Reindexing a Research Repository from the Ground up: Adding and Evaluating Quality Metadata

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Abstract
This article details the outcomes of the ‘National Learning and Teaching Resource Audit and Classification’ project, commissioned by the Australian Government’s Office for Learning and Teaching (OLT). The project used a range of methodologies to reorganise the OLT’s Resource Library (http://www.olt.gov.au/resource-library), constructing and selecting an optimal set of metadata elements, along with certain vocabularies for these elements, and then reindexing the content of the Resource Library utilising the new schema and vocabularies. This paper reports on a before-and-after evaluation of the Resource Library’s search performance through an information retrieval experiment based on searches logged by the repository’s content management system. It was found that the reindexing produced a significant increase in average recall from 25.1% to 37.1% and a significant increase in average precision from 37.6% to 50.4%. The paper also describes the construction of a new controlled vocabulary for the ‘resource type’ element, and confirms the importance of clarity, conciseness, structure and scope in research report summaries for accurate document selection. Further, the paper outlines the audit of the OLT collection based on the frequency of particular Australian Thesaurus of Education Descriptors and Australian Standard Classifications of Education used in the reindexing.

Keywords: Scholarly repositories; Document retrieval; Discovery; Evaluation; Controlled vocabularies; Report summaries; Collection analysis

Introduction
Over the past two decades, the Australian government has funded, through the Office for Learning and Teaching (OLT) and its predecessors, a wide range of projects that have aimed to improve the quality of learning and teaching in the nation’s universities. At the end of 2013, the OLT commissioned the authors with the task of redesigning its Resource Library (http://www.olt.gov.au/resource-library), which is essentially a repository of materials emanating from all these projects. The project was completed in the latter part of 2015; its seven phases consisted of:-

1. attribute identification through examination of resources, a user survey and expert consultation;
2. evaluation of existing keywords, through experimentation using logged search queries;
3. evaluation of existing vocabularies for possible adoption;
4. creation of new taxonomies and development of existing vocabularies;
5. writing of indexing guidelines;
6. reindexing of database resources; and,
7. a system evaluation and audit of existing resource collection’s coverage.

Earlier phases of the project, and the literature review, have been reported previously (Hider et al., 2015b; Hider et al., 2016). In summary, phase 1 resulted in a new schema of metadata elements, recommended for implementation; phase 2 provided a baseline for the redesigned and reindexed Resource Library to be measured against (in phase 7); phase 3 resulted in the adoption of the *Australian Thesaurus of Education Descriptors* (ATED, http://cunningham.acer.edu.au/multites2007/index.html) and the retaining of the *Australian Standard Classification of Education* (ASCED, http://abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1272.02001) as indexing vocabularies; and, phase 4 focused on the preparation of ATED for use in the project, as well as the development of a new Resource Type vocabulary, and supplementary Grant Type and Funding Body lists.

Key methodological sources for the project cited by Hider et al. (2015b) include ISO 25964-1, *Thesauri for Information Retrieval* (2011) and Aitchison, Gilchrist and Bawden (2000). The information retrieval experiment reported in this article is in the form of an operational test as discussed by Tague-Sutcliffe (1992), while the methodology employed for the collection audit described here is discussed specifically by Holbrook, Findlay and Misson (2000).

Due to existing system constraints, not all the recommendations for the Resource Library redesign could be implemented as part of the project, but the most important means of access, i.e. subject access, as identified in the first phase of the project, was addressed through the reindexing of the Library’s content using ATED. This article reports on the evaluation of the effectiveness of this reindexing, as well as on the development of the supplementary Resource Type vocabulary, on a brief study of optimal project summaries, and on the collection audit conducted by means of ATED and ASCED.

**Development of the Resource Type Vocabulary**

As with the (subject) ‘keyword’ terms, the existing ‘resource types’ in the OLT repository were uncontrolled. It was decided to reindex the resources using a taxonomy, and, since no pre-existing taxonomy was found that would accurately describe the resources in this particular collection, a new vocabulary was constructed. First, a preliminary list of ‘resource types’ was compiled using a range of education thesauri, including ATED, by searching each of the thesauri for the terms: ‘curriculum material(s)’, ‘curriculum resource(s)’, ‘teaching material(s)’ and ‘teaching resource(s)’. Along with the terms found, their narrower terms (NTs) and related terms (RTs) were also included, as were the NTs of the NTs and RTs, etc. Uncontrolled terms currently used in the Resource Library for resource types were likewise added to the list. Duplicate terms were then eliminated. The list was shortened further by eliminating those terms that pertained primarily to subject, rather than form, and those types unlikely to ever be represented in the Library; and by merging synonyms and near-synonyms. The remaining short list of about 70 types was facet analysed,
with six provisional facets identified: *media type, project outputs, reference materials, teachers’ resources, student resources and assessment resources.*

To evaluate the short list, a survey of how users and prospective users viewed the Library’s resources was conducted by means of an online questionnaire; respondents were recruited through the project’s initial user survey, previously reported by Hider (2015b), with invitations sent out to 20 (randomly selected) participants who indicated an interest in being contacted again for a later phase of the project. A total of 17 responses were collected.

The first question of this survey asked participants to list resource types they would expect/like to find in the Library; the second question asked them to sort half of the types in the short list; the third question, to list any more relevant resource types they could think of; and the fourth question to sort the other half of the short list into the six predetermined facets. The first and third questions were designed to elicit additional resource types not captured through the development of the short list, and represented, essentially, a ‘free-listing’ exercise; the second and fourth questions were designed to test the intuitiveness of the classification of the resource types in the short list developed through the initial facet analysis, and to elicit alternative classifications for consideration, and represented, essentially, an open and closed ‘card sorting’ exercise, respectively (Morville and Rosenfeld, 2007).

From the first and third questions, 55 and 19 types were considered valid and compared with those on the short list, resulting in the addition of three more resource types.

The groupings used by the participants for the second question were then analysed. Although these did not always map very accurately to the facets previously identified, only one difference represented a pattern: participants tended to sort types into *instructional resources* and *curriculum resources*, rather than *teachers’ resources* and *student resources*. This difference was confirmed by responses to question 4: types placed in the provisional *teachers’ resources* and *student resources* facets by the researcher were quite often placed elsewhere by the participants.

The question 4 sortings were analysed closely, type by type. Where a majority of respondents placed a type under a different facet (from that of the preliminary facet analysis), the type was moved accordingly. In some cases, where sortings for a type were disparate, the type was eliminated by merging it with another type. The types in the *teachers’ resources* and *student resources* facets were re-sorted into instructional and curriculum resource groupings.

It was anticipated that further amendments to the taxonomy might be made through the reindexing exercise, but in the event only a few more adjustments were carried out; the final taxonomy is set out in appendix A.

**Key Qualities of Effective Project Summaries**

A potentially important element of the new metadata schema for the Resource Library was Project Summary. Most of the final project reports in the Library included executive summaries which could be used for this field. It would be valuable for future project teams, however, to be guided on what makes for effective project summaries, particularly as aids to selection (and de-selection) of resources. To this end, an online user survey was conducted, asking participants to identify positive and negative aspects, for selection purposes, of project
summaries taken from reports in the Resource Library. Twenty-four participants each commented on, and rated, five summaries from a sample of 20.

The survey participants’ comments on the summaries were coded by two of the authors, working independently. The resulting set of labels was then analysed for common themes, and two similar taxonomies were constructed, for positive and negative comments respectively. Comments were divided into those pertaining to readability and those pertaining to content. In the ‘readability’ theme, several sub-themes emerged, including clarity, brevity, structure and layout; in some cases these were further divided. In the ‘content’ theme, as well as general comprehensiveness, and aspects such as accuracy and bias, various elements of content, or the omission of them, were noted. A summary of the participants’ views on what make for useful summaries focused on the more frequently coded themes and sub-themes, and was written up as follows.

*Summaries should be clear, concise, well structured. The use of dot points, headings, examples and definitions is encouraged; jargon and dense writing should be avoided. Summaries should cover all the key aspects of the project, including aims, context and rationale, inputs (e.g. details of participants), methodology, findings, recommendations and outputs (e.g. exemplars and other resources), as well as links or references to other project materials (e.g. the project website).*

These views are broadly in line with those in the literature, including those promulgated in standards such as the *Guidelines for Abstracts*, ANSI/NISO 239.14, even though the latter does not only pertain to the context of selection. Intelligibility is emphasised, as are conciseness and the avoidance of jargon. For research reports, especially desirable elements include purpose, methodology, results and conclusions. ‘Inputs’ and ‘outputs’ are emphasised less, but these elements may well be of particular importance in the context of the OLT repository—the projects’ inputs include their grants, while their outputs include a range of resources in addition to final reports and which should be found in the repository.

The interest in inputs and outputs was likewise less pronounced in the results of a study by Montesi and Urdiciain (2006), who employed a methodology similar to that used in the OLT project and targeted a similar user group, with educationalists assessing abstracts from the field of education. On the whole, however, these participants identified similar problems to those identified by the OLT projects’ participants, including: unclear terminology, over-condensation, missing or unclear aims, methodology, results, conclusions or reasons for doing the project, structural issues, lack of a formal register, and issues around layout. The OLT survey also highlighted the need for brevity, which again would probably have been less applicable in the Montesi and Urdiciain study, as the abstracts would likely have been shorter, and the value of dot points and examples.

The need for brevity was reinforced by the inverse correlation between ratings and length of the sample Resource Library summaries, which ranged between 248 and 1,278 words, with a median of 605. It appears that the ANSI/NISO standard of a page or 300 words for a report summary would be quite appropriate for the OLT repository.
Reindexing the Resource Library

Current system constraints meant that the full set of metadata elements and recommendations could not be implemented as part of the project. Nevertheless all of the current resources in the repository were reindexed using a new set of detailed guidelines, and controlled vocabularies, including ATED and the new Resource Type taxonomy. A total of 703 records were edited, with resources from projects indexed at the project level (so that records may be linked to multiple resources). Nearly 5,400 subject terms were added, with over 1,500 of these being unique; 641 discipline terms were added, with 84 being unique; over 1,000 resource type terms were added, with 85 being unique.

Evaluation of New and Old Subject Vocabularies

To determine the effect of the new subject indexing, an information retrieval experiment was conducted before and after the reindexing, employing the standard measures of recall and precision. Forty ‘future search queries’ extracted from the initial user survey data (Hider et al., 2015b) were selected for the experiment based on their clarity; they are listed in appendix B.

A pooling method was used to obtain what was deemed the vast majority of relevant resources for each search question across the entire collection (Hersh et al., 2004), with two information professionals (searchers A and B) from the project team asked to search on the Resource Library database system, independently, for as many relevant resources as possible to answer each of the 40 search questions, both before and after the reindexing.

In the pre-hoc procedure (i.e. before the reindexing), searchers A and B were asked to use, for their initial queries, the specific terms offered by the survey respondents for each of the 40 questions. They were then allowed to use other suitable terms that they could think of or that they encountered during their searching. The searchers were asked to spend up to 20 minutes on each question. All of the retrieved documents (resources) were recorded.

In the post-hoc procedure (after the reindexing), the search queries entered by the searchers before the reindexing were re-entered and all of the retrieved documents were again recorded.

De-duplicated lists of the URLs for all the documents retrieved before and after the reindexing were returned to the same two information professionals for their independent relevance assessment. Each document was judged relevant, partially relevant, or not relevant. For each judgment, at least the title and any summary or table of contents were considered.

A total of 1,430 documents were assessed by the two judges before the reindexing and an additional 349 documents after the reindexing. The graded relevance data was coded as 2, 1 and 0 for relevant, partially relevant and not relevant respectively. Cohen’s kappa coefficient for the level of inter-rater agreement in the pre-hoc data (i.e. the before reindexing) was 0.91 or ‘very good’ (Fleiss, Levin, & Paik, 2004). The small number of cases of relevant/not relevant disagreement was set aside; cases of relevant/partially relevant disagreement and partially relevant/not relevant disagreement were resolved in favour of the partially relevant assessment. Several questions were found to have yielded no relevant or partially relevant documents at all and so the corresponding searches were excluded from the analysis, as were those that had involved follow-up filtering.
The consolidated data was used to determine pre-hoc and post-hoc precision and recall ratios as follows. The precision ratio for each search was calculated as

\[ \frac{\text{relevant} + \text{partially relevant documents retrieved}}{\text{total retrieved documents}}. \]

The recall ratio for each search was calculated as

\[ \frac{\text{relevant} + \text{partially relevant documents retrieved}}{(\text{total relevant} + \text{partially relevant documents retrieved for the question})}. \]

Before the reindexing, the average precision for initial searches across all (analysed) questions was 0.376 \((n = 66)\), while the average recall for initial searches was 0.251 \((n = 66)\). In other words, about a third of the documents retrieved in a typical search were at all relevant, while about three times as many relevant documents were missed. In contrast, after the reindexing, the average precision for initial searches was 0.504 \((n = 66)\), while the average recall for initial searches was 0.371 \((n = 66)\). In other words, about half of the retrieved documents were relevant, and these represented over a third of all relevant documents (on average).

To determine whether the reindexing has caused this improvement, mixed-effects models were constructed to fit the data (Bates, Mächler, Bolker, & Walker, 2014; Carterette, Kanoulas, & Yilmaz, 2011; Robertson & Kanoulas, 2012). The variables of the reindexing and searchers, and their interactions, were considered fixed effects, whereas a by-searcher intercept and topics were treated as random variables (Barr, Levy, Scheepers, & Tily, 2013). Results showed that there are statistically significant differences in system performance in terms of the precision measure for initial \((F= 10.97, p < .05)\) and last queries \((F = 17.81, p < .0001)\) due to the reindexing. There are also statistically significant differences in system performance in terms of the recall measure for initial \((F = 12.39, p < .001)\) and final queries \((F = 8.13, p < .05)\) due to the reindexing. This suggests that the reindexing has substantially improved the system performance of the OLT Resource Library. The results are presented pictorially in figures 1 and 2.
Audit of the Resource Library’s Contents

The reindexing of the Resource Library using controlled vocabularies presented an opportunity for a systematic audit of its content to be conducted. The aim was to explore the scope of the resources provided by the repository so as to identify concentrations and gaps to help inform future funding prioritisation. By comparing the Library’s disciplinary coverage to that of the university student population at large, historical ‘biases’ or ‘omissions’ in funding for particular disciplines might be uncovered. Similarly, by examining the Library’s subject
content, any historical concentrations or gaps in funding for particular topics may be revealed. The data drawn upon for this analysis was a count of the projects within the Library indexed with particular ASCED discipline classifications and particular subject categories and descriptors from the ATED vocabulary.

**Projects by discipline**

Table 1 shows the number and percentage of projects with resources in the Resource Library indexed with each top-level ASCED discipline category. It should be noted that a number of projects are indexed with more than one discipline category, while a considerable number of projects are not discipline-specific and thus not indexed with any of these categories. This might reflect an implicit prioritisation of projects addressing issues and applications that are relevant more broadly across the sector rather than being specific to a single discipline. The final column shows the percentage of students in the Australian higher education sector studying courses classed within the same discipline categories.

<table>
<thead>
<tr>
<th>ASCED discipline category</th>
<th>Projects (n)</th>
<th>Discipline categories (%)</th>
<th>Students in sector (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Disciplinary Based</td>
<td>267</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Health</td>
<td>83</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>Natural and Physical Sciences</td>
<td>63</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Society and Culture</td>
<td>59</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>Engineering and Related Technologies</td>
<td>37</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Education</td>
<td>25</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Management and Commerce</td>
<td>23</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td>Creative Arts</td>
<td>21</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Architecture and Building</td>
<td>18</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Information Technology</td>
<td>12</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Agriculture, Environmental and Related Studies</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Food, Hospitality and Personal Services</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mixed Field Programs</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

* 2013 data from http://highereducationstatistics.education.gov.au

Noteworthy in table 1 is the significant underrepresentation of the ‘Management and Commerce’ and ‘Society and Culture’ disciplines, and the overrepresentation of the ‘Health’ and ‘Natural and Physical Science’ disciplines, compared with the proportion of students within the sector studying in these disciplines. There is a range of reasons one could hypothesise for these differences between the discipline mix of students in Australian higher education and the distribution of discipline-specific projects awarded by the OLT and its predecessors. For instance, the ‘Health’ and ‘Natural and Physical Science’ disciplines tend
to receive a larger proportion of government research grants more generally (e.g. 433 of the 635 Discovery Project proposals approved by the Australian Research Council for 2016 funding were from these disciplines; Australian Research Council, 2016) and so it is possible that their large share of OLT grants is reflective of a stronger grant application culture amongst academics in these disciplines. Importantly, the underrepresentation of some disciplines could help to inform future funding directions. There may be scope for some targeted grants within certain discipline areas in order to help develop scholarship and stimulate the creation of knowledge about effective teaching as well as the development of effective learning resources in these disciplines.

Projects by subject category

Table 2 shows the number of projects with resources indexed using subject descriptors associated with each of the leading 10 ATED ‘subject categories’ (out of 41 subject categories in total). Each subject descriptor is associated with a single subject category, as well as being formally related to other descriptors in one or more hierarchical trees: there are 121 top terms, i.e. at the top of these trees, and over 6,000 descriptors altogether. The subject categories, rather than the subject descriptors, were chosen as the primary focus of analysis, given the additional complexity of polyhierarchy to be found in the trees, in which descriptors could appear under more than one parent. Again, it should be noted that projects (and their resources) may be indexed using descriptors from more than one subject category and so the total frequency is greater than the total number of projects represented in the Resource Library.

Of note in table 2 is the large number of projects focusing on the educational process, on aspects of the curriculum, and on discipline-specific issues. This is arguably quite different to the distribution of projects within educational research more broadly, where there tends to be a more significant focus on the sociology of education and broader issues relating to the role of education within society. This perhaps reflects, at least in part, the applied focus of grant criteria stipulated by the OLT and its predecessors.

Table 2: Projects by leading subject category

<table>
<thead>
<tr>
<th>ATED subject category</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC: 320 Educational process: institutional perspectives</td>
<td>273</td>
</tr>
<tr>
<td>SC: 310 Educational process: classroom perspectives</td>
<td>260</td>
</tr>
<tr>
<td>SC: 330 Educational process: societal perspectives</td>
<td>258</td>
</tr>
<tr>
<td>SC: 520 Social processes and structures</td>
<td>196</td>
</tr>
<tr>
<td>SC: 400 Curriculum subjects</td>
<td>161</td>
</tr>
<tr>
<td>SC: 490 Science and technology</td>
<td>159</td>
</tr>
<tr>
<td>SC: 210 Health and safety</td>
<td>144</td>
</tr>
<tr>
<td>SC: 350 Curriculum organisation</td>
<td>143</td>
</tr>
<tr>
<td>SC: 710 Information / communications systems</td>
<td>119</td>
</tr>
</tbody>
</table>
Additionally, in order to provide a picture of the kinds of projects appearing under each of the leading subject categories, the most frequently used subject descriptors associated with each category were identified: those for the top five subject categories from table 2 are listed in tables 3-7.

**Table 3: Leading descriptors associated with ‘320 Educational process: institutional perspectives’**

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational leadership</td>
<td>62</td>
</tr>
<tr>
<td>Student assessment</td>
<td>41</td>
</tr>
<tr>
<td>Academic standards</td>
<td>30</td>
</tr>
<tr>
<td>Academic staff development</td>
<td>28</td>
</tr>
<tr>
<td>Graduate attributes</td>
<td>17</td>
</tr>
</tbody>
</table>

The descriptors listed in table 3 point to a large number of projects having focussed on institutional or policy related issues, which is probably not a surprising finding; all of the areas represented by the descriptors have been commonly cited as priorities by many Australian universities.

**Table 4: Leading descriptors associated with ‘310 Educational process: classroom perspectives’**

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdisciplinary approach</td>
<td>25</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>18</td>
</tr>
<tr>
<td>Teaching effectiveness</td>
<td>17</td>
</tr>
<tr>
<td>Experiential learning</td>
<td>16</td>
</tr>
<tr>
<td>Computer assisted teaching</td>
<td>14</td>
</tr>
</tbody>
</table>

The descriptors in table 4 focus on aspects of teaching approach or pedagogy, with a wide range of other descriptors also used within this category, reflecting the diversity of pedagogical approaches and teaching strategies that have been explored in projects funded by the OLT and its predecessors.

**Table 5: Leading descriptors associated with ‘330 Educational process: societal perspectives’**
The top two descriptors in table 5 indicate the importance attached to the development of the online mode of study in the Australian higher education sector.

Table 6: Leading descriptors associated with ‘520 Social processes and structures’

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best practice</td>
<td>27</td>
</tr>
<tr>
<td>Capacity building</td>
<td>26</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>19</td>
</tr>
<tr>
<td>Peer evaluation</td>
<td>12</td>
</tr>
<tr>
<td>Distributed leadership</td>
<td>12</td>
</tr>
</tbody>
</table>

There is considerable alignment between the descriptors in table 6 and those in table 3. For example ‘Staff development’ is a key element of ‘Capacity building’, and ‘Benchmarking’ and ‘Best practice’ are related to ‘Academic standards’.

Table 7: Leading descriptors associated with ‘400 Curriculum subjects’

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership training</td>
<td>17</td>
</tr>
<tr>
<td>Legal education</td>
<td>14</td>
</tr>
<tr>
<td>Business education</td>
<td>13</td>
</tr>
<tr>
<td>Preservice teacher education</td>
<td>13</td>
</tr>
<tr>
<td>Architectural education</td>
<td>10</td>
</tr>
</tbody>
</table>

While the top descriptor in table 7, i.e. Leadership training, provides an example of a generic aspect of curriculum that clearly cuts across many disciplines, the other leading descriptors pertain to particular disciplines that on the surface might conflict with the analysis of the ASCED discipline categories above. However, further exploration reveals that the descriptors within the ‘Curriculum subjects’ category by no means cover disciplines uniformly: the reason why descriptors pertaining to health and science disciplines, for example, do not appear in table 7 could well be because they are featured in other subject
categories (e.g. ‘Science and technology’). It may be that the ‘Curriculum subjects’ category needs some attention to clarify its scope, which may or may not extend to disciplines *per se*.

A list of the most frequently used descriptors across all subject categories (i.e. those used for more than 20 projects) is presented in table 8. It reveals several other topics often dealt with in Resource Library projects, including ‘Curriculum development’ (under the subject category ‘Curriculum organisation’) and ‘Undergraduate study’ (under the subject category ‘Educational levels, qualifications and organisations’).

Table 8: Leading subject descriptors

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Projects (n)</th>
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</thead>
<tbody>
<tr>
<td>Educational leadership</td>
<td>62</td>
</tr>
<tr>
<td>Curriculum development</td>
<td>45</td>
</tr>
<tr>
<td>Student assessment</td>
<td>41</td>
</tr>
<tr>
<td>Academic standards</td>
<td>30</td>
</tr>
<tr>
<td>Academic staff development</td>
<td>28</td>
</tr>
<tr>
<td>Best practice</td>
<td>27</td>
</tr>
<tr>
<td>Online learning</td>
<td>26</td>
</tr>
<tr>
<td>Undergraduate study</td>
<td>26</td>
</tr>
<tr>
<td>Capacity building</td>
<td>26</td>
</tr>
<tr>
<td>Interdisciplinary approach</td>
<td>25</td>
</tr>
<tr>
<td>Engineering education</td>
<td>25</td>
</tr>
<tr>
<td>Science education</td>
<td>22</td>
</tr>
<tr>
<td>Medical education</td>
<td>21</td>
</tr>
<tr>
<td>Nursing education</td>
<td>21</td>
</tr>
</tbody>
</table>

Finally, in order to explore any ‘gaps’ in the coverage of projects funded by the OLT and predecessors, an analysis of the subject categories with the descriptors that were used the least was carried out. Table 9 shows these subject categories, representing the least number of projects (i.e. 20 or fewer). In contrast to table 8, which lists the most used individual *descriptors*, the categories in table 9 each comprise a number of descriptors and so represent a large number of descriptors that have been hardly or never used.

Table 9: Subject categories representing the least number of projects

<table>
<thead>
<tr>
<th>ATED Subject Category</th>
<th>Projects (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC: 230 Mental health</td>
<td>20</td>
</tr>
<tr>
<td>SC: 730 Publication / document types</td>
<td>19</td>
</tr>
<tr>
<td>SC: 410 Agriculture and natural resources</td>
<td>18</td>
</tr>
<tr>
<td>SC: 450 Language and speech</td>
<td>18</td>
</tr>
<tr>
<td>SC: 610 Government and politics</td>
<td>17</td>
</tr>
<tr>
<td>SC: 220 Disabilities</td>
<td>12</td>
</tr>
</tbody>
</table>
Most noteworthy here, perhaps, is the limited number of projects and resources related to ‘Social problems’, ‘The individual in the social context’, ‘Bias and equity’, Disabilities’ and ‘Mental Health’. Given the importance of student retention to the financial position of universities and the focus in recent government policy initiatives on inclusiveness (e.g. the allocation of over $100m per year to the Higher Education Participation and Partnerships Program from 2012 to 2016; Department of Education and Training, 2016), the relatively small number of projects in these areas is quite surprising.

Conclusions

The OLT project reported in this article demonstrated the value of controlled vocabularies in even a relatively small-scale research repository such as the Resource Library. In addition, it showed how various innovative methods can be employed to construct these vocabularies, and how the vocabularies can be used not only for the purposes of document retrieval, but also to evaluate a collection. Finally, the project confirms many of the qualities that make for effective metadata; as well as control in the case of ‘keywords’, clarity, conciseness, structure and scope are all important considerations for report summary writers.

The project made over 20 recommendations in its final report (Hider et al., 2015a) for future implementation, addressing issues such as current system constraints (including a lack of interoperability) and ongoing metadata creation and quality assurance. The OLT has responded by commissioning a follow-up project (http://www.olt.gov.au/fellowships-and-secondments/secondment-projects/professor-hider) that will submit a costed proposal for a new, state-of-the-art repository system to support the Australian higher education community into the future. By doing so, the OLT recognises the critical role that well designed repositories play in promoting and disseminating research and scholarly outputs.

Acknowledgements

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References


**Appendix A: Resource Type taxonomy**

*(Key: RT = related term, SN = scope note, USE = use preferred term indicated)*

**Media type** USE one or more descriptors below

- Apps USE Software
- Audio
- Booklets
- *Books USE E-books*
- CDs
- E-books
- Maps
- Papers [USE Conference papers or Journal articles if reporting on the project]
- Photographs
- Podcasts USE Audio
- Powerpoints USE Slides (presentations)
- Reports [SN Use only if not pertaining to the project]
- Slides (presentations)
- Software
- Sound recordings USE Audio
- Tables (data)
- Toolkits
- Video
- Websites

**Project outputs** USE one or more descriptors below

- Appendices [SN Use only if no other specific descriptor applies]
- Brochures [SN Use only if pertaining to the project]
- Case studies [RT Exemplars of practice]
- Conference papers [SN Use only if pertaining to the project]
- Conference programs [SN Use only if pertaining to the project]
- *Discussion papers USE Papers*
- Exemplars of practice [RT Case studies]
- External evaluation reports
- Final reports
- Interim reports
Interview protocols USE Survey instruments
Journal articles [SN Use only if pertaining to the project]
Media releases USE Press releases
Media reviews
Models USE Exemplars of practice
Position papers
Press releases
Project evaluations (external) USE External evaluation reports
Questionnaires USE Survey instruments
Scenarios USE Case Studies
Supplementary reports [SN Use only if pertaining to the project]
Survey instruments

**Instructional resources [SN Use only if no descriptor below applies]**
Games (educational)
Learning modules [RT Study guides]
Lectures (recordings)
Lesson plans
Problem sets [RT Workbooks]
Study guides [RT Learning modules, Workbooks]
Teaching guides
Templates
Training materials [SN Use only if no other descriptor applies]
Training packages [SN Use for integrated set of materials]
Workbooks [RT Problem sets, Study guides]

**Curriculum resources [SN Use only if no descriptor below applies]**
Course guides USE Program guides OR Unit guides
Curriculum guides [SN Primarily for teachers]
Curriculum mappings
Program guides [SN Primarily for students]
Subject outlines USE Unit guides
Unit guides [SN Primarily for students]

**Assessment resources [SN Use only if no descriptor below applies]**
Assignments
Exam papers USE Test papers
Peer/self assessment tools
Self assessment tools USE Peer/self assessment tools
Test manuals
Test papers

**Reference materials USE one or more descriptors below**
Annual reports
Bibliographies [RT Literature reviews]
Databases [SN Use only if no other specific descriptor applies]
Directories
Frameworks [RT Guidelines, Policies]
Glossaries
Guidelines [RT Frameworks, Policies]
Appendix B: Search questions for IR experiment

1) Whether anyone is creating games or apps for teaching/learning literacy or research skills
2) Curriculum renewal incorporating blended learning
3) I would be looking at blended learning for communication studies, or for sociology or social sciences
4) Projects about work integrated learning
5) I am interested in the history of online learning and teaching
6) Search for projects related to service learning in higher education
7) Looking for any records which relate to internationalisation, international strategy, international education
8) What teaching innovations in software development education have been initiated in Australian universities? Search terms include: innovation; learning and teaching; software; ICT (and expanded) IT (and expanded); software engineering
9) Blended learning resources for higher education. Search terms: blended learning, flipped classroom, flipped learning
10) Meeting the needs of a diverse student cohort in work integrated learning - terms included: work integrated learning; inclusive practice in work integrated learning; student diversity and work integrated learning; graduate capabilities; student agency and building graduate capabilities that employers seek; industry and work integrated learning
11) Student agency, classroom democracy
12) Establishing scholarship of learning and teaching in a tertiary institution
13) Development and deployment of learning objects to support leadership competency development in undergraduate students
14) Use of external peer review in verifying or assessing academic standards
15) I would like to pull out studies that have looked at strategies for developing and using blended learning in science. Possible keywords would be science (but this could include lots of alternative inclusions, e.g. social science), blended learning (or possibly online learning, flexible delivery etc)
16) Assessment in teaching education professional experience
17) Threshold learning outcomes in arts and humanities
18) Attraction and retention strategies higher education students
19) Project reports on HDR leadership
20) Projects considering development opportunities and standards for sessional teachers
21) Pre-service teacher, practicum, learning and teaching
22) The role of visual literacy and data visualisations in undergraduate coursework to help students understand complex concepts
23) Discipline-specific uses of learning technologies
24) I might look for resources on the student experience - search terms would include: student experience, student as producer, change agents, student engagement
25) Quality assurance - calibration/moderation/benchmarking - tools
26) Science, assessment
27) I would like to search for other projects related to assessment and feedback. Search terms would include the following: higher education assessment feedback
28) Currently am interested in linking approaches to curriculum design and assessment with approaches to assurance of learning in a standards based environment
29) Research on academic integrity/plagiarism/first year student experience/embedding
30) Information about assessment rubrics
31) Leadership higher education elearning
32) Typically I would start by looking for a particular grant or fellowship holder's name (say "Boud").
33) My colleagues and I as academic developers are working on an application for a project that will help support early career academics in developing scholarship of teaching and learning, and work in interdisciplinary teams to enhance their careers
34) Assessment of learning outcomes
35) Student grievances and appeals - search on student complaints, student appeals
36) I search regularly for the discipline threshold standards
37) Design, implementation and evaluation of assessment methods
38) Projects related to assessment of teamwork
39) I am in the process of investigating online learning and blended learning approaches to teaching and learning and so will be continuing my search for information and resources in the area. Search terms - 'online learning', 'blended learning', 'course design', 'online assessment', 'online technologies'
40) Using case studies in teaching