. The CLTE involvement allowed access to certain stakeholder groups and it ensured that the project received the necessary input from marketing, registrar and university wide services with a significant role in course data. The involvement of the computing services ensured that the project would be able to retrieve course data from systems and databases that were in use (i.e. PIP, MISIS).

The first stage of the project ensured that stakeholder groups were identified and engaged in discussion about a number of issues, including (i) the nature and type of course data being held and their current state, (ii) the systems being used the structure of databases including the elements used to hold course data elements, (iii) the role of course data in various operations and services and the needs for course data that may not have been fulfilled so far, and (iv) the possible uses of streaming course data according to user needs. This final discussion point allowed to link existing uses of course data to the XCRI-CAP information model and the possible benefits from the JISC

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funded project. The role of the institution's marketing unit was critical as it provided an understanding of how course data were being used for promoting courses to applicants and visitors of the website.

The brainstorming sessions were followed by a series of demonstrations of tools that were proof of concept prototypes showing the possible applications of semantically analysing programme handbooks and other documents. Emphasis was given on the fact that XCRI-CAP allows course data to be classified according to specific fields, giving meaning and providing associations between course data.

The MUSKET-ICIF project was based on a proposal that was rather ambitious in identifying possible aims that exceeded the initial brief of the call. It was required that the projects of the programme should produce XCRI-CAP feeds for courses that were outside of what is perceived as mainstream learning provision. In other words, the requirement was for feeds of course data from short courses, post graduate courses and other learning offerings that could not be classified as three-year undergraduate courses. The obvious challenge was to deal with inconsistent practices, different templates and systems used for course data generation.

The project's capacity and previous experience of the team as well as the strong support from the stakeholder groups allowed MUSKET-ICIF also to (i) provide XCRI-CAP feeds even for undergraduate courses offered, (ii) offer tools that could transform even offline versions of course data to XCRI-CAP feeds, (iii) semantically analyse and compare courses based on the XCRI-CAP feeds produced and (iv) produce the necessary resources to sustain the use of XCRI-CAP at institutional level through a series of short courses and an accredited postgraduate programme.

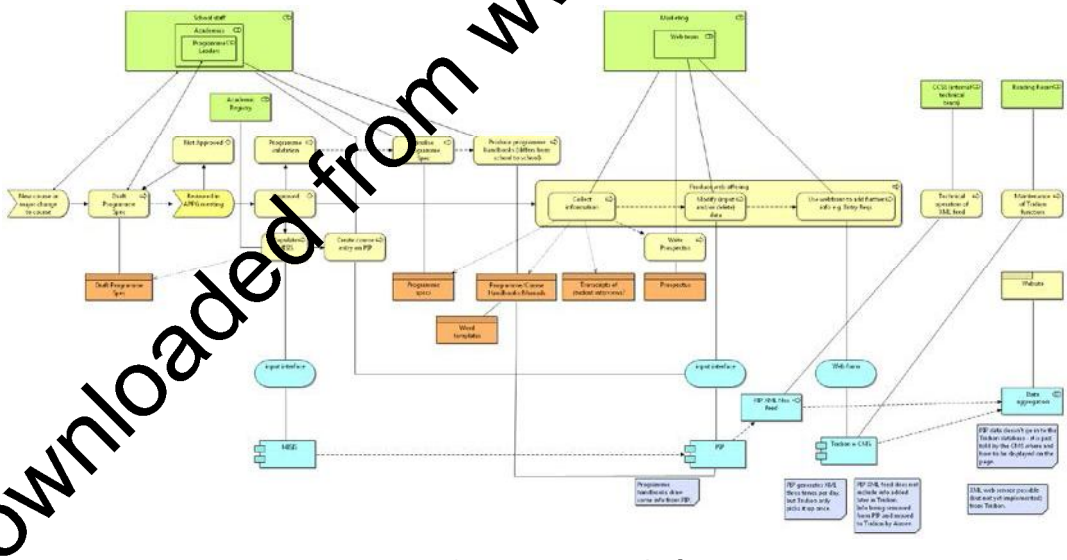

Figure 1: MUSKET Enterprise Architecture

II. BACKGROUND

"The growing understanding of the role played by knowledge and proximity in building competition has led to interest in industry clusters which are in effect, skill ecosystems (without the emphasis on skills). Research on regional clusters indicates that innovation and competitiveness increase when organisations work together in clusters. Industry clusters of local businesses and educational providers increase efficiency, stimulate innovation,

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create new labour market approaches and facilitate new business models" [1]. "Recent research undertaken by the Council for Industry and Higher Education [2] and for the DfES [3] highlights that employers are seeking quality of provision, relevance to business needs and a delivery method suited to the company rather than the HEI. The need for improved communication between HEIs and employers is a common feature of both reports. The Leitch Review of 2006 challenges institutions to deliver learning opportunities so that 40% of adults of working ages have a higher education qualification" [4]. The collection of projects developed at Middlesex University was based on the eXchanging Course Related Information: Course Advertising Profile (XCRI-CAP) standard [5]. The XCRI-CAP information model uses XML to provide consistent description of course documentation with the aid of identified course data fields. Previous work focused on the development of tools supporting the transformation and mapping of course data [7, 8, 9].

III. PROJECT WORK

The project's second stage focused on the development efforts and more specifically on creating the XCRI-CAP feed for the selected courses. The main difficulty was to identify the source of data as the institution had three main potential sources. Initially a CRM system was investigated, with no success, as its role was not to provide course data but focus on future collaboration opportunities. The MISIS system that is being used by academic and administration staff as well as students was also investigated as a possible source of data.

The development of the XCRI-CAP feed would allow the project to provide a single source for course data in the form of a COOL-URI. The scope of the project was to ensure that the http://musket.mdx.ac.uk portal would provide the XCRI-CAP feeds for the course data according to the type of course a user might be interested in. This was achieved and apart from the complete XCRI-CAP feed for the entire course provision that exists in the PIP database, the portal also includes sample XCRI-CAP feeds for the different course types as identified at the original proposal.

However, there are still course types that are not entirely covered by the PIP database, mainly short courses and training courses that are not accredited or validated. Such courses do not fall under the main categories of learning provision but still offer a learning experience which is not easily retrieved due to the fact that it does not adhere to the standardised procedure of curriculum design and development. In order to deal with such types of courses, the MUSKET-ICIF project extended the work that was done in the original MUSKET project and was disseminated through the MUSKET-BR benefit realisation project. Emphasis was given on developing further the algorithm used for the semantic analysis of course documentation to allow curriculum designers to transform any document that includes course description such as programme and module handbooks into XCRI-CAP format. This is achieved by providing the structure of each document in the form of clear headings used to describe the various parts of the programme description. The algorithm matches each heading with the most appropriate field of the XCRI-CAP model and the course data extracted from the content that is included under the heading of the original document. This solution allows the creation of an XCRI-CAP feed from any type of document that adheres to a reasonable structure.

The ability to generate course data in XCRI-CAP opens several opportunities for further analysis and use of the course data feeds. The MUSKET-ICIF project has developed online tools that can be used to compare and contras programmes and modules against each of the XCRI-CAP fields that contains data for the courses that are compared.

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The user has the ability to compare courses against pre-set keywords or even against keywords of their preference. The use can also decide which course data fields are compared, whether the entire course data feeds are compared like for like and even select weights for certain XCRI-CAP fields that should have highest priority. The project's online tools also allowed a number of visualisation options including (i) pie charts for the similarity of each course against the search keywords, (ii) pie charts for the selected XCRI-CAP fields used for comparison including any user provided weights, (iii) bar charts ranking the most comparable XCRI-CAP fields and (iv) tree maps showing the relevant frequency and number of instances selected search keywords were found in the course data.

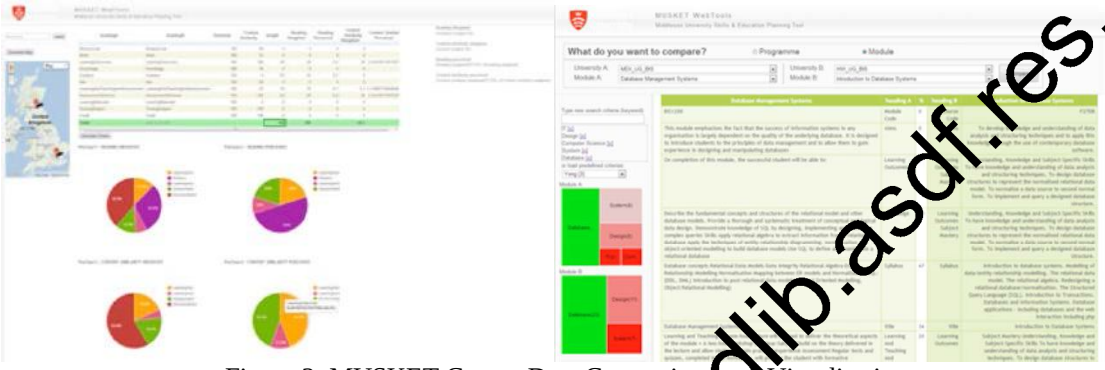

Figure 2: MUSKET Course Data Comparison and Visualisation

IV. IMPACT

The MUSKET-ICIF project has produced outputs that can have a clear impact on the following areas:

- Admissions – quite often departments have combined honours or major-minor programmes that re very similar to each other. Quite a few programmes may also share the same core modules, making it quite difficult for applicants to become aware of the differences between programmes. To add to the confusion, cross-discipline curriculum design may lead to programmes that are very similar and difficult to distinguish. A common pattern has emerged with applicants asking the same questions during open day events, applicant day events or even via email to programme leaders. Such questions aim at identifying the differences between similar programmes with respect to the topics covered, the learning outcomes, skills gained, technologies or specific aspects taught and even job prospects after graduation. The mapping of course descriptors against certain XCRI-CAP fields allowed the alignment of programme aspects such as modules taught, learning outcomes and career prospects. It means that students are able to understand differences between similar courses and perhaps the impact of their decisions when they wish to change modules or transfer to another programme.
- Curriculum design – the final few months of the project coincided with the validation of all the undergraduate provision in the Department of Computer Science. Typically, the design of a new programme or the review of an existing one, takes under consideration a number of factors that may affect the programme structure and content. Some of the recent consideration of the validation team included (i) establishing a clear programme scope, (ii) attempting to target a specific segment of the student market interested in the area of each programme, (iii) avoiding significant overlaps with existing programmes, and (iv) providing competitive programmes compared to existing programmes from HEI competitors. The use of XCRI-CAP allowed creating

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a consistent representation of programme structures regardless of discipline. The creation of XCRI-CAP feeds from a critical mass of institutions ensured that the Middlesex feed could be used by aggregator services in the future. The project's online tools allowed the like-for-like comparison of entire programmes or a selection of their headings that correspond to specific XCRI-CAP fields. The main benefit is that the project team has collected programmes from other institutions that are included in the project's repository that continuously grows. The repository is used for comparing programmes that are transformed to XCRI-CAP. One of the future steps is to integrate the online tools with aggregator services that utilise the XCRI-CAP feeds produced by projects participating in the course data programme. Another benefit for curriculum designers is that it is possible to use the visualisation functions to assess the extent to which certain programmes are similar, making better-informed decisions when it comes to programme content.

- Programme delivery – the use of XCRI-CAP allows the creation of programme pathways and facilitates mapping similar programme components such as modules and units. This ensures that when significant similarities are identified between two modules this can be used when delivering a programme with optional modules. The use of XCRI-CAP can be also used to determine pathways including pre-requisites, possible module options and alternative programme structures. This is achieved by transforming the programme content into XCRI-CAP and searching for certain criteria in order to identify potential programme paths. The MUSKET-ICIF tools are currently being extended to map course information to career prospects and possible study pathways.
- Marketing – the MUSKET-ICIF tools are currently being demonstrated to the project stakeholders. Their role can be critical to the institution's efforts to pull course data and better manage necessary course advertising information. The use of the XCRI-CAP feed allows a consistent view of all programmes offered by the institution, while the online tools support the identification of marketing aspects of courses that do not fall under any of the traditional undergraduate programmes offered by Middlesex. Currently the use of the developed tools allows the classification of different programme details according to how suitable they are for different marketing objectives. Furthermore, the use of XCRI-CAP allows the generation of information that could be used for both KIS and HESA initiatives.

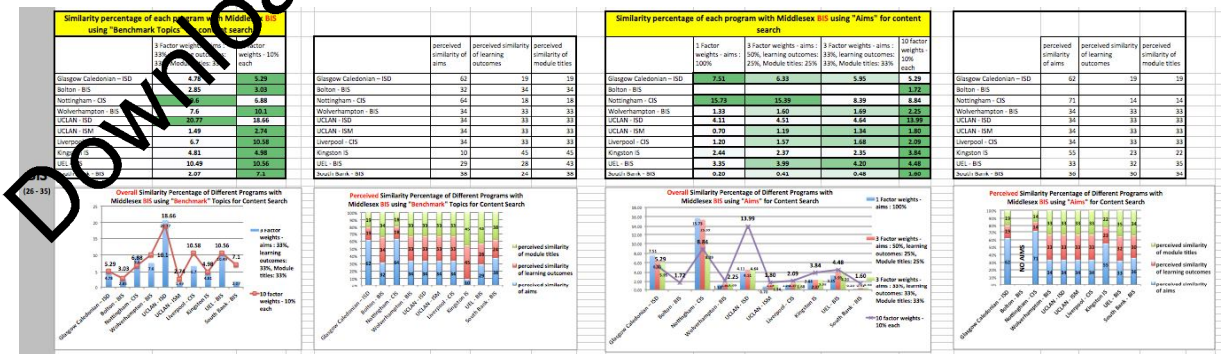

Figure 3: MUSKET Course Content Similarity Matching

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V. CONCLUSIONS

The project has produced a solution for the effective and efficient use of course data cross the institution. The project's outputs included (i) a set of tools that can be used to transform any structured-document that contains programme or module specification into the XCRI-CAP model that defines each element of course data, (ii) an XCRI-CAP feed for a range of courses offered by Middlesex University based on course data residing in the existing database (PIP) used by the University's marketing unit, and (iii) a range of resources including accredited course at postgraduate level, with supporting documentation for sustainable training in the relevant technologies (i.e. XCRI-CAP).

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